Haute Ecole

« ICHEC – ECAM – ISFSC »

Enseignement supérieur de type long de niveau universitaire

Design and Implementation of an Enterprise Resource Planning Tool for Companies who Switches to Long-term Teleworking

Mémoire présenté par :

Valbona SAHITI KÖPRÜLÜ

Pour l'obtention du diplôme de:

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Promoteur:

Sed SAAD

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ABSTRACT

Master's Graduate Project

Design and Implementation of an Enterprise Resource Planning Tool for Companies who Switches to long term teleworking

Valbona SAHITI KÖPRÜLÜ

In the market, there are numerous Enterprise Resource Planning (ERP) software that are used to manage day to day business activities such as accounting, project management, risk management and supply chain operations. However, an interactive ERP software becomes crucial as teleworking is getting more common as a result of global pandemic that started in 2020. All enterprise daily activities can be managed and stored in a web-based collaborative platform to cope with teleworking challenges. It is essential for companies to adapt themselves with the global pandemic conditions and encourage collaboration between departments within the company. Unfortunately, traditional ERP systems can be limited to meet today's challenging requirements due to above mentioned conditions.

In this case, the ERP becomes vital in order to maintain the workflow and to optimize daily business activities. This study proposes a turn-key effective solution for those companies that are intended to have a cost affordable ERP software. Microsoft Office 365 is widely used among the organizations and mostly provided together with SharePoint which is highly configurable in terms of customization according to the company organization structure and requirements. As a scope of this study a customized SharePoint portal will be designed and implemented for organizations who switch to long-term teleworking and to choose to work with SharePoint as a compact ERP tool.

The aim of this thesis is to design and implement an Enterprise Resource Planning tool for the companies that are trying to adapt with the "new normal" teleworking due to global pandemic. The tool is designed to be presented to the company who accepted to implement it for day-to-day business use.

The implemented portal is consisting a general design for the small and medium enterprises in order to fulfil their requirements and to decrease the workload by automating routine tasks of key personnel. The study could be used as a guide to implement more customized ERP systems according to the unique requirements of companies.

This study aims to answer the research question that is given below.

1. How can we design and implement an affordable ERP tool that can fulfil the requirements of small and medium enterprises?

Keywords: Enterprise Resource Planning, Web Based Application, Project Management, Corporate Portal, Teleworking

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CONTENTS

ACRONYMS

BoM	Bill of Materials
CSS	Cascading Style Sheets
DMS	Document Management Systems
ERP	Enterprise Resource Planning
FOA	Friend-of-a-friend
HTML	Hyper Text Markup Language
MIS	Management Information Systems
MS	Microsoft
PEO	Project Engineering Office
PM	Project Manager
PMO	Project Management Office
RSS	Rich Site Summary
W3C	World Wide Web Consortium

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INTRODUCTION

The aim of this study is to design a web interactive project management tool based on the needs of an engineering project firm based in the EU. The project management platform is open to access from lower-level managers to middle and senior level managers. Many people, from technical personnel who practice in the field to project engineers, project assistants and project managers, can enter data on this tool. Furthermore, the tool can make reports at the last stage by processing these data entries into different lists. Project Management tool has been designed in accordance with project management needs. This tool can be accessed by the people who contributed to the project in the organization and each stage of the project can be followed from here.

For this study, the tool has been designed according to the needs of the selected sample company that is performing services in the area of engineering. The sample company may have to produce many documents during the contracts they undertake. This situation creates various problems depending on the size of the project. Although these problems are mostly caused by the human factor, it points out that the main problem is system-baseness. In document management systems, it is important to design dynamic and user-friendly tools where documents can be easily accessed by all users. If the creation and storage of documents is based on a process, the ability to observe this process by the possibilities offered by the tool will also be welcomed by the managers. The document management tool also provides benefits to project employees in the process management and completion of the assigned tasks.

For instance, personnel from different departments and sub-departments of the organization work in an engineering project. This staff; Apart from basic employees such as Project Manager, Project Engineer, Project Specialist, Project Assistant, there may also be people working in the purchasing, accounting and finance departments. In this case, it is important for different departments to unite on a common tool in order to work together. Although there are many tools to solve this problem in today's market, companies use these tools and resist to meet the cost. In this study, a software-based solution has been developed that will not cause any cost problems for companies and can be directly integrated into existing tools.

Execution of project management from two separate lanes is important for a successful project and efficient evaluation of the process. Although personnel can perform both administrative and engineering tasks, it is not possible for the engineering personnel to follow up the works in the administrative sense and to hand over the works in the recruitment of new personnel. Therefore, within the scope of the Engineering Project Management Program, a separate office called the Project Management Office (PMO) has been established so that Project Managers and Project Management Assistants can carry out the work pertaining to their job descriptions. Within the scope of PMO, Project Managers are assigned to their own projects and they can continue the process from where they left off even if the

Project Manager changes, when necessary, the same opportunity applies to Project Assistants.

Engineering department, which is the second department of project management, carries out only engineering activities under the name of Project Engineering Office (PEO); It constitutes a section that contains sub-menus that can be used by personnel in positions such as Project Engineering Manager, Project Engineer, Draftsman, Technician and where even the smallest building block in the technical dimension of the work can be documented, that is, kept under systematic records. In this section, technical manuals, user manuals and drawings of all materials used on a project basis, from the most expensive to the cheapest basic materials, are kept. There are specific lists where Bills of Material (BoM) are prepared to be transferred to the purchasing department for the control of materials by expert engineers.

Within the scope of the study, it was mentioned how an engineering company should operate and the method of design was explained for small and medium companies using similar infrastructure in order to meet the needs for this. Not only the program interface and features, but also the installation of the tool is mentioned in this context, how the tool works after the installation is completed and what kind of applications companies should use are explained with examples.

CHAPTER 1. LITERATURE REVIEW

1.1. Enterprise Resource Planning Systems

Today, ready-made web portals (IBM-WebSphere, Microsoft-SharePoint, etc.) offered by large software companies and specially developed web portals enable the customers to perform the services provided by the companies themselves on the internet. However, today's web portals, contrary to these benefits, are not flexible in personalization, changing the content of the portal, and storing and displaying information. (Zhdanova, 2005:66)

Web portals are trying to provide their semantics and flexibility with the features that emerged with Web 2.0 and added later. Web services2 defined by the W3C (World Wide Web Consortium) have been defined and put into use in order to increase the communication between many web portals. RSS (Rich Site Summary) support, which was conceived as a news service, but later used to announce updates on websites, is provided in many web portals today (Peter, Geert-Jan, Frasincar, Vdovjak, 2004:1).

FOAF (Friend-of-a-Friend), which is not widely used, enables the establishment of Social Networks within the web portal and among web portals. As a result, all these technologies show that semantic web technologies are partially included in today's web portals. (Bursa, Unalir, 2004:215)

When we look at web portals as a ready-made solution, Microsoft SharePoint was developed to combine many applications and services. It is a platform that integrates web applications. In general, it is related to the functions of document management and content management. It supports Intranet and extranet as website management. Apart from that, it supports the areas of document management, collaboration, social interaction and networking. It helps in the formation of business intelligence and the integration of process and information. The main benefit is that all intranet, extranet and web applications can be combined on a single platform. For every business level in an organization, MS SharePoint has a site template such as: My Sites, Team sites, Collaborations, etc. Using MS SharePoint as a solution for the Extranet benefits the establishment of multiple collaboration modules with partners, government agencies and customers. (Dokic, Zrakic, Bogdanovic, Labus, 2015: A11)

Designing a system for adaptive management of documents in electronic environment includes implementing a Document Management System, integration of internet services within the intranet network, and a business information system. (Despotovic, M., Savic, A. & Bogdanovic, Z., 2006:55)

Integration in Document Management Systems (DMS) is done at various levels. In human integration, users can access the system or communicate with each other by accessing the system from a remote location. Each user gets access to their own personalized resource set. User data is stored in Active Directory (a service offered by Microsoft) so they can be easily integrated with other components. In information integration, the system allows the collection of various, unstructured data. Users can access structured information through the

portal. This feature is achieved by using the service called "content management". Also, here users can find various reports, analysis, data interpretations. It leverages the use of XML Web services to unify existing business processes in process integration. Each user is given a set of tools that match the description of his job. On the Application Platform, on the other hand, applications are implemented using various technologies, so integration needs to be done at the application level as well. (Dokic, Zrakic, Bogdanovic, Labus, 2015: A14)

When we look at the relationship between web portals and MIS, we see that they form an integrated human-machine system based on computers. In MIS, information that can be accessed at any time is processed not by a single system, but by a combination of many subsystems, and there is a mutual exchange and interaction between human and computer. Since the user will be using the computer to process information, systems analysts and designers need to take people's abilities and behaviours into account. On the other hand, the manager who will process and use information needs to learn the basics of computers and its use in MIS. Knowledge Level Systems support data workers and information in the organization. Knowledge level systems help control a firm's stationery and integrate new information into the business. Information level systems are the fastest developing applications for today, especially in workstations and office systems. (Ozcan, Bilal 2006:20). Accordingly, we see that Web Portals are included in the Information Level Systems type from the information systems types in MIS.

1.2. Teleworking in the Corporate World

After the COVID-19 outbreak, corporates all over the world switched to working remotely overnight. However, now with the battle won against this pandemic, many employees continue to be permitted to work remotely by their employer. According to Josh Howarth statistics (2022), almost one third of employees are hired by remote working companies and 50% of professional employees believe that the productivity is higher when working from home. As a result, the employees teleworking tends to use technological tools such as ERP tools in order to co-operate with their managers and colleagues within their company. (Josh Howarth statistics, 2022)

To supervise a remote working team is a challenge for managers and companies nowadays. Kathy Gurchiek (2020) has explained briefly guidelines on how to successfully manage remote employees. To have positive results with teleworking, managers need to set expectations early, need to be able to track their employees work progress and most importantly to provide a way to communicate. Here is where ERP tool becomes fruitful to companies. With the right ERP tool, employees can collaborate with each other and keep track of each other and also companies can manage their workers easier. For instance, the company can create a document in SharePoint and state what is expected from each team member while working from home and when is expected for the task to be completed. (Kathy Gurchiek, 2020)

1.3. Microsoft SharePoint

Microsoft's SharePoint (share point) service first appeared in 2007 with Microsoft Office 2007 and Microsoft SharePoint 2007 Server. SharePoint service specially designed for corporate companies and educational institutions includes a common workspace platform. By sharing its own documents on this platform, the institution finds the opportunity to accelerate document processing and transfer processes among each other and to create a collaborative working environment. Along with Microsoft Office 2010, the SharePoint Workspace plug-in was presented to the user ready-made during installation. The SharePoint Workspace plug-in allows users directly connected to this host to meet in a collaborative working environment (Retrieved from: http://sharepoint.microsoft.com/en/pages/default.aspx). SharePoint is a package built on the basis of Windows SharePoint Services 3.0 and Asp.Net 2.0, which enables the use of internal document exchange and versions developed by Microsoft. SharePoint Portal Server application can be grouped under the following main headings:

- Information sharing
- Document management
- Advanced search functions
- Form Services
- Excel Services
- BDC (Business Data Catalogue)

These main topics form the building blocks of SharePoint Portal Server (Microsoft Office SharePoint Server). In addition, making all the information used within the company easily accessible through search engines that are very easy to use for the end user or through categorized views can be counted as one of the biggest advantages of MOSS (Retrieved from: https://ab.org.tr/ab05/tammetin/117.doc).

When we examine it technically, MS SQL (Microsoft database manager) uses its own database structure as the SharePoint Server database. As a web server, it uses IIS, that is, its own server structure. As a programming language, it is a system written based on C#. It is a fully customizable tool and can be integrated with other systems such as financial system, human resources systems etc. It should be purchased for a certain fee and integrated into the system. It is completely user friendly and can be adapted to the company’s needs. SharePoint online is a cloud version that supports multitenancy and can be accessed from everywhere with only internet connection and a web portal.

CHAPTER 2. METHODOLOGY

For this research two methodologies were used in order to come to the conclusions. The first method used is "interview" that was performed with ERP experts particularly in Microsoft SharePoint and Microsoft Dynamics. The experts were contacted directly through either recommendation or through social platforms such as LinkedIn. LinkedIn as a social media platform, helps us to identify the experts within a particular region by using advanced search and filtering parameters. Moreover, the final method that was used is "qualitative method". Online resources were found and analysed in order to answer the research question of this study.

2.1. Interviews

Interviewed person: Name is not available due to privacy reasons.

Interviewed person's profile: ERP Systems Developer, experienced in SharePoint Online and SharePoint on premise.

SharePoint could be used as an ERP tool but the expert would suggest it more for small and medium enterprises rather than the large ones. We can say it does more or less the job of an ERP tool but it does not help managing employees in the company. But she agrees that it can be considered as an ERP tool as the software can be customized with other systems such as finance system, HR system, CRM etc. Once you integrate these systems and customize it, it can be very useful and almost the same as the ready-made customization.

She also mentioned problems that could happened working with SharePoint. The reason companies choose the other ERP tool rather than SharePoint is because of customization. In SharePoint you can customize and Integrate developments thanks to SPFX technology but as you know SharePoint is managed by Microsoft meaning that every 6 months, they release a new version. This would be an issue for the companies because on the previous customization, there could malfunctions. However, you can always do a migration but there might be a problem at the integration itself. Companies think this way "Why customize something when there is a ready-made tool"

When asked if you can add third party application, she said that it is possible to add and adapt it to the companies need. With integrating customized apps, it does extend SharePoint 's action range, therefore could be considered as an ERP tool, enabling people to collaborate, work and manage their business or the company resources.

The user mentioned that SharePoint is an application part of the Microsoft 365 suite which can be easily integrated with other applications such as Dynamics 365, Salesforce or Success Factor (SAP HR). In the Company the end-user works for, they consider SharePoint more like an "Enterprise Content Manager" (ECM) than a pure ERP, but ERP definition can be quite large. Documents management tool, by its importance inside a company, could/should be considered as such. (Name is not available, personal communication, April 20, 2022)

Interviewed person: Xavier Huysmans

Interviewed person's profile: ERP Systems Consultant, experienced in various ERP systems including SharePoint.

Mr. Huysmans said that SharePoint is an information and collaboration tool that cannot be acceptable as an ERP tool. But it completely depends on what the company or the employee wants to do with it. The process of implementing the SharePoint design is to keep it as simple as possible for the employees to use it.

For the question if SharePoint is enough to use for the companies or would they need to combine it with another tool. Mr. Huysmans said that it all depends on what the client wants. For instance, if the company wants to manage client's information, it first needs to do it on Dynamics and then create some reports in Microsoft Power BI and then create a SharePoint access to the different Microsoft Power BI reports.

In the question of which version is better to use SharePoint online or SharePoint on premises, Mr. Huysmans said that the only reason today some companies continue to use SharePoint on premises is when they have High level confidential documents which makes it impossible for companies to put information in the cloud. The difficulty today is that with certain very sensitive data you are not allowed to put them in the cloud or you have to make sure that they are managed within the European Union. This can be arranged with Microsoft in big companies. If the company has a license, they can have special arrangements to make sure that information is kept on service within European Union. However, it's not the same case for the small companies. For the rest of the companies, there is no reason to not use the online version.

The companies can customize and integrate SharePoint with other systems but it is not the same functionality as it is with ERP tool such as Oracle, Microsoft Dynamics. An example taken to explain SharePoint is Lego bricks. What companies do is take these Lego bricks and they build completely ready modules with it by combining them. But you don't have to build it completely by yourself when you can just take it ready from the market.

As a conclusion, Mr. Huysmans declares that SharePoint is not an ERP solution. SharePoint is really intended for document management and collaboration on information. It is not about resource management or to manage operations. (X. Huysman, personal communication, April 19, 2022)

Interviewed person: Jamel Hajaji

Interviewed person's profile: Office 365 and SharePoint Consultant, experienced in various Microsoft Office products particularly in SharePoint.

Mr. Jamel said that SharePoint is not an ERP solution as it does not manage resources. It is more used to be able to collaborate, share, make tracking of activities and manage documents. Companies choose to mostly combine SharePoint with other ERP tools. The

company where Mr. Hajaji works, they use Dynamics together with SharePoint. In Microsoft Dynamics, there are different modules like Sale modules. Microsoft Dynamics is more of a Database with all forms and rules. For instance, when using Sales module, the employee can track customers, new opportunities (Whether the opportunity is won or lost and the reason why). Therefore, to start the new opportunity or the new project, employee puts the document on SharePoint and then invite the people that need to work on that particular project. This is how the companies choose to work by combining these two tools.

In the past companies used SharePoint on premises as an ERP tool alone. It was possible to do everything such as reports, BI reports etc. It was possible to customize it as many times as the company needed. Now Microsoft has decided that instead SharePoint could be used for documents management and collaboration. But it is possible to integrate other systems and third-party application, however there is a limit with SharePoint online. For instance, companies use lists in SharePoint and it is limited to 5000 lists, it means if the company has 2500 employees, each of them has requested at least one time a holiday, you are already to 2500 requests, if they ask for another request, it means you are touching the limit of 5000. Accordingly, when the company decides to design a SharePoint portal, they need to think of a solution where they won't be faced with a problem of limitation. But then again for SharePoint on premises, it is not the same case, however it is expensive to implement and maintain for small and medium companies. (J. Hajaji, personal communication, April 21, 2022)

Interviewed person: Salim Bharuchi

Interviewed person's profile: ERP Consultant, specialized in Microsoft products and technology, particularly in SharePoint and Office 365

Before the present ERP tools, the big companies were using SharePoint as a multipurpose tool. They were using SharePoint for business process workflow, collaboration environment, intranet and at some point, it was used for public websites. However, now the main focus for SharePoint is the collaboration within the company. It is also used as a work flow tool, so if you have a business process where you need approvals from the stakeholders, SharePoint is used for that as well.

SharePoint on premises indeed has no limitations to use but it does not have the same features that the SharePoint online provides. Many organizations now prefer SharePoint on cloud as it is very well integrated with all the other technologies with office 365 like for example Power apps, Power flows, power automate, power BI etc. If the company has a business process and wants to automate, it is very easy to do it on SharePoint online rather than SharePoint on premises. If there are confidential information, then it is another case.

When SharePoint is integrated with other systems and customized, it can definitely fulfil the operation requirements that an ERP tool does. SharePoint is not an ERP system, however, for small and medium companies Mr. Bharuchi strongly recommends to use

SharePoint as an ERP tool as the actual ERP tool costs a lot. (S. Bharuchi, personal communication, April 25, 2022)

Interviewed person: Adrian Ganea

Interviewed person's profile: SharePoint/Software Engineer

SharePoint provides a built-in service application (Business Data Connectivity Service) that allows for integration with other platforms. Moreover, SharePoint exposes access to its contents via RESTful web services that allow 3rd party applications to read or write data.

Mr. Ganea would recommend using SharePoint for such purpose for small businesses only. The built-in lists come with an overhead that might perform slow when large data sets are needed. Also, there are some other hard limitations (like 30 million records limit or the 5000-list view threshold) that make a transactional database model more suitable for an ERP for medium and large organizations.

MS has always made new product versions backward compatible. However, indeed, technology evolves and one might be required at some point to completely rewrite applications because of deprecated tools, but that is the risk with any platform. For example, in the beginnings, SharePoint designer was the preferred choice for customizing SP - MS stopped putting any effort into improving the product in 2013 and it will be deprecated in future version.

As for the 3rd party applications, Mr. Ganea recommended to go for a 3rd party app where the source code is available and can be adjusted so that it meets company's needs. More often than not the company will be in a situation where they have such a specific need that no library can fill.

As for which version of SharePoint is better to used, online or on premises, Mr. Ganea said that it depends - from a data availability standpoint SharePoint online is definitely the choice. If the company has a special requirement about where the data sits and who can access it, company might need to turn to SharePoint on prem. (A. Ganea, personal communication, May 4, 2022)

Interviewed person: Besnik Bashari

Interviewed person's profile: SharePoint Site Collection Specialist

SharePoint can be customized and integrated with other systems with exchanging data from different system database. SharePoint indeed can be integrated with other application and third-party products. It all depends on the company's requirements; one can integrate and design it how they want as SharePoint is very flexible.

The object models help with integration from a usability perspective, which means that users can "access both SharePoint and other informational assets from a single interface that does not necessarily have to be the SharePoint interface."

SharePoint typically can be used as an ERP tool for a small and medium companies that have limited number of employers. Using SharePoint Design and InfoPath or PowerApps, creating (workflows, alerts and different forms for automation reason), creating different site collection (that have a different security boundary suitable for sensitive information), managing permission, customized different web parts (using JavaScript, HTML) make SharePoint to be used as an ERP perfectly for practice and security aspects with small IT department for developing and administrating SharePoint. One has to keep in mind that SharePoint has few limitations and threshold for number of items, views etc.

Ultimately, everything depends on what the company requires if they want to use SharePoint as a mini-ERP tool. Both mentioned versions of SharePoint are similar in term of functionality, however each of them has their own complexity.

SharePoint On-Premises it gives the company the chance to have control over their own confidential information and compliance standards. However, sometimes it can be very complex as there are companies who face problems even with SharePoint On-premises.

A company should choose SharePoint On-premises only if they have the required infrastructure and has requirements to have high customization, storage space that is bigger than what Microsoft offers, if they have high compliance standards when it comes to security of the documents, if company wants better control of the architecture of SharePoint farms and most importantly if the company requires availability of intranet connectivity in enterprise network.

Moreover, SharePoint Online is simpler to setup and manage. SharePoint Online is the best choice when one intends to create from base zero an intranet as it can be affordable and less complex. With SharePoint Online, there is no need to invest in the infrastructure.

Furthermore, indeed, Microsoft is developing applications that are compatible versions with each other. However, in long term the risk for deprecate of applications/tools is high as one has to upgrade all the time new versions and, in some point, it can reach in no-support applications/tools situation. (B. Bashari, personal communication, May 8, 2022)

2.2. Qualitative Method

The third methodology used was qualitative methodology. Research has been done regarding if SharePoint can be an ERP tool for small and medium companies. Articles and online resources were found that answered the question. However, as this is a new idea, and applied by very few companies as they choose to continue with ready-made tools rather than think out of the box, there are limited articles and information regarding to the research question.

SharePoint is a document sharing and collaboration platform that is developed by Microsoft. SharePoint has been first developed and released in 2001 as an in-house version. SharePoint online version was released in 2011 together with Microsoft Office 365 from Microsoft. There have been many versions of SharePoint from 2001 until now. However, currently, only SharePoint 2013 (support will be terminated in 2023), 2016 (support will be terminated in 2026), 2019 are available. The companies can continue to use the SharePoint terminated versions, but they cannot receive new updates. (Michael Bose, November 19, 2020)

The usage of SharePoint online is deemed to be user friendly. The companies do not need to install anything as this is an on-cloud version in Microsoft data centres. They will need only a subscription plan and internet connectivity.

On SharePoint online, it is possible to have integration with Microsoft Office 365 applications as it is completely supported. SharePoint can integrate with products from the Microsoft 365 Suite and software products outside of the Microsoft 365 Suite such as CRMs, ERPs, financial systems, Human resources systems, project management systems etc (Andrei Zhurauski). Companies can also develop custom applications thanks to Power BI. One can customize to the company's need. However, customization is one of the reasons big companies choose to work with ready-made ERP tools as when the business requires lots of customization, it may cost a lot more than just buying the license of SAP or Sales force etc.

The subscription plans for SharePoint Online provided by Microsoft are given below (Michael Bose, November 19, 2020):

- SharePoint Online Plan 1 ($5 user/month); includes SharePoint, OneDrive (1 TB), Lists
- SharePoint online Plan 2 ($10 user/month); includes SharePoint, OneDrive (unlimited storage), Lists
- Microsoft Office E3 ($20 user/month); includes SharePoint, OneDrive, Lists and the full set of Office 365 apps/features.

Table 1 SharePoint vs Microsoft Dynamics 365

Microsoft Dynamics 365	Microsoft SharePoint
It's a multilanguage Enterprise Resource Planning (ERP) software. This tool has been designed for medium and large enterprises and is fully customizable.	SharePoint is a documents management and collaboration tool.
111 Features: Activity Dashboards Reporting and statistics Third-Party integration Document Management Workflow Management Data Import/export To see more features: https://www.getapp.com/operations-management-software/a/microsoft-dynamics-ax/features/	44 Features: Collaboration tools Access Controls/Permissions Document Management Alert/Notifications Third-Party Integrations File Sharing To see more features: https://www.getapp.com/collaboration-software/a/microsoft-sharepoint/features/
Price: $50/user (per month)	Price: $5/user (per month)
Total Integrations 229	Total Integration 493

Although above solutions are produced and developed by Microsoft, they have different characteristics in terms of features. While Microsoft Dynamics is ready to use ERP tool, SharePoint online require customization and integration with other systems such as financial systems, Human resources system, CRM system etc. However, it always depends from the needs of the company. If the company doesn't need customization, it is not necessary for the company to require it. Furthermore, MS SharePoint Online is licensed on a per user basis that costs $5 per user or $10 per user, depending on the purchasing plan the company requires. However, MS SharePoint Online can also be purchased as a standalone plan or included as part of Office 365. (Retrieved from: https://www.microsoft.com/en-us/microsoft-365/sharepoint/sharepoint-licensing-overview)

As we can see above, Microsoft Dynamics has got 111 features while SharePoint has 44 Features and it is affordable for the companies.

Table 2 Microsoft SharePoint vs Dynamics CRM

Features	Microsoft Dynamics CRM	Microsoft SharePoint
General Structure	Entities	Lists
Workflow	Workflow with a possibility of triggering events	Workflows can create events or update them. Possible to integrate with other tools. Possibility to extend its capabilities by using Power Automation.
Flexibility	It can be purchased for specific roles such as sales. Customer services or marketing. It is possible to customize the three roles. Redundant new fields and/or forms can be created.	Possible to customize according to business requirements also to add extra functionalities. This includes additional software tools that exist in the market for marketing and invoicing.
Document Management	It is not designed for Document Management but documents can be uploaded as entities (usually as attachments)	Available and provides document libraries with a possibility of linking to different entities such as client, contacts etc.
Security	Fields can be secured. Roles are possible and different business units/teams can be created according to the territories.	There are several permission levels, user groups can be created to define those levels. Customized user groups can be created with unique permissions if required.
Cost	It can cost around $45/per user, per month to $310 per app. It can adjust to the company's need.	It can cost $5.per user per month, however, if used as an ERP tool such as Dynamics, it can cost around $40 per user per month.
Individual Strengh	- Captures structured business data - Can work offline with Outlook	- Captures unstructured documents and web content

	- Possibility to create queries	- Admin can administer their own content - Possibility to search through data (documents and web content)

As per information on the above done from Lucidica IT company, we can come to a supposition that SharePoint online can be constructed to be a CRM, however a CRM can't be automated to do the tasks that SharePoint can. (Retrieved from: https://lucidica.co.uk/blog/products/sharepoint-as-a-crm/)

As a conclusion, both of the systems are powerful tools to help companies in tracking records of their clients, manage documents within the company or/and manage the operations of the company. Some big enterprises choose to use CRM and SharePoint online together. However, this can cost a lot for small and medium enterprises. Instead, they can choose to have a fully customizable software and save money in the process. (Retrieved from: https://lucidica.co.uk/blog/products/sharepoint-as-a-crm/)

CHAPTER 3. DESIGN AND IMPLEMENTATION USED FOR RESEARCH DISCUSSION

3.1. Program Structure

In a complex engineering project, not only the main staff of the project but also people from other departments work. These people may have also pioneered the initiation of the project, for example, when the business development department enters the tender for a new contract and wants to submit a proposal in accordance with the job description, they may want to access the documents related to the contracts that have been successfully completed, as well as various related to previous projects. reports can also be used for business development. With the developed program, it is aimed to contribute to the information management system by systematically classifying the project documents used for the same purpose in previous projects. The program can access the databases where the documents of the previous projects are hosted, when the necessary authorization and conditions are met, and as a result, it can report to the user requesting the information. On the result screen, the user can not only see the created documents, but also view how many documents were created and for what purpose they were created on the graphic.

Spreadsheets of drawings and their parts lists, if available, are common files for all projects. These files are usually produced by qualified personnel such as drafters, or they can be produced by project engineers. Assuming that the drawings are produced by the draftsman, the drawings and charts are stored in the Technical Drawings section of the program and are controlled by the project engineer or project manager. Generally, drawings are revised in engineering projects and errors are corrected as a result of teamwork. In this case, it is very important to check the drawings. Thanks to the program, this task can be accomplished easily, and after the drawing is checked, the project engineer/manager can give feedback on the program that it has been checked. In addition, constantly storing the drawings on the program allows the current version of the file to be kept and the revision number to be followed in case of an engineering and design change. In the same way, revision numbers can be written on the program instead of being written to the file name, if desired, so that it can be seen how many times a drawing has been revised. At the same time, information about who the draftsman/engineer is and when he uploaded the file to the program can be seen. In case of a possible error, it can help to find the person responsible for the error.

Another important issue in engineering projects is that the documents called Bill of Materials (BoM) in English must be collected in one place, filled by authorized personnel and transferred to other authorized personnel. When appropriate, several personnel can work on the same bill of materials and purchase these bills, etc. can be submitted to departments. At the same time, the project employee can see the approval of the submitted BOM, its occurrence in the process and the result of the transaction through the program. These are a part of the process tracking feature in the program, each user should perform process tracking

based on their own duties and responsibilities, and should also observe the follow-up of other users' tasks in terms of work tracking when deemed necessary.

"Configuration Management" is one-to-one compatible with the program's configuration management and allows the user (can be Project Manager or Configuration Manager) to develop his own configuration management strategy. Accordingly, the configuration management levels of the project can be entered on the program and the configuration level can be defined for each document. While the configuration levels are unique for each project, they can also be fixed for a company that performs standard works. Configuration elements can be added to the program, categorized by specifying the level of each element, and filtered, listed or output according to the desired category. Files related to configuration elements can be kept together by categories and filtered according to their level.

When engineering firms are working on a contract, they want to hold meetings with their customers and subcontractors during the contract phases. These meetings are moderated by the Project Manager and are requested to be recorded. These records are kept by the project manager or project assistant; therefore, the user is given the authority to write to this folder in the program. All other users have read privileges on this folder. In addition, holding weekly meetings in project companies has become the company culture and allows project personnel to discuss the design and process. While the weekly meetings are held in-house, the minutes of these meetings are still within the institution.

3.2. Program Interfaces

The Program consists of four interfaces. These; It is divided into four as Project Management Office, Project Engineering Office, Human Resources Management Office, Accounting Department. Project Management Office (PMO) is mostly used by personnel such as Project Manager, Project Assistant and Project Specialist, personnel working in non-engineering departments such as procurement, accounting, business development also have access to PMO. These personnel can also contribute to the PMO through Project Assistants. Figure 1 shows the structure of the Project Management Interface.

Project Engineering Office (PEO), on the other hand, is used by personnel specialized in technical subjects such as Project Engineering Manager, Project Engineer, Quality Manager, Quality Control Specialist and Technical Painter. Project Engineering Office (PEO) Interface is as shown in Figure 2 below.

Human resources Department and the Accounting department is used by personnel specialized in Employment, recruitment manager, human resources coordinator, human recourses manager, Recruiter etc. Human Resources interface is shown in Figure 3 below.

Accounting Department is used by personnel specialized in accounting manager, controlled, bookkeeper, staff accountant etc. Figure 4 shows the structure of the accounting department interface.

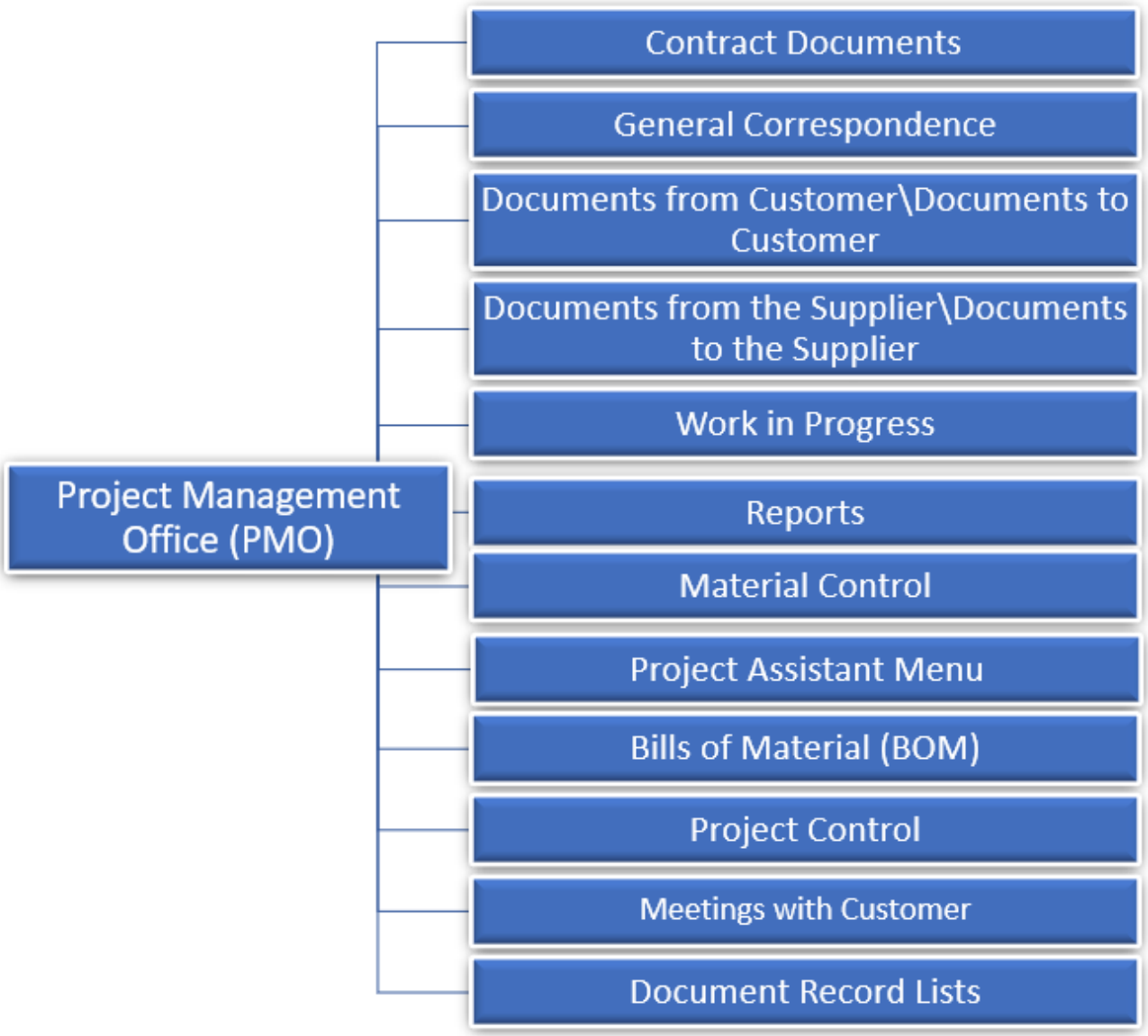

Figure 1 Project Management Office Interface

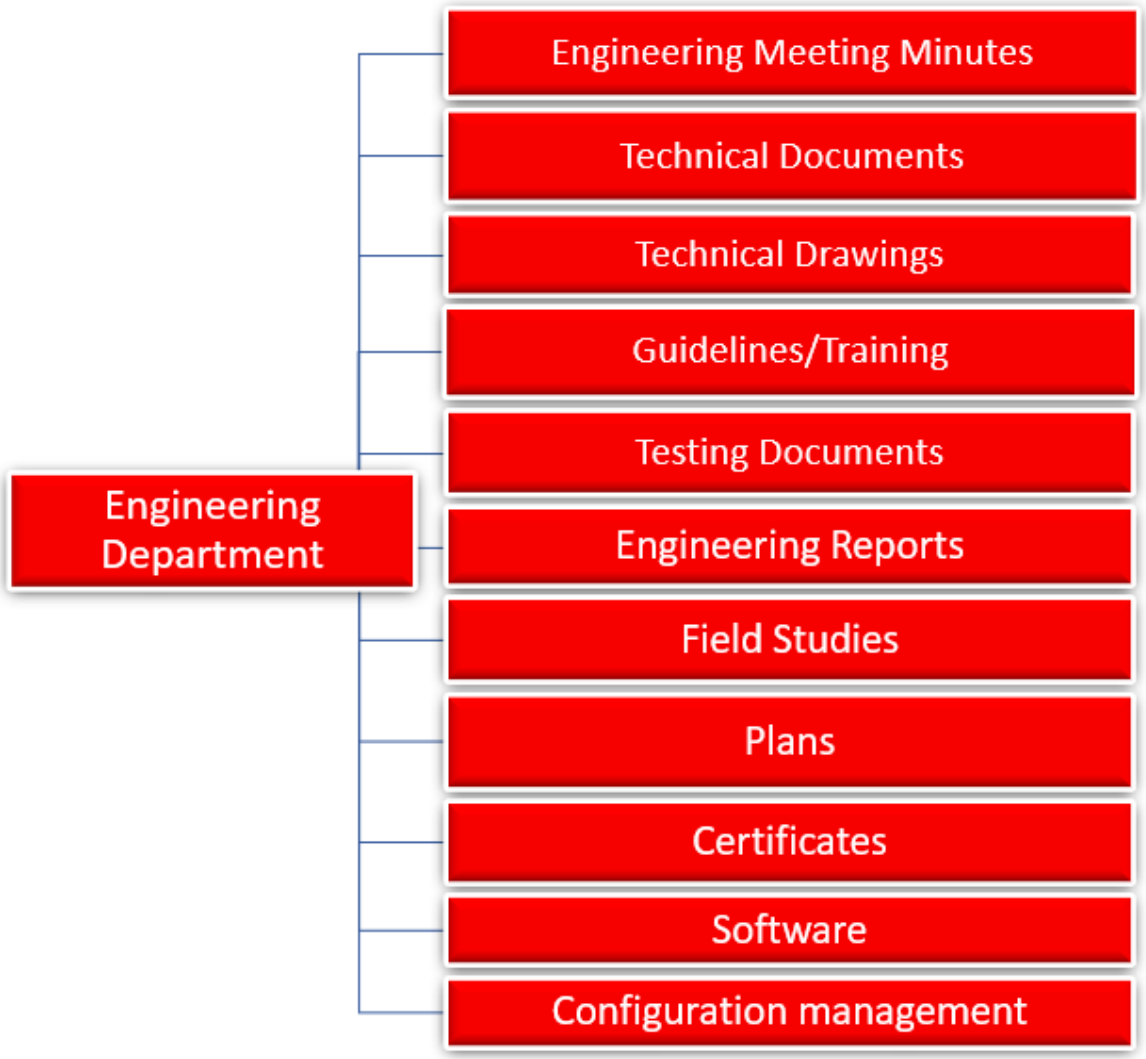

Figure 2 Project Engineering Office Interface

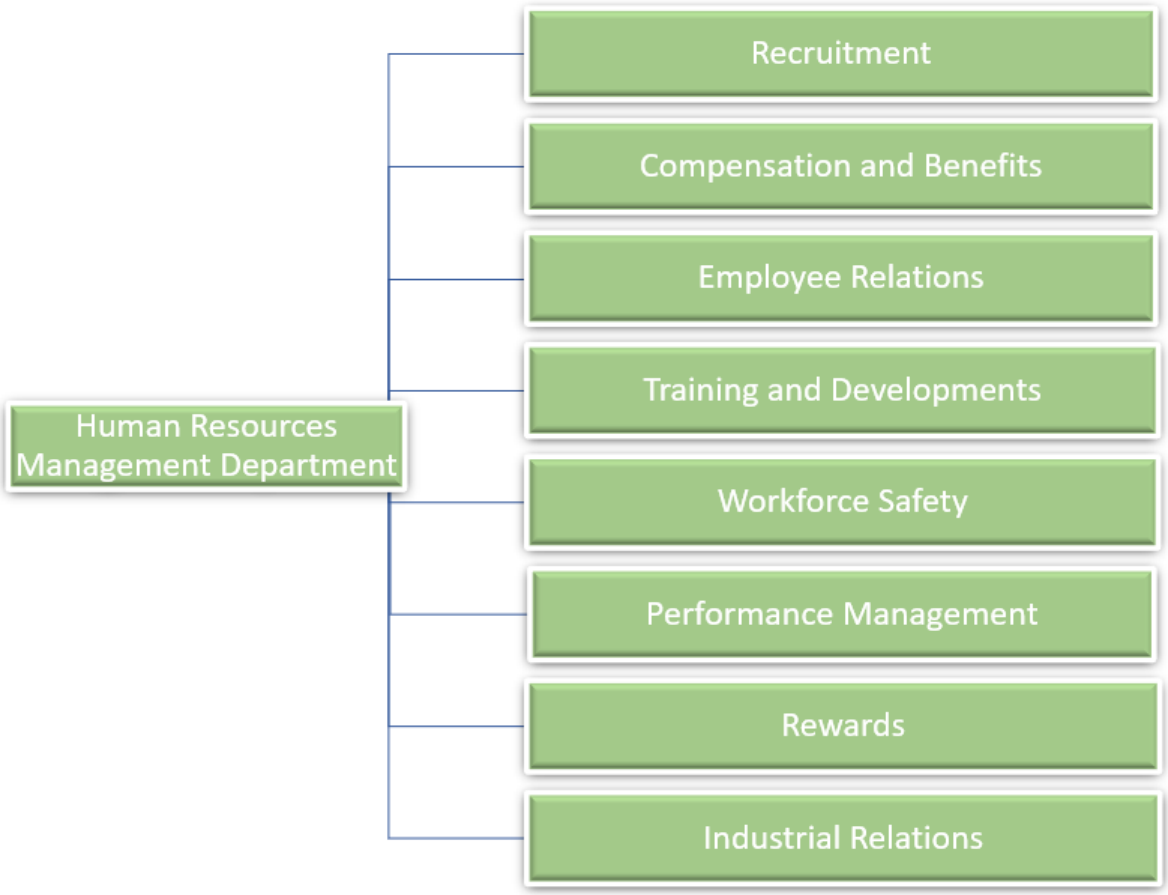

Figure 3 Human Resources Management Department

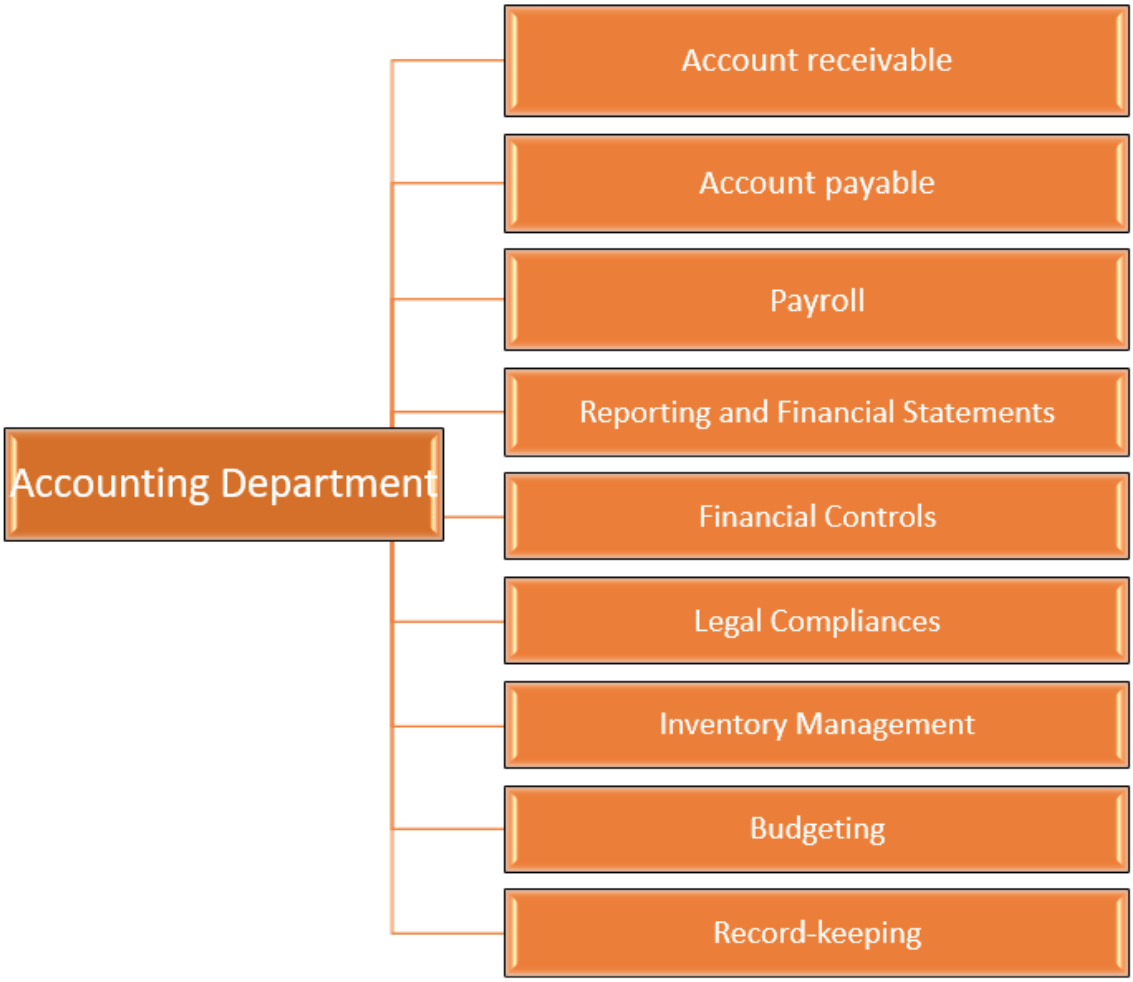

Figure 4 Accounting Department

3.2.1. Project Management Office (PMO)

Managed by Project Manager Project Management Office Interface consists of the following subsections.

- Contract Documents
    - Contract
    - Contract Attachments
- General Correspondence
    - Official correspondence between institutions
- Documents From Customer/Documents Outbound to Customer
    - Contract related technical documents, design documents
- Documents From Supplier/Documents Outgoing to Supplier
    - Offers, Purchase Requests
- Work in progress
    - Documents in preparation are kept in this folder
    - Revised documents are kept here for review
- Reports
    - Various reports are kept on record
- Material Control
    - This menu is part of the configuration management
    - Subfolders of Configuration Elements are hosted
- Project Assistant Menu
    - Customizable by Assistant
    - The status of the tasks assigned to the assistant can be observed
- Bills of Materials (BOM)
    - Material lists required for the project to be purchased are collected here
- Project Control
    - Project Stages Tracking
- Meeting with the Customer (Meetings)
    - Meeting minutes
- Document Registration List
    - All documents created for the project are recorded

3.2.2. Project Engineering Office (PEO)

The Project is Managed by the Engineering Manager. Project Management Office Interface consists of the following subsections.

• Engineering Meeting Minutes

- Meeting minutes are kept here

• Technical Documents

- Design, installation, integration, etc. Documents describing how to do things are collected here

• Technical Drawings

- All technical drawings (Mechanical, Electrical, Civil, Architectural etc.)

• Guides/Training

- User manuals, training documents for personnel

• Test Documents

- Documentation on acceptance tests is collected here

• Engineering Reports

- Technical reports prepared by engineering are collected here

• Field Studies

- Reports of on-site exploration by engineering are collected here

• Plans

- The Engineering Plan prepared by the Project Engineering Manager is kept here.

• Certificates

- Certificates of Conformity, CE Certificates, end-user certificates, CoCs, etc. of purchased products. certificates are collected here.

• Software

- Installation files and manuals of all software used in the project are collected here

3.2.3. Human Resources Management Office

This department is managed by HR manager. This department consists of the following subsections.

- Recruitment
  - This process includes four steps: job analysis, sourcing, screening and selection, and onboarding. All the applications and the process documentation are kept here.
- Compensation and Benefits
  - All the compensation, monetary and non-monetary benefits records are collected here.
- Employee Relations
  - All policies regarding to a healthy workplace and recordings are kept here.
- Training and Developments
  - All the records of staff training requirements, programs and career developments are kept here.
- Workforce Safety
  - Manuals and training records are collected here.
- Performance Management
  - Communication of the company's mission and measurement of KPIs of the management is collected here.
- Rewards
  - Rewards records is kept here.
- Industrial Relations
  - Records of policies are collected here.

3.2.4. Accounting Department

This office is managed by the Chief Financial Officer. This department consists of the following subsections.

- Account Receivable
  - Records are kept of the bills sent to the client.
- Account Payable
  - Approved and processed payments made to the suppliers or clients. Tracking if there is something owned to any of the suppliers or clients. All these records all collected here.
- Payroll
  - All the payroll checks, reimbursements, bonuses, overtime and holiday pays are kept here.
- Reporting and Financial Statements
  - All the reports and documentations are collected here.
- Financial Controls
  - Company records of the accounting functions are kept here.
- Legal Compliances
  - All the reports of the company to any risk exposures chances are collected here.
- Inventory Management
  - The company's inventory costs are kept here.
- Budgeting
  - All the reports, plans and evaluation performance of the company's revenue is kept here.
- Record-keeping
  - Records of the company for audit reasons, compliance checks and other necessities are collected here.

3.3. Program Setup

Within the scope of the project, access was provided by logging in to the address "https://www.office.com" via a browser with a computer with an Office 365 license and a Windows 10 or Windows 11 operating system, using the e-mail address and password for which the license is defined. You can log in to the SharePoint application from the Office 365 home page that comes up when you log in. Office 365 provides online access to many MS Office applications with cloud technology without hosting any server in the company. The current Office 365 hosts SharePoint Online version 2019, which is the latest one and Microsoft provides full support. This study was focused only on the online version of SharePoint that comes along with Office 365 subscription.

However, there are other versions of SharePoint that can be used to design and implement the ERP tool that is described in this study. These kinds of versions are called as "SharePoint on premises" or simply "on-prem". Some old versions are not supported anymore therefore one should take into account that the implemented version should be the latest version launched.

Prior to on premises SharePoint installation, one needs to make sure that the hardware and the software required for SharePoint Server 2019 are available and most importantly to have a 64-bit version of Windows Server 2016 operating system. Microsoft lists the minimum requirements for a server in a server farm on its website, the requirements are being updated on each release. For SharePoint databases, either SQL Server 2016 or 2017 that is compliant with 64-bit is needed. There are particular steps to follow in order to install SharePoint Server 2019. One needs to run the Microsoft SharePoint Products and Technologies Preparation Tool so that one can install all the criterion needed to use SharePoint Server. As a second step, one should run setup, which installs binaries, makes possible the permissions and edits registry settings. For security reasons Microsoft advises the administrators to use least-privileged administration. https://docs.microsoft.com/en-us/sharepoint/install/install-sharepoint-server-2016-on-one-server.

Over all there are 6 crucial steps need to followed which, one can find a detailed explanation that will help during the program set up, installation, configuration of particular sites and databases available in the following reference link. https://docs.microsoft.com/en-us/sharepoint/install/install-sharepoint-server-2016-on-one-server.

3.3.1. Office 365

Office 365 is a cloud platform provided by Microsoft where you can access your e-mail and calendar from anywhere, edit your Office documents (Word, Excel, PowerPoint, etc.) over the web, make instant messaging and video audio conferences, and share your files. Thanks to Microsoft's Office 365 product, you can start using Microsoft Exchange ™, Microsoft Lync ™, Microsoft SharePoint ™ and Office Web Apps services instantly by paying as much as the number of users, without server hardware and software investment costs. (https://support.microsoft.com/en-us/office/what-is-microsoft-365-847caf12-2589-452c-8aca-1c009797678b)

3.3.2. Creating a SharePoint Site

In the project, MS SharePoint is configured using Office 365 infrastructure. A secure login must be made from the e-mail address with the domain extension of the company website where the license is defined, from the address “https://www.office.com”. When logged in, there are Office applications defined to the Office 365 account as shown in the figure below. SharePoint application must be selected from this page.

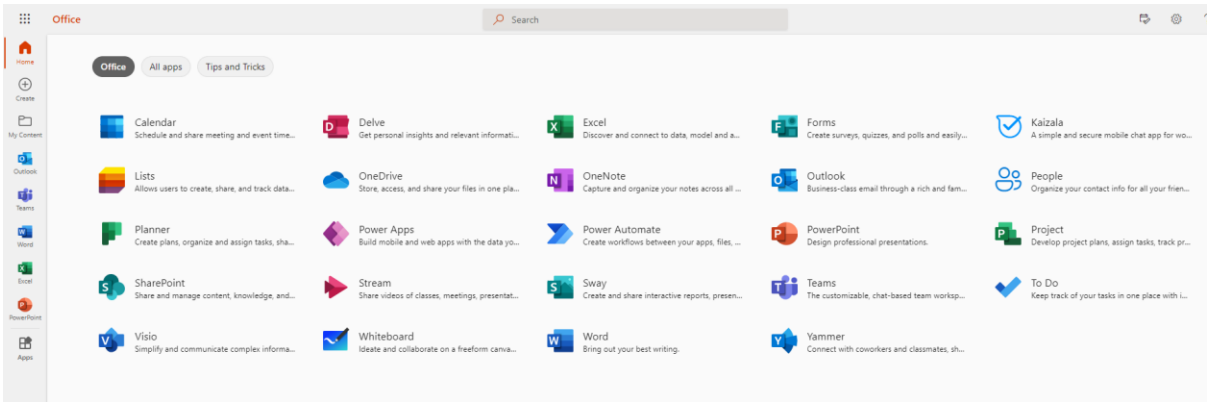

Figure 5 Office 365 Home Page

When the SharePoint logo is clicked, the main screen of the application appears. On this page, you can view the SharePoint sites you have created, and add the ones you want from these sites to your favourites. When the "Create Site" button is clicked on this screen, the steps to create a new SharePoint site appear. In our project, the "Communication" type site type was selected. The steps to create the site are described below.

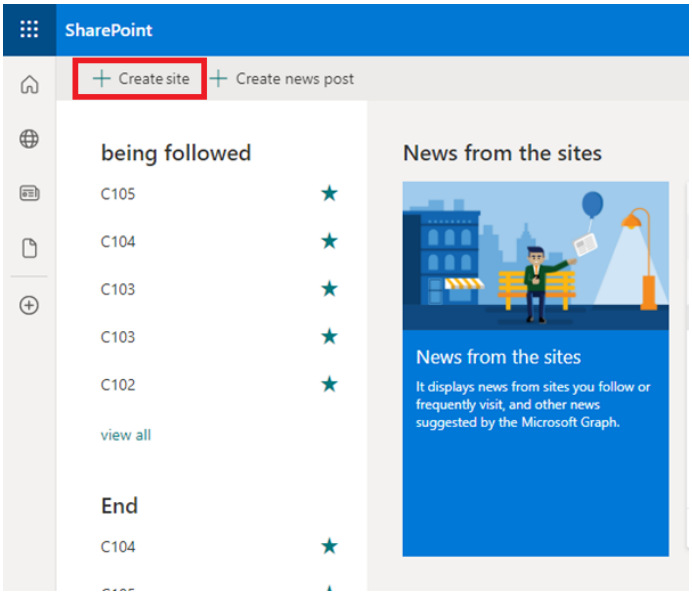

Figure 6 Creating a SharePoint Site Step 1

In the Figure below, in the first step of creating a new site, you have to click on the team site which contains of a private space where the team members across the other departments can collaborate with each other.

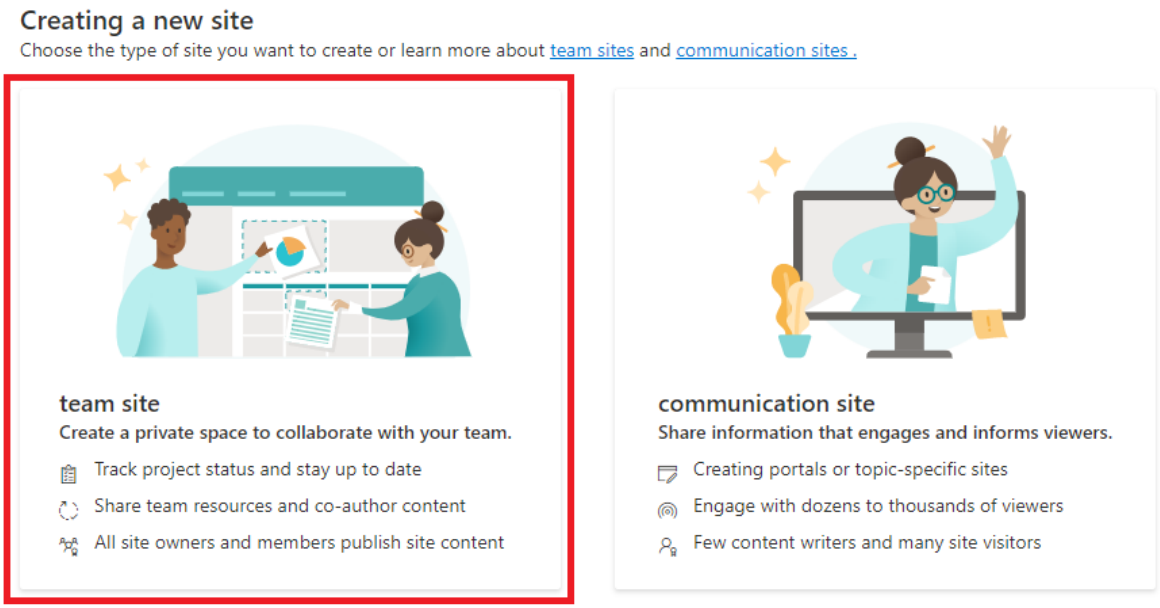

Figure 7 Creating a SharePoint Site Step 2

As indicated in the figure below, in the second step it will ask you to enter basic information such as Site Name, Site Address and Site Description. If you are a multinational company, you can choose English as a language. You must complete this step by clicking the “Finish” button.

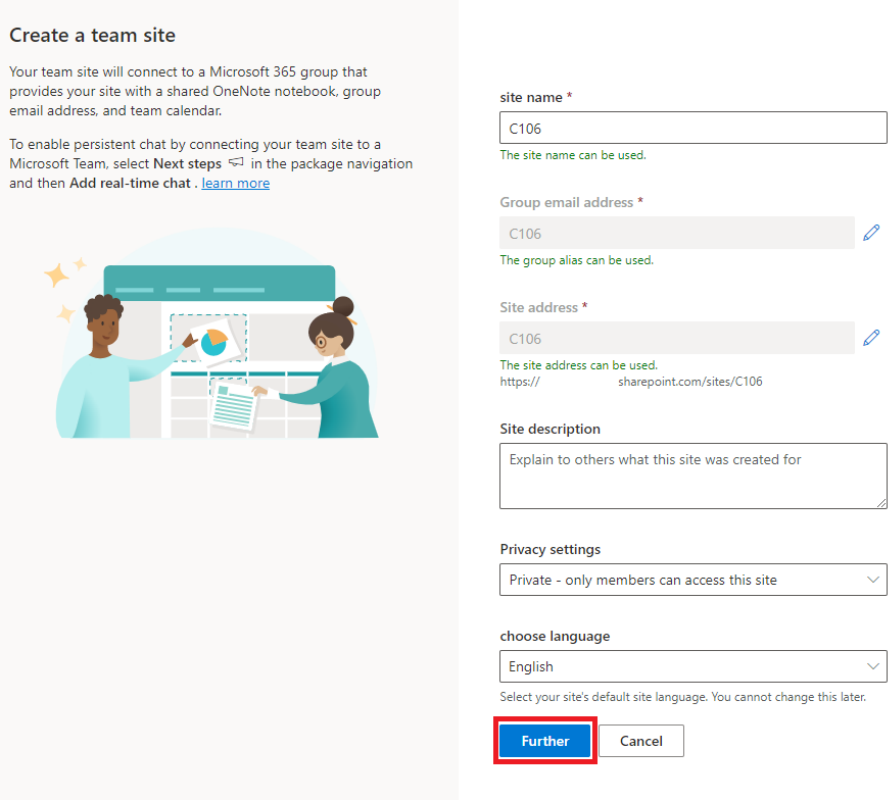

Figure 8 Creating a SharePoint Site Step 3

Adding a Logo to the Settings Menu and the Site

After creating your site, you may want to add your organization's logo, for this you should click on the "Wheel" symbol in the right corner of the top menu. A menu will open as shown in the figure below. From this menu, you must switch to the "Site information" menu.

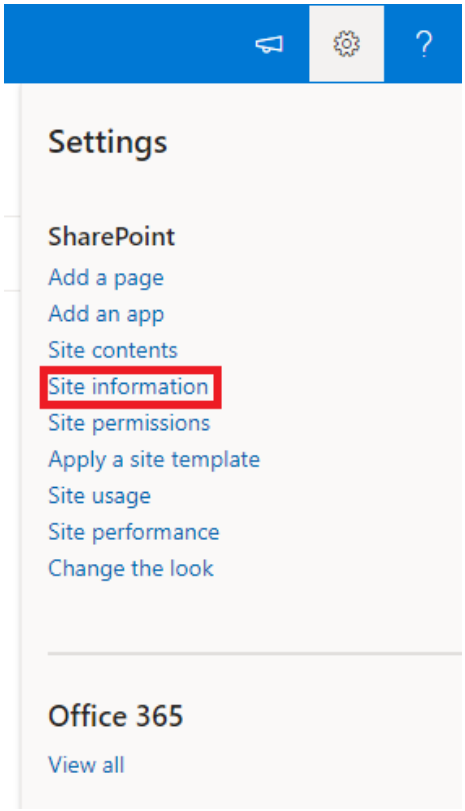

Figure 9 Settings Menu

When the “Site information” menu is clicked from the Settings menu, a menu like the one below will appear. In this menu, the site logo will appear in white. From here, you can change the logo by pressing the “Change” button and upload a logo from your own computer.

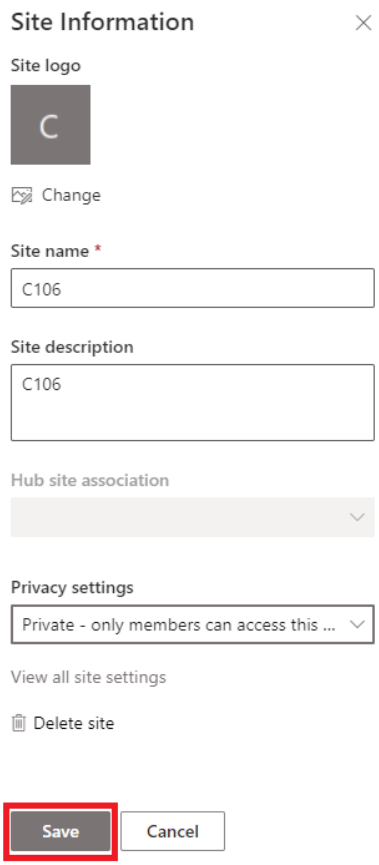

Figure 10 Editing Site Information and Adding Logo

Site Information menu also serves to correct any mistake you made in data entry while creating the site. For example, incorrectly entered site name or site description can be corrected here.

Due to need-to-know basis practices, all project sites should be in “Private” mode. The users that need to access to the site to be selected by the administration according to the project management plan and project requirements. Those users will have privileges in accessing the dedicated project site.

3.3.3. SharePoint Site Homepage Layout

When the site is first created, SharePoint will present you with a ready-made template home page. It is possible to customize this homepage. To do this, click the "Edit" button next to the pencil symbol in the upper right corner.

When you hold the mouse on the part you want to change, three symbols will appear. In the example below, symbols will appear when we hold on to the larger image. You need to click on the "pencil" one of these symbols and say "edit web part". With that, "Layout options" will open from the side menu. From here you can change the composition of the tiles you want to appear on the main screen.

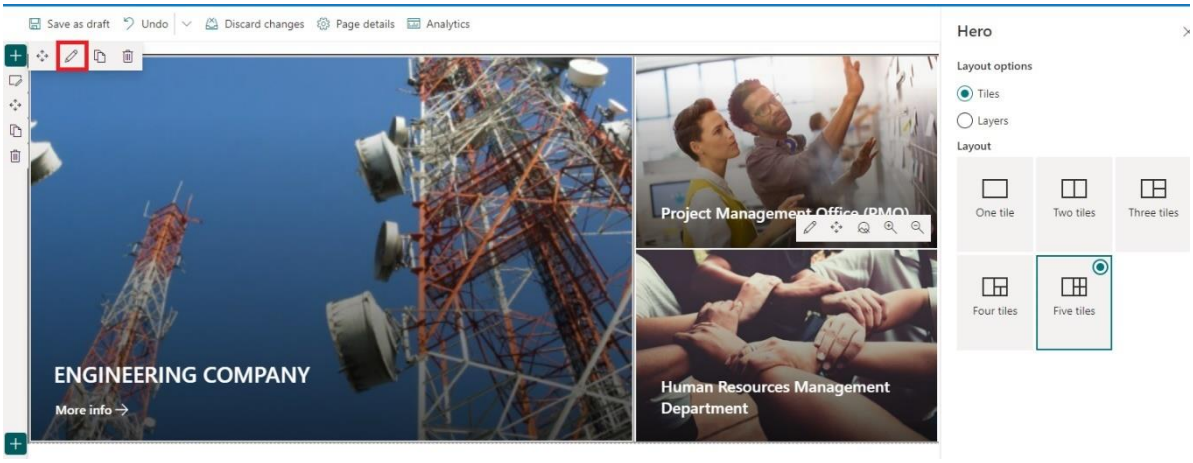

Figure 11 Editing a SharePoint Site Home Page

It is possible to select a template to build up your site. There is a “Project Management” template that could be selected to facilitate the customization. It is also possible to select a template that was created by the organization itself. With this feature a common project template can be applied for whole company projects. This is a crucial feature that enables us to apply the best practices across the company.

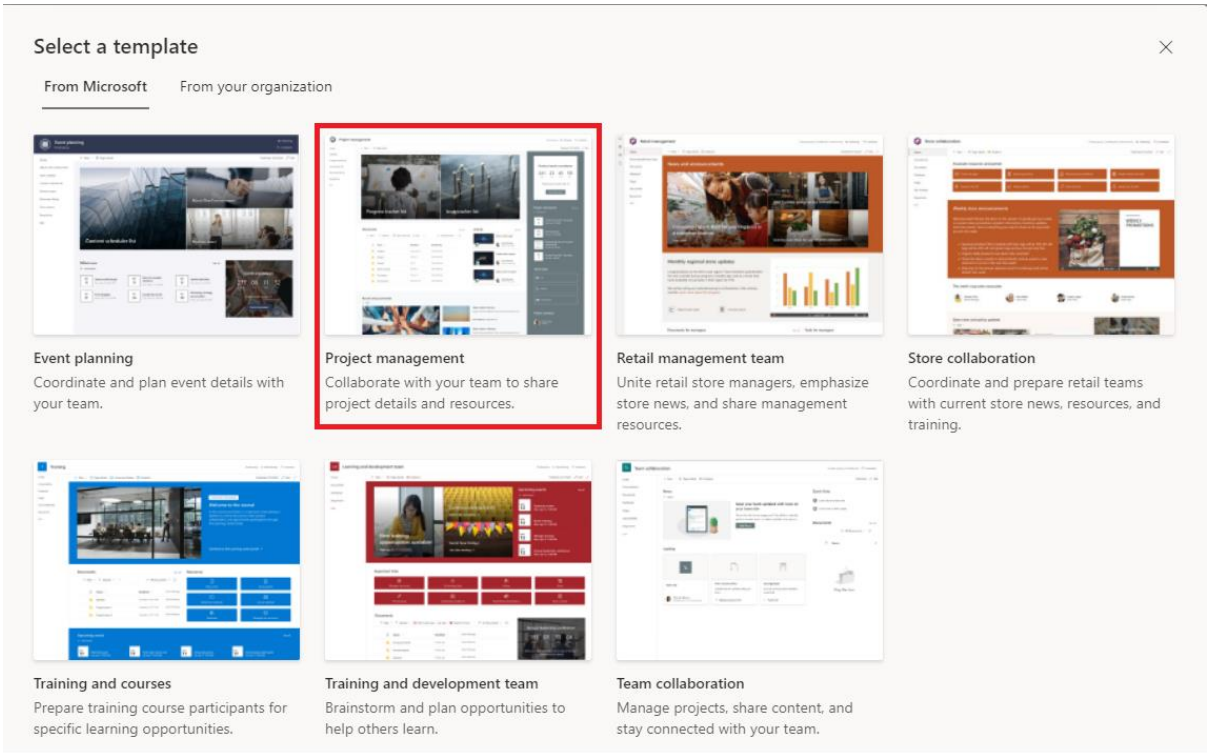

Figure 12 Selecting a Template

After completing the editing, the blue “Republish” button in the upper right corner must be pressed so that the new version of the page can be viewed by all SharePoint users.

3.3.4. Adding Images to the Homepage

In order to customize your home page and add images, you need to use the menu that opens below, by clicking your mouse on the lower right corner of one of the images that come with the ready template. From this menu, you need to press the "pencil" symbol and say edit details.

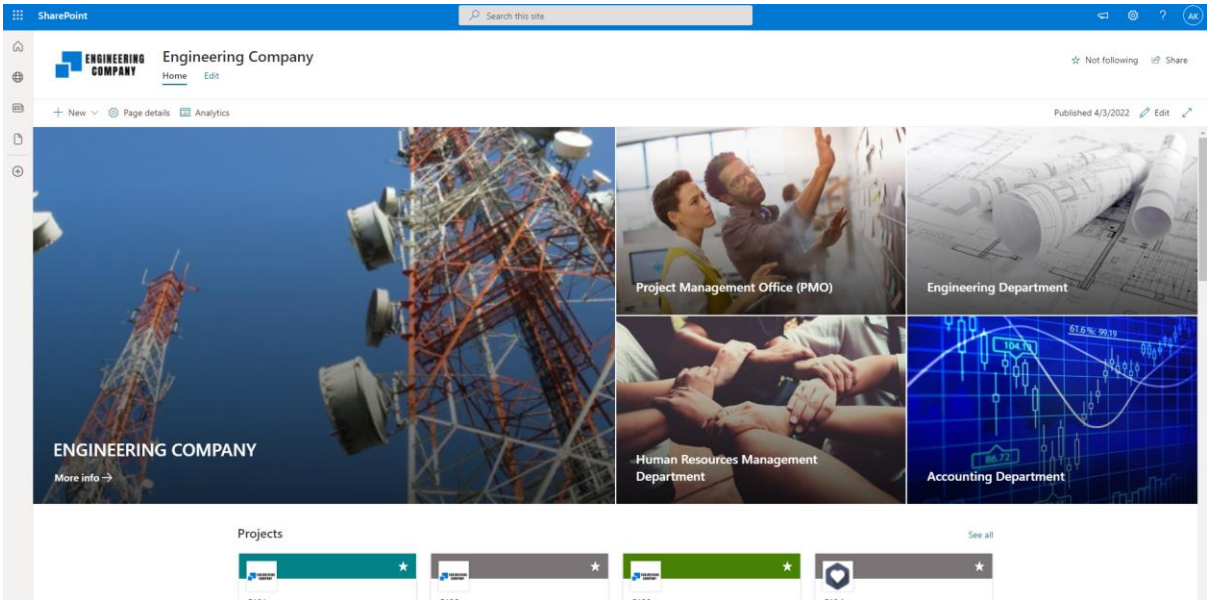

Figure 13 Adding Images to the Homepage

Two methods are recommended for adding images, one of which is to copy and paste the link of an image you know the link to or its extension in the SharePoint storage. To do this, click the "Change" button on the "Connection" tab. When you add the link, the image will appear if the link has been reached. If the image is not visible, the link must be checked via the browser. From this section, you can also add a caption that will appear on the main page to the side of the image by adding a caption.

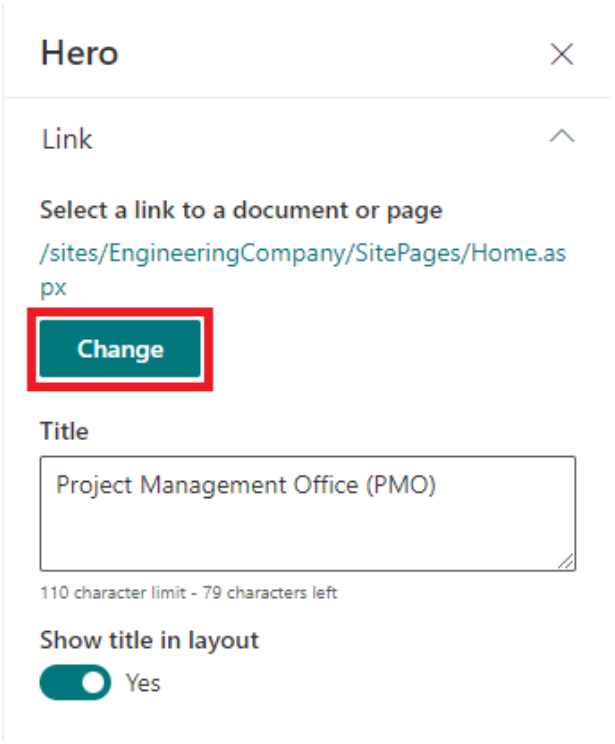

Figure 14 Adding Images to the Homepage

In the second method, the Picture tab should be used. Click the “Change” button in order to add a picture. For visually impaired users, a verbal description of this picture can be entered as alternative text. In today's world, where accessibility features gain importance in mobile and web applications, the content of the picture should be entered in this section in order to increase the participation of visually impaired individuals in business life. Other features that can be applied to the image you want to upload with the Options sub-tab also come to the fore.

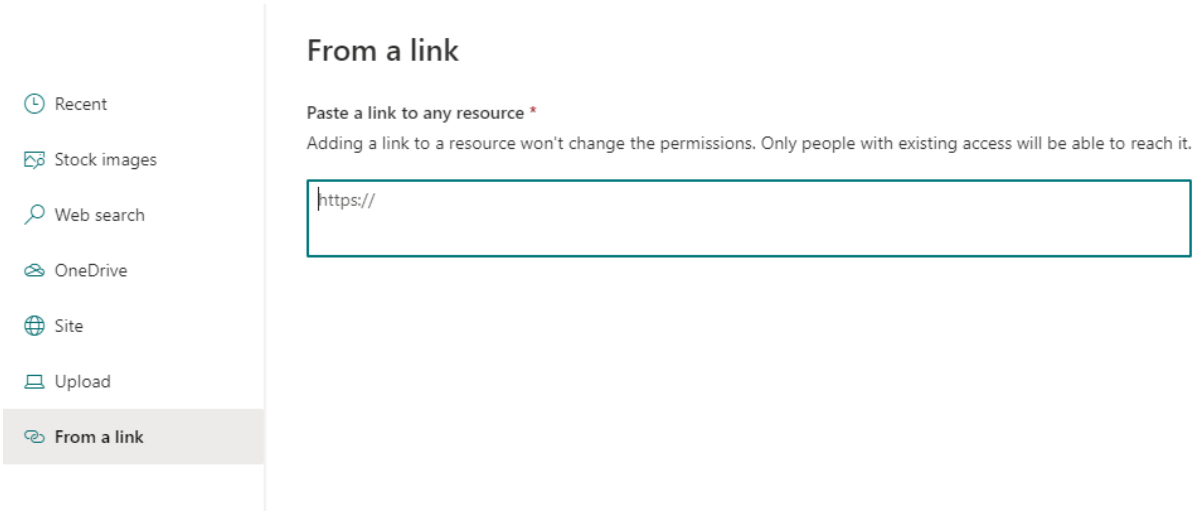

Figure 15 Adding Image from a link

If you want to upload a picture from your computer after clicking the "Change" button on the Picture tab, you must click the "Upload" button. The preview of the uploaded image will appear on the side. After you see it on the side, the image you uploaded with the "Add Image" button will appear on the main page.

MS SharePoint offers us various features when it comes to uploading items. These features are also enhanced by the fact that SharePoint is connected to the Internet. When you say web search, an image found on the web can be added by entering the keyword. In the OneDrive option, you can choose from the images you have previously uploaded to the cloud system. You can easily access these images if you have uploaded them in a short time when you click on the option that says "Finish". Finally, when you select the "Site" feature, you can add an image from the content of a site you previously created on SharePoint.

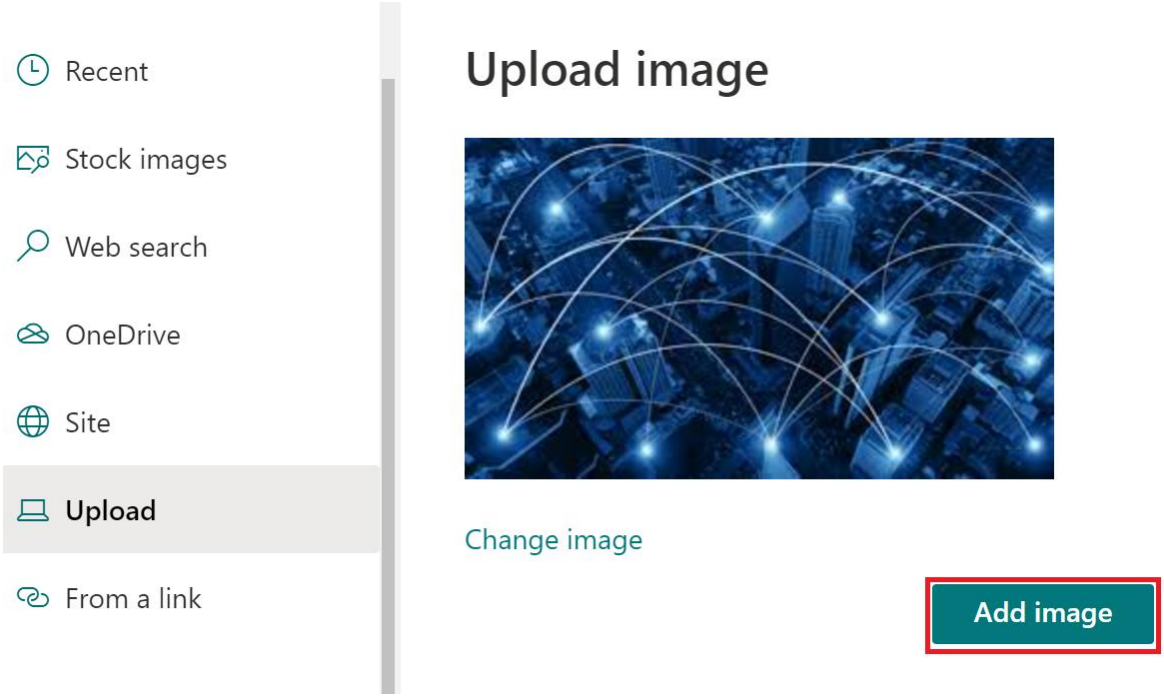

Figure 16 Uploading Images under the Image Tab

The main page screen designed for the Engineering Company in the project is as follows. The "Edit" option appears because it is accessed as an Administrator. Although the home page looks like a typical website, you can customize it using the layout options you want. When you click on the "More" link in the main image, it directs you to the "About Us" section of the company. When you click on the Project Management Office section, it takes you to an information page that includes items such as the contents, rules, events and meeting schedule published by the top directorate to which the Project Managers are affiliated. When we click on the section that says Project Engineering Office, it directs us to a page used by the top management to which Project Engineering Managers are affiliated. On this page, there are contents such as directives, rules, events and meeting schedule that Project Engineering Managers, accounting office and HR Managers can access. When you scroll to the main page, the newsletter with the news in the company catches the eye. In addition, there is a main calendar and important developments in the organization, meetings, etc. There is a section with the times and locations of the activities.

When you go to the bottom, there is a visual sliding menu with all the projects. From here, you can view all available projects in order by using the arrows, if you have permission to access, you will be directed to the project home page. These projects are; It appears as C101, C102, C103, C201, C202, in numerical order.

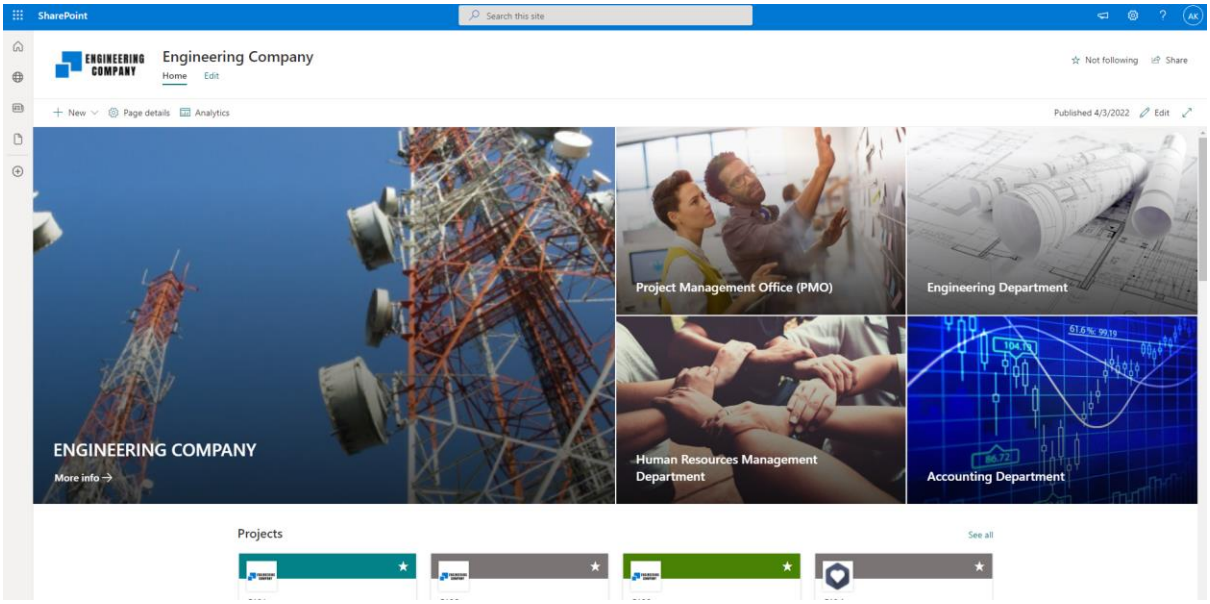

Figure 17 Engineering Company Homepage Design

3.3.5. Subsite Creation

The Engineering Project Management Program consists of four subsections. These subsections are hosted on subsites on SharePoint. Subsites can be accessed under the extension of the main site. In order to create a subsite, it is necessary to enter the "Site Content" submenu from the "Settings" menu. In the Site Content menu, the "New" button indicated with a plus sign should be clicked on, and the "Subsite" option should be selected from the opened submenu.

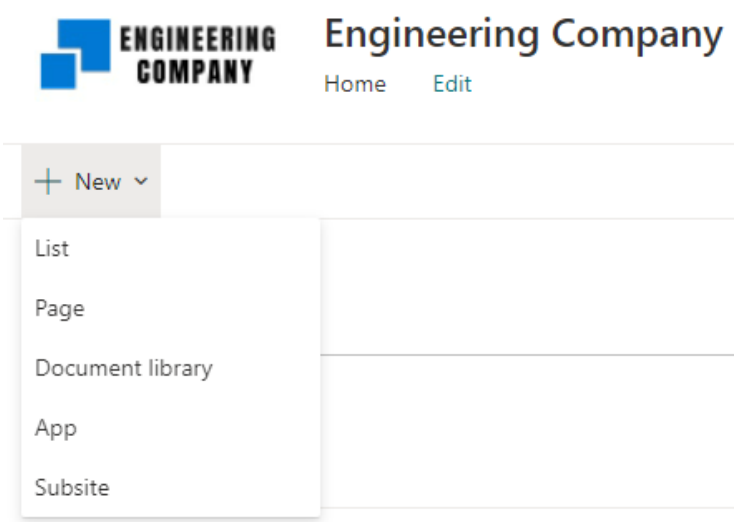

Figure 18 Adding Subsites Stage 1

After selecting the subsite option, a page with the title "New SharePoint Site" will open. On this page, you are expected to enter some information as if you are creating a site from scratch. The title, description, etc. should be given the name of our sub-site. There are two main subsites in the project, Project Management Office Subsite and Project Engineering Office Subsite. These sites will be used by both Project Managers and Project Engineering Managers for process management purposes. As seen in the figure below, the information for the Project Management Office has been filled. You will be asked to define a web address in the blank field where the website address is written. This web address works with the subdomain logic of classical websites. You are actually creating a subdomain for your existing website. The URL address you have written here can be used in Hyperlinks to access the subsite you have created in the future. It is recommended to choose Team Site (classic experience) under the collaboration tab as the template selection.

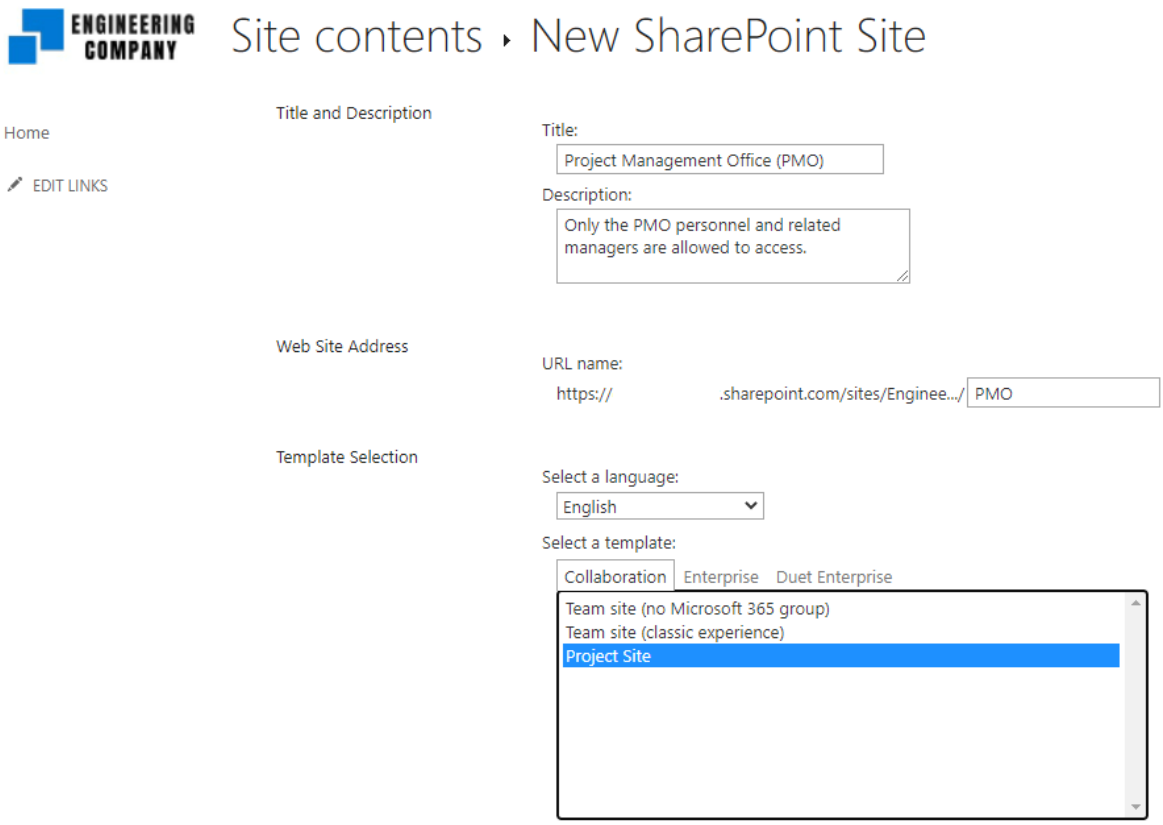

Figure 19 Adding Subsites Stage 2

Web Based Interactive Engineering Project Management Program uses subsite logic to separate projects from each other. In other words, apart from sub-sites such as Project Management Office (PMO) and Project Engineering Office (PEO), each project has its own sub-site. A sub-site can be created according to the relevant contract number by using the sub-site addition stages, for example, “C” represents the contract, a 3-digit contract number is entered next to it, so we have a contract number like “C101”. When we want to access the sub-site of this contract number, you can access the main page of the sub-site where the relevant contract is located, from the extension below.

- “https://sharepoint.com/sites/EngineeringCompany/C101”.

In a typical project subsite, there are submenus, in other words modules, which form the basic components of PMO and PMO. When the project subsite is opened for the first time, modules related to PYO appear. This is because the project home page is actually the PYO home page. There is also a toggle button to access the PMO home page of the project. The extension directed by the button redirects to the PMO site, which is also a subsite, for example;

- “https://sharepoint.com/sites/EngineeringCompany/C101/PMO”.

The logic of subsites in the Project Management Program is explained through the diagram below. This logic works the same for all projects.

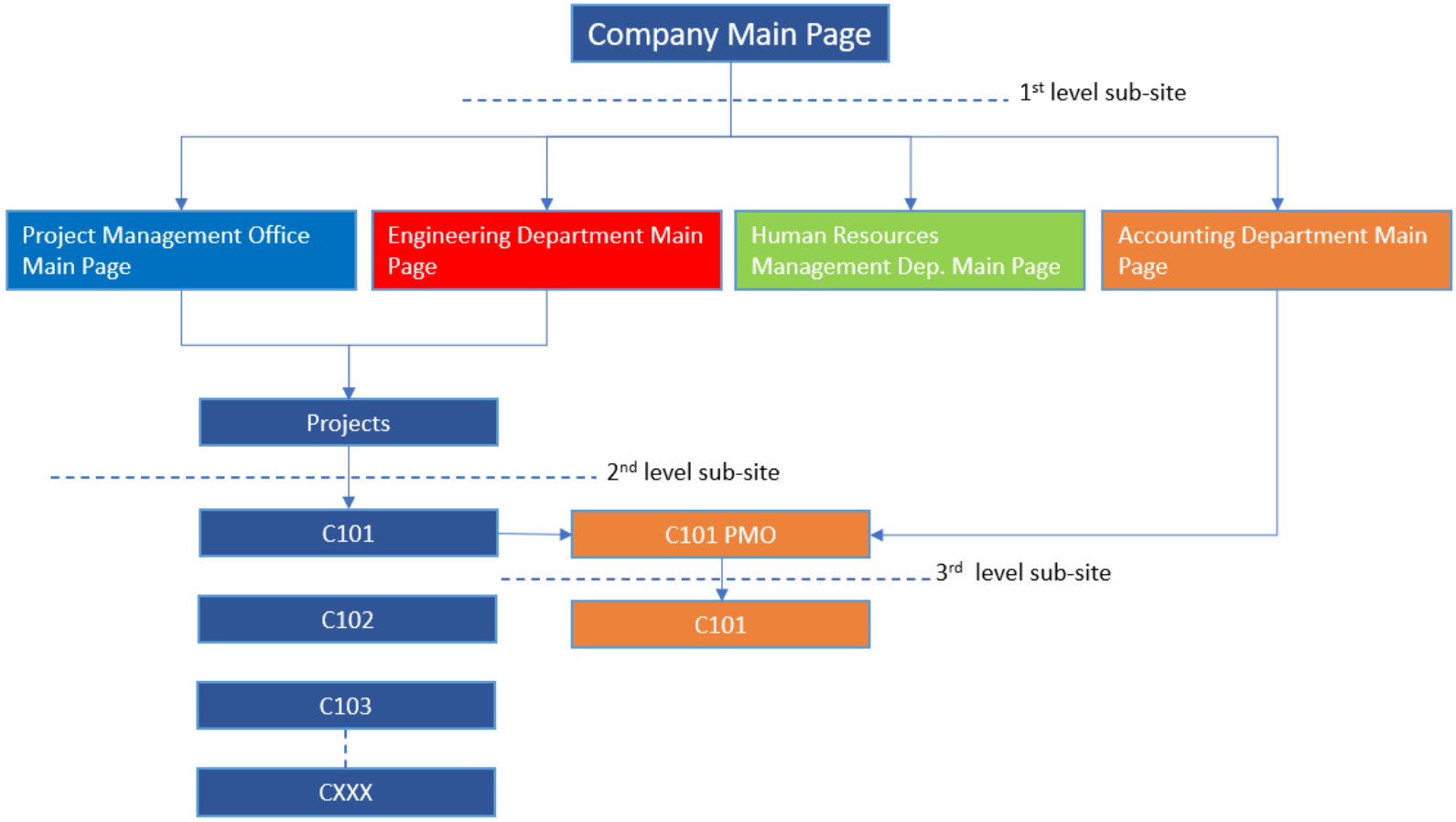

Figure 20 Sub-site Grades and General Structure

3.3.6. Project Subsites

Project subsites are designed to be conjugates of each other. In all projects, identical sub-sites will be created by copying the main template. Only as described in section 2.1.3.7, the contract number should be written in the site name section and the necessary information regarding the sub-site should be entered. By entering the Project Management Program main page, PEO General Main Page and PMO General Main page are accessed, these are defined as 2nd Degree sub-sites. It is possible to access the list of projects from both pages. From here, the relevant sub-site is accessed, on the sub-site designed as a template in the graduation project, the PMO page comes as a third-degree sub-site, from there it is possible to switch to the PEO, that is, to the 4th-degree sub-site. One project sub-site was designed as part of the graduation project. The sub-project site has been realized at a level where all project personnel can work, addressing the management and engineering part of the virtual C101 project created on behalf of the project.

All tasks and deadlines assigned to the personnel can be seen in the tasks section here. If the personnel are online, a green light is on next to their name. If the user accessing the page has the authority to assign a task, he can assign a task by clicking the plus sign next to the "New Task" text. Refreshing the page after the task is created will show the new task both on the timeline and added to the task list. A due date must be entered when creating a task, if a due date is not entered the system will reject it. When a new task is assigned, an e-mail will be sent to the personnel responsible for the task.

The home page of the subsite is as in Figure 21.

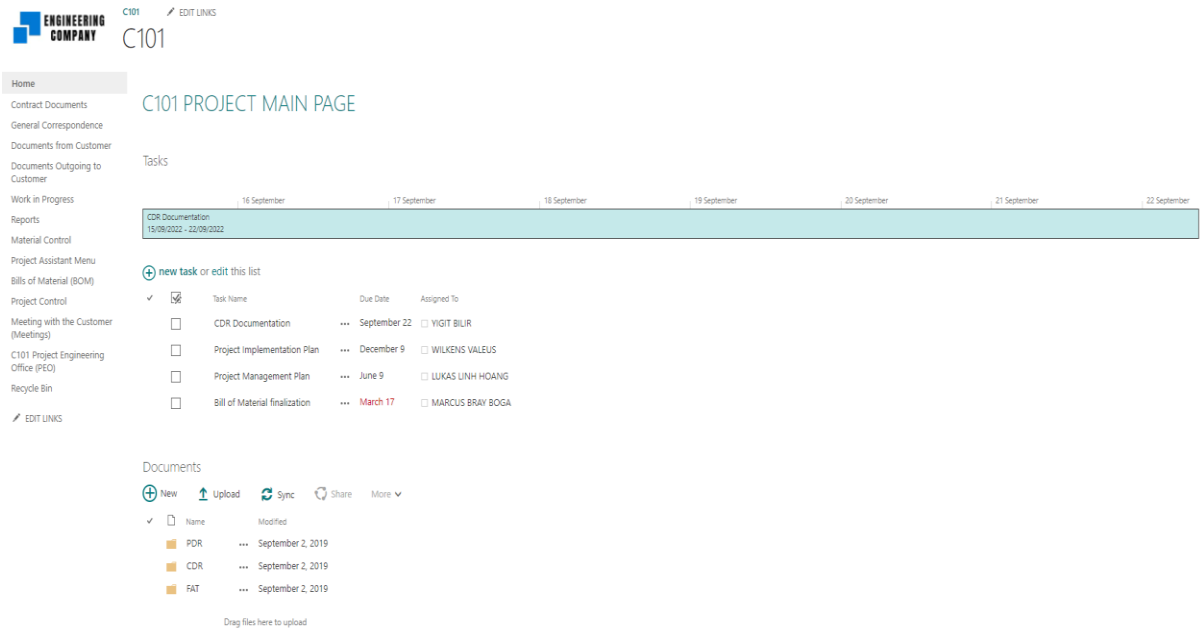

Figure 21: The Home page of the Subsite

A virtual project named C101 was created under the template project name. When the home page is accessed, the home page and modules for the PYO part of the C101 Project are displayed. The home page is an important part of the project in terms of follow-up and division of labour. This section contains an interactive timeline, which includes milestones for the project. On the board below the timeline, there are the tasks that the personnel involved in the project should do. In the documents section below it, some documents and various files developed for project purposes are stored. The Project Engineering Office (PEO), which can be accessed from within the PMO, has been designed within the scope of the C101 project, as seen in Figure 22.

3.3.7. Permissions

Within the scope of Web Based Interactive Engineering Project Management Program, all members of the organization must be defined by grouping. Major user groups should be determined according to the needs of the organization. MS SharePoint offers us various permission levels, within the scope of the project, permission levels have been assigned to users considering the needs of the organization. The permission levels provided by SharePoint are as follows;

- Full Control: Has full control.
- Design: Can view, add, update, delete, approve and customize.
- Editing: can add, edit and delete lists; can add, view, update, and delete list items and documents.
- Join: List items and documents can be viewed, added, updated and deleted.
- Read: Can only view pages and list items, download documents.
- Restricted View: They can view pages, list items, and documents. Documents can be viewed in the browser, but not downloaded.

Permission levels within the scope of the project have been prepared considering the requirements of the Project Management Office and Project Engineering Office and the IT department within the organization. Accordingly, a “Group Owner” is defined for each group, that person, the “Group Owner”, can change everything related to the group (add and remove members, delete cross-site group). Only one user or group can own it.

Group Settings

Those who have permission to see the list of group members and those who have permission to add or remove members from the group are specified. In the Membership Requests settings section, it is specified whether users are allowed to request membership in this group and whether users are allowed to leave the group. All requests are sent to the specified email address. If auto-accept is enabled, users are automatically added or removed when they make a request. At this point, if “yes” is selected in the Auto accept requests

option, all users who request access to this group are automatically added as members to the group and receive the permission levels associated with this group.

Table 3 Permissions Table

Group Name	Permissions
Project Managers	Arrangement
Project Engineering Managers (PEM)	Arrangement
Project Assistant	Participation
HR Department	Arrangement
Accounting Department	Arrangement
Computing Department	Full control
The Purchasing Department	Read

As can be seen from the permissions table, the "Full Control" permission should only be given to the manager and expert personnel of the IT department dealing with the subject. Because Project Managers and Project Engineering Managers manage the process, they have the "Edit" authority, in this way they have full control over the lists and can use this feature according to their own project management strategies. These are the personnel who are not related to the management of the project; Project Assistants are divided into three as Project Engineers and Technical Painters. These personnel are given permission to see their needs such as uploading, downloading and deleting the documents they work under the name of “Participation”. The personnel of the Purchasing Department, who do not directly contribute to the project but play an active role in the procurement of materials, should only be given "Read" permission, in this way, they can download the material prescriptions (BOM) to their computers and perform their purchasing processes. In order to create a group, the side menu is opened by clicking the "wheel" button in the upper left corner of the main page. From the Settings menu, click on the "Site Permissions" section, then click on the "Advanced Permission Settings" section from the menu that opens, and access the settings page where all the permission-related operations have been performed. From the permissions tab at the top, wait on the icon that says "Grant" and click on the "Create Group" icon from the submenu. The following steps have been followed.

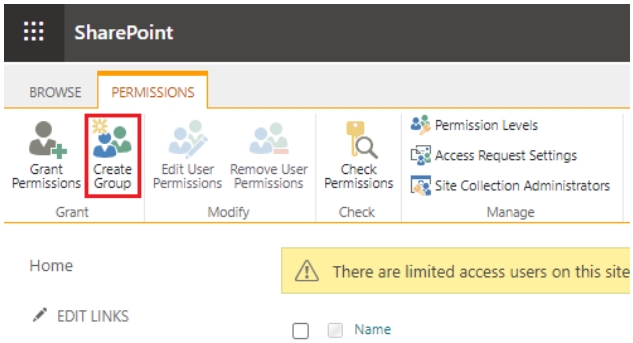

Figure 21 Group Creation Step 1

After Selecting Create Group button, we can see the figure below:

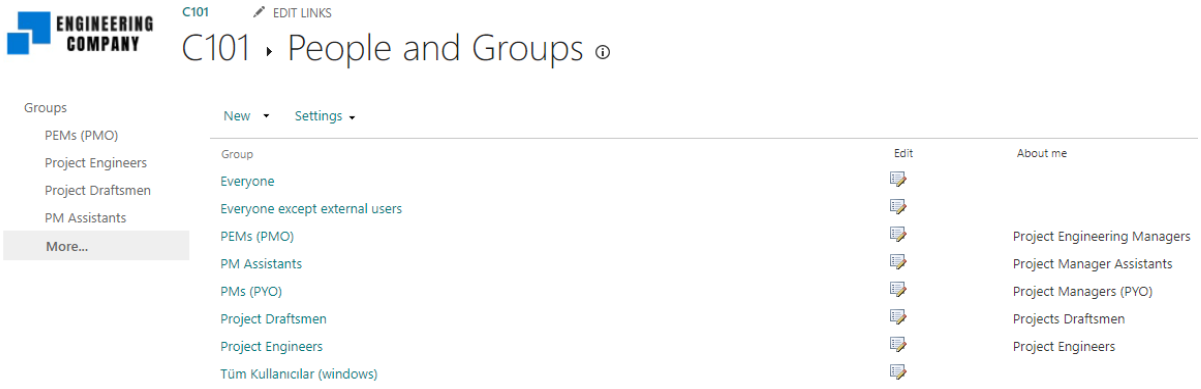

Figure 22 Group Creation Step 2

In this step, the name of the group we will create should now be written, for example, “PMs (PMO)” and “Project Managers (PMO)” as the description, and the name of the personnel responsible for the group, that is, mostly the relevant IT personnel, should be written in the owner part. In the group settings section, “Who can view the group membership?” The option should say “Group Members” and “Who can edit group membership?” option should be called “Group owner”, in this way, mistakes that may arise from human factors, such as accidental deletion of group members, will be prevented.

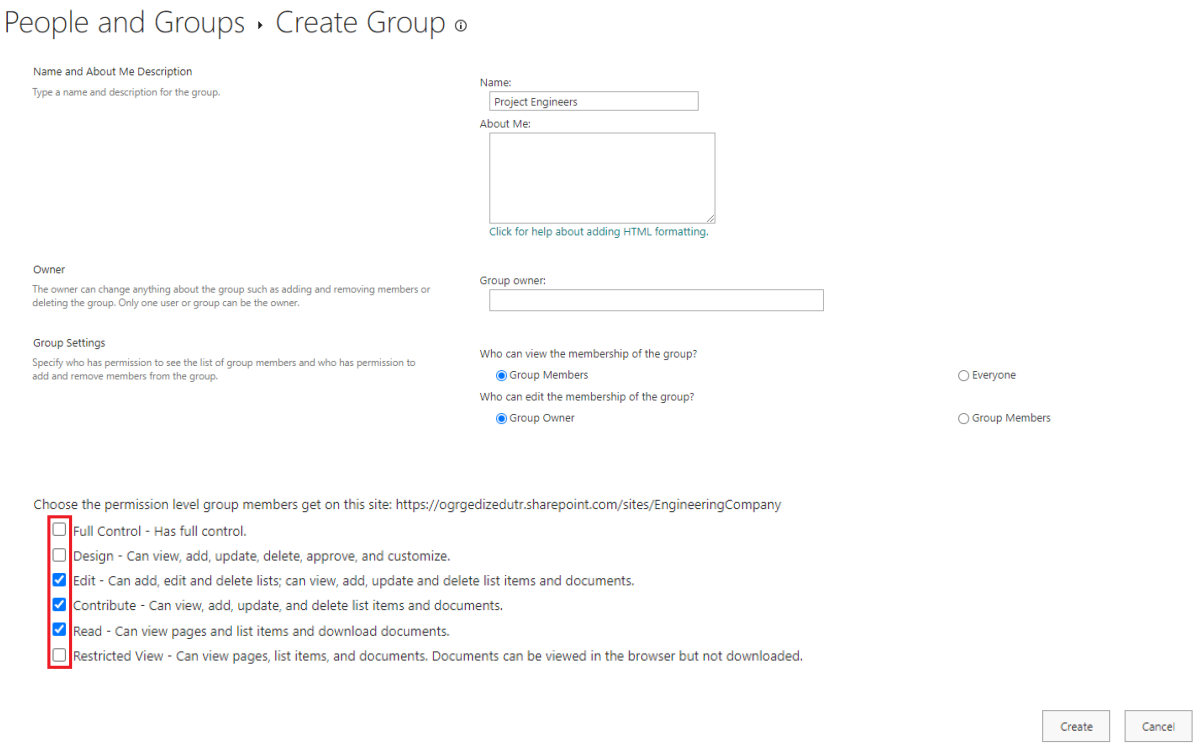

Figure 23 Group Creation Step 3

As we continue, “Who can edit group membership?” the question should be called “Group Owner”, “Who can view the membership of the group?” to the question “Group Members”. The reason for all this is to prevent both safety and human factors. The address to which membership requests should be sent should be the general e-mail address of the IT department and/or the e-mail address of the relevant IT personnel. The most important part is the last setting before the process is completed, called "Select the level of permission that group members have on this site:", the boxes here should be made according to the degree of permission given in Table 1. The type of permission that should be granted for this example should be "Edit".

The "Design" permission, which is a type of permission not included in Table 1 in the Permissions section, was not used for this project. The use of this permission is only valid for companies running MS SharePoint functional managers, it can be a person or people working in the Project Manager Assistant position in the said manager organization.

When all user groups are created from the permissions section, a situation like the one below will occur.

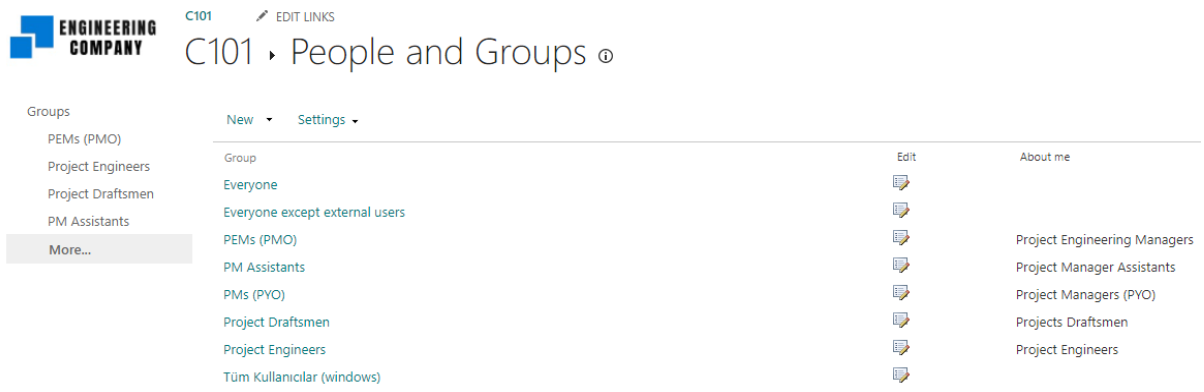

Figure 24 Groups and Permissions

There are also some groups that MS SharePoint assigns as standard, there are groups named "All Users", "Everyone" and "Everyone except external users". These groups must be given "read" permission as given to the purchasing department in Table 1.

3.3.8. Creating a Workflow

MS SharePoint offers us the opportunity to create workflows to provide automation, this feature is called “Work Flow”. Accordingly, by coming to the project page that we want to create a flow for (for this study, the C101 project), from the top left SharePoint main menu, go to the Applications section, then click All Applications to expand the menu. Select “Flow” from the expanded menu and click “Create” with the plus icon from the menu on the left. Here we will come across templates, here it is important to choose the right template. The template “Send a customized email when a new file is attached” is selected to generate a notification. The template for the C101 project should be arranged as in the figure below.

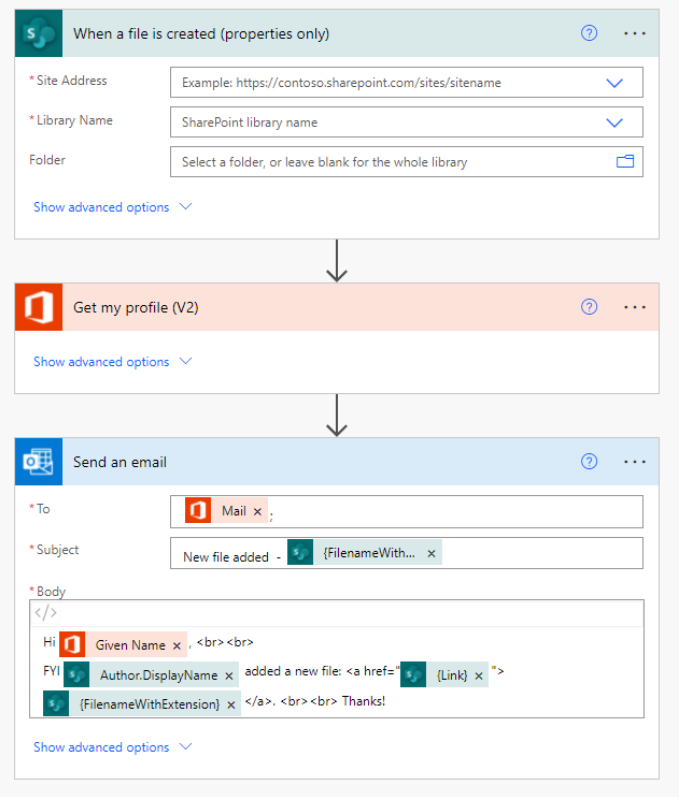

Figure 25 Workflow Creation Step 1

In the first stage, the address of the site is entered, although this is usually entered automatically, it is useful to verify, the name of the project site should be entered here. Accordingly, when the file is attached, the name of the directory to be sent to the e-mail should be selected. This directory can be found under the name of libraries. From here, the library to which the relevant file will be loaded is selected.

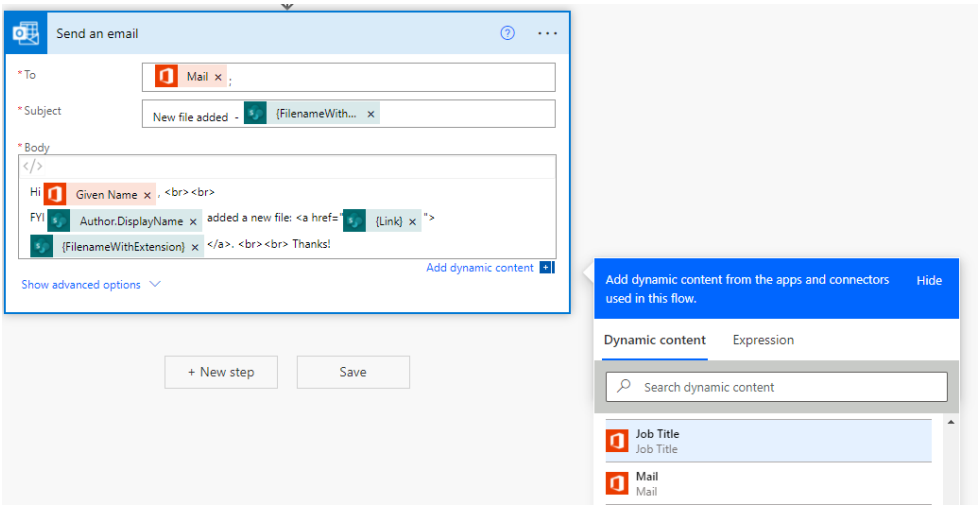

Figure 26 Workflow Creation Step 2

In the second stage, the template of the e-mail to be sent is being prepared. Accordingly, the mail address of the user who will send the e-mail is selected from the dynamic content

section. This is a general feature, that is, the staff working in the project can access the e-mail address registered on the Microsoft Exchange server. In the feeds these are referred to as Microsoft Outlook and Office 365 users. Here, not only the e-mail address, but all the profile information of the personnel in charge are available; such as full name, surname, institution name, position, department, telephone number, address. Other dynamic content, such as the full name of the file we add, its extension, and the link to the item.

Streams can also be combined with other Office 365 features;

- Microsoft Forms
- Office 365 Outlook
- Microsoft Teams
- One Note Business
- Project Online

By using these features together, a form can be created over MS SharePoint, and it can be run with MS Project, for example; A task can be created in MS Project Online for new SharePoint items.

Within the scope of the Web-Based Interactive Engineering Project Management Program, it is seen that the organization has made progress in monitoring the situation in the project management stages. All kinds of information that will make it easier for the Project Manager and Project Engineering Manager to make decisions in any situation are available in the program. Thanks to advanced search functions, managers can find the document they are looking for with the help of categories besides keywords. In addition, project engineers can see the changes made on a document and know by which engineer this change was made, making it easier to follow the work in the future.

3.3.9. Project Follow-up

Project tracking is done on the sub-site of the project, which starts with the relevant "C" and continues with the 3-digit contract number. What a project manager has to do on a daily basis is to review the project tracking screen with the milestones from the Project Management Office, that is, the project home page. The second thing to do is; The task is to keep the list of tasks up-to-date by checking whether the tasks undertaken by the personnel are realized or not. The same actions mentioned should be performed by the Project Engineering Manager, who is the official of the Project Engineering Office.

3.3.10. Following the Drawing

Technical drawings are subject to revision more than once and this continues until the project is completed. When the Web Based Interactive Engineering Project Management Program is used by the drafters assigned to the project, it is seen that the local files of the revised drawings are preserved. In addition, when the parts lists of the technical drawings are

kept together with the local files, it is seen that it facilitates the procurement of parts in case the drawing is reused in another project in the future.

3.3.11. Bills of Material (BOM)

It is clear that the purchasing department works more simultaneously with the engineering department and the procurement of the products is more appropriate to the project milestones, with the bills of materials (BOM) created by the engineers being included in the Project Management Program.

3.3.12. Job Description

Within the scope of the task definition feature, Project Managers and Project Engineering managers will be able to assign various tasks to the engineers, drafters and project assistants taking part in the project. This feature can be accessed with the help of the home page of the relevant department where the personnel works, each personnel work in this office; It can be Project Management Office or Project Engineering Office, it can be followed from the relevant home page. Thanks to Office 365 technology, as soon as a task is assigned, an informative e-mail is sent to the inbox of the organizational e-mail address of the personnel undertaking the task. Using this feature provides Project Managers and Project Engineering Managers with a high viewpoint in terms of tracking the work done. It is seen that this feature increases the remote workability again.

3.3.13. Workflow Application

The most common use of the Work Flow feature is the transfer of bills of materials (BOM) to purchasing after they are completed. A document uploaded to the Bill of Materials section through the Project Engineering Office will be automatically forwarded to the purchasing department. This redirection warns the purchasing department personnel by sending an information mail with the extension of the address folder.

In the Engineering Project Management tool, the document approval process is managed according to a certain flow. For example; It can be given that a technical draftsman in charge of the project first submits the drawing made by the Project engineer to the approval of the Project Engineer, then submits it to the Project Engineering Manager and a decision is taken accordingly.

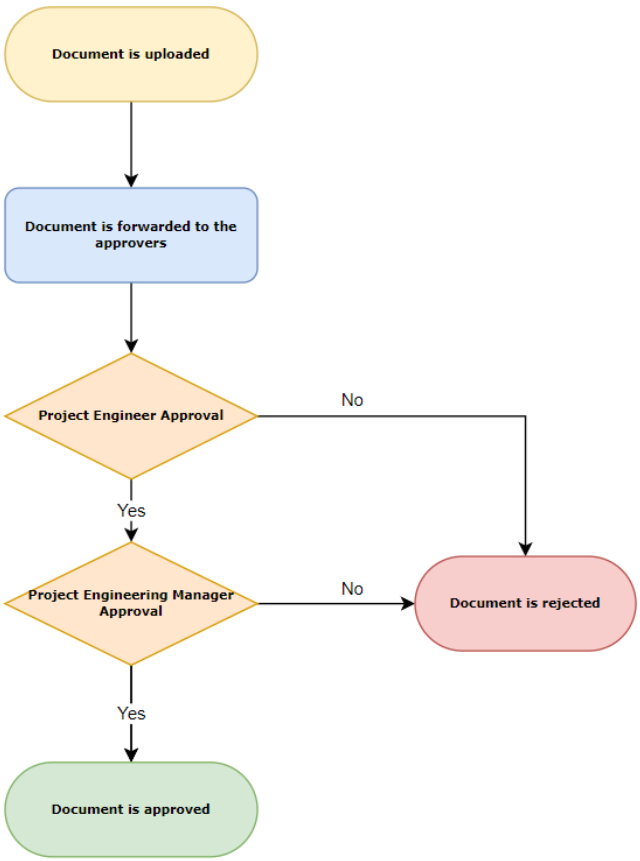

Figure 27 Document Approval Process Flowchart

3.3.14. Testing the Workflow Application

The purchase request workflow created by the method described in the Workflow Creation section has been tested. Accordingly, a bill of materials containing the number of the material type to be purchased has been prepared. While preparing the BOM, the first three digits must determine the project number and the other part must determine the BOM class and subclass of the product. After a bill of materials suitable for this definition is prepared, it is uploaded to the list in the Bill of Materials (BOM) section of the Project Engineering Office page, and an e-mail with the subject of a purchase request is sent to the relevant personnel of the purchasing department.

CONCLUSIONS

In the study, the requirements of the sample company were determined and specific sub-sites were implemented. These sub-sites are in four main categories those are: Project Management Office, Project Engineering Office, Human Resources Management Office and Accounting Department. As a result of the study, an application that provides follow-up and document management at all stages of business activities or projects, adapted from the organizational structure of a real company, was simulated. The software is designed to meet the usual business requirements and at the same time it is aimed to facilitate the work of key personnel such as managers.

When we look at this study's contribution to the field of Management Information Systems (MIS), this study and its contents allow more customized ERP tools to be developed to meet the unique needs of small and medium companies at low cost. The software contributes to information system levels and management system level, which are types of information systems. It enables the organization to process data and store information in a meaningful way, on the other hand, it helps middle level managers to monitor events. The middle level managers that this program takes as a criterion are Project Managers, as well as senior managers such as engineering department managers and business development managers can partially benefit from the designed software.

In addition, the Engineering Project Management software will be under the management of qualified personnel working in organizations in the positions of Management Information System Specialist and will encourage the employment of MIS Specialists in organizations using this program. For example, from the management of the program and configuring the projects according to their needs; MIS Specialist will be responsible for works such as creating a list, creating a page, creating a work flow and creating an application.

As it is known, MS SharePoint allows the use of languages such as HTML and CSS in application development. However, specific applications can be created by using C# programming language. When necessary, MIS Specialist can work in coordination with a software expert, develop his own modules that will use web programming languages such as HTML and CSS, and make system improvements in order to increase automation.

There are three types of management levels in a company/organization. As it is seen on the Figure 28, there is Operational level, Management level and Strategic level. In the Operational level managers keep tract of basic but crucial activities such as sales, receipts, cash deposits, credit decisions, the flow of materials in a warehouse, project assistance etc. In the Management level, managers deal with decision making, monitoring, controlling and other administrative activities. In the Strategic level, managers tend to focus on strategic issues withing the company and outside the company. (https://paginas.fe.up.pt/~acbrito/laudon/ch2/chpt2-1main.htm) Management levels and functions are outlined in the figure below.

Figure 28 Levels of Management in an Organization

There are four tables where it is reported which list/library is mostly used by which level administrators.

Table 4 PMO Management Levels

List/Library name	**Management Level Used**
Contract Documents	Middle and Low Level
General Correspondence	Middle Level
Documents From Customer/Documents Outbound to Customer	Middle and Low Level
Documents From Supplier/Documents Out to Supplier	Middle and Low Level
Work in Progress	Middle and Low Level
Reports	Middle Level
Material Control	Low level
Project Assistant Menu	Low level
Project Control	Low level
Meeting with the Customer (Meetings)	Middle and Low Level
Document Recording List	Low Level

As seen in Table 4, the lists belonging to the Project Management Office are generally used by middle-level managers. The reason for this is that the Project Management Office is controlled by the Project Manager and the duties and responsibilities brought by the job description of these list belong to the Project Manager. Project Manager Assistants and Project Assistants use this list at the lower-level manager level. Since these lists are intended to fulfil the requirements of management science, it is not expected that low-level managers will be concentrated. Although it is written at a low level, the control of the work done as a result of most lists is still done by a middle level manager.

Table 5 PEO Management Levels by List/Library

List/Library name	**Management Level Used**
Engineering Meeting Minutes	Middle and Low Level
Technical Documents	Low Level
Technical Drawings	Low Level
Guides/Training	Low Level
Test Documents	Low Level
Engineering Reports	Middle and Low Level
Field Studies	Low Level
Plans	Low Level
Certificates	Low Level
Software	Low Level
Configuration Management	Low Level

As seen in Table 5, the lists of the Project Engineering Office are mostly used by lower-level managers and technical personnel. Except for the Project Engineering Manager, there is no middle level manager who can frequently use the lists of the Project Engineering Office in a project, although rarely, the Project Manager can review the work in this section. In this regard, Project Engineers who manage draftsmen, technicians and workers are also included in the lower-level manager's section. In addition, since the drawings or products produced by the Project Engineering Office will be applied by the production department, they will remain at the disposal of the lower-level managers working in the production department.

Table 6 Human Resources Management Levels by Lists/Library

List/Library Name	Management Level Used
Recruitment	Low level
Compensation and Benefits	Low level
Employee Relations	Low level
Training and Developments	Low level
Workforce Safety	Low level
Performance Management	Low level
Industrial Relations	Medium level

As it is seen in Table 6, the lists of Human Resources Department are mostly used by Low level Managers. However, manager who takes care of the Industrial Relation can frequently use the lists of the Human Recourses Department. In addition to that, Human resources department employees who manage employee relations, compensation and benefits, training and developments, workforce safety and performance management are included in the low-level manager's section. In the Human Resources Department, HR director is the top-level manager. The HR makes sure everything in the company works as per the regulations and policies of the company.

Table 7 Accounting Management Levels by Lists/Library

List/Library Name	Management Level Used
Account Receivable	Top Level
Account Payable	Top Level
Payroll	Low Level
Reporting and Financial Statements	Top Level
Financial Controls	Top Level
Legal Compliances	Middle Level
Inventory Management	Top Level
Budgeting	Top Level
Record-keeping	Low Level

As seen in Table 7, the lists of the Accounting Department are generally used by Top-level managers. As Accounting department is very crucial for the company as it is responsible for the overall economy of a company, it is mostly used by Top-Level managers to access and edit reporting and financial statements, financial controls, inventory management, budgeting, account payable and receivable. However, legal compliances list is used by middle level, whereas record keeping is done by the low-level managers.

As a conclusion of this study, according to the interviews and the online research, SharePoint is strongly recommended to use for small and medium companies from most of SharePoint developers. The general view of the experts is the following, since SharePoint can be customized, integrated with other tools such as HR, finance etc, for small and medium companies, it is affordable flexible decision taken to use. As for the big companies, SharePoint continues to be a document management and collaboration tool due to its limitations such as the entry lists limited to only 5000. However, SharePoint continues to support these big companies together with ERP tools such as Salesforce, Oracle, Microsoft Dynamics etc.

When we look at today's working conditions due to COVID-19 global pandemic, teleworking is deemed to be essential and MS SharePoint can fulfil companies' teleworking requirements. MS SharePoint Online is a document management and online collaboration tool, thanks to the other applications coming together with Office 365 subscription, MS SharePoint online can be augmented via other applications such as MS Teams. Furthermore, its automation capabilities can be improved by using applications such as workflow.

In conclusion MS SharePoint can always do the job of an ERP tool, but ERP tool may not do the job of MS SharePoint in some occasions. The implemented features also reveal that SharePoint can be customized easily and become an ERP tool for the small and medium enterprises that adopt permanent teleworking principles.

Recommendations

This study can help to change the point of view of many companies regarding to SharePoint having the capability to be not only a document management and collaboration tool but also an ERP tool.

In this study, the third-party SharePoint Online applications have not been used, but for the follow-up study it was recommended that those applications are included. It can be helpful to perform a market analysis of those applications and also to compare their price and performance. Those applications can potentially be used to improve for instance automation and reporting of the designed ERP tool.

Another tool that exists on Office 365 such as Power BI can be used in order to create interactive dashboards and reporting. Power BI as a business intelligence tool can potentially be integrated into the ERP tool to make use of the data that is collected in the organization.

There are differences between MS SharePoint Online and MS SharePoint on premise versions. While there are limitations of entry lists for MS SharePoint Online, it was not the same case for MS SharePoint on premises. As a follow-up study, it is recommended to make research and explain how MS SharePoint on premise can become an ERP tool for big enterprises. This would increase the scope of the follow-up study as big enterprises can be very complex as strategic level management becomes more crucial and top-level managers often require well-prepared reports and analytics in order to set strategic goals for the organization which would create big impact for the company in the long term.

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