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KERNEL:
A Project Management System for Taters Enterprises, Inc. (TEI)

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Abstract

The paper discusses main concepts of project management and how they attribute to project success. The paper is focused on the project management life cycle of Tater Enterprises, Inc. (TEI), a franchisor under the food and beverage industry. TEI currently experiences delays in project execution due to the lack of process improvement and lack of the proper tools to adequately manage their projects. The researchers follow the Agile Methodology, specifically the Rapid Application Development (RAD) Model in order to have clear image of the project as compared to the client, TEI, as they are highly involved in the entire project. A project management system that would aid the organization in managing projects will compose of four (4) modules, aligned with the project management cycle. The specific features that will help solve their current difficulties are, project templates, workload assessment, RACI and Gantt chart, Project progress, document tracking, and performance assessment.

1.0 Introduction

This chapter defines what Information and Communication Technology (ICT) is and discusses how it affects project management through ICT business management trends. The significance of a Project Management System (PMS) to the organization, Taters Enterprises, Inc. (TEI), is supported by problem identification and assessment done by the researchers.

1.1 Introduction to Information and Communication Technology (ICT)

Information and Communication Technology (ICT) is used to convey, manipulate and store information electronically. ICT is defined as the combination of information technology with other related technologies, especially communication technology. Through technology, it can support activities such as, gathering, storing, processing, and presenting data. Nowadays, communication is considered as an activity, hence the name, Information and Communication Technology (Gokhe, n.d.). According to Moursund (2005), "*ICT has become one of the basic building blocks of modern society.*" The growth of ICT is the evolution of technology, and businesses are expected to adapt and integrate new trends in ICT to their business processes to gain more opportunities and competitive advantages.

ICT has been evolving at an extremely fast pace. Not only is it increasing at a fast rate, but it also costs a lot to keep up with the current trends. These trends in business management include digital transformation, cloud computing, and analytics.

Digital transformation is changing business through technology (Hopping, Marzouk & Marshall, 2018). Over time, technology has been an aid that businesses use to get ahead of the industry. Today, technology is, more often than not, the most valuable asset in a business. Automating processes as "going digital" has become an added value bonus. "Going digital" is a product of combining other trends, such as mobile technology and information technology. Through automating business processes, productivity in the workplace has a chance to increase, as well as collaboration with employees as tools and technology allow people to work together through systems and the Internet (Calixterio, 2017).

With the digitized data, this can now be uploaded and saved to the cloud. The cloud, otherwise known as cloud computing, is the use of technology to process data through the Internet. This allows businesses to be able to access and process data anywhere and anytime as these data are easily accessible in the cloud (ESDS, 2014). This also ensures that everyone involved in the organization has access to all updated files, thus avoiding data discrepancies. The cloud also serves as a data repository for organizations.

A business, may it be big or small, startup or established, all, need data to help the business grow. By analyzing data, organizations can improve upon themselves, internally and externally, improve on business processes and on customer relations, and reduce cost all the while increasing profit. Analyzed data also helps the organization as it aids management to make the right decisions and the best decisions based on facts for the betterment of the organization and its stakeholders.

The application of ICT in business processes, specifically project management, guarantees that the right technology solves the problems of the organization, and is being implemented properly considering the schedule, resources, risk, and quality management. Decades ago, project management has already been existing. According to the Gentile (2012), project management ensures that resources are maximized by organizing and managing them and projects are delivered within schedule, budget, and scope. The practice of managing projects became more common, thus, leading organizations to invest more on project management tools and techniques, such as Gantt charts for scheduling, RACI charts for responsibilities assignment, and Work-Breakdown Structure for distributing the workload within the project team. These tools and techniques have been proven to be necessary in managing teams and projects effectively. Project management is usually seen in the construction industry and hardly is it seen in food and beverage, but as the industry evolves, big player organizations tend to deviate from the norm.

Project Management Systems (PMS) have been increasingly in-demand as the act of managing projects has increased over time. Several of a PMS' functions would be planning, scheduling, generation of Gantt charts, and documentation. Organizations that have invested in the use of PMS' are Uber, who uses Asana, NASA, who uses Basecamp, Cisco, who uses Jira, Toyota, who uses Microsoft Project, Netflix, who uses Smartsheet, and Google, who uses Wrike. These

systems and their respective functions and features would be discussed in the next chapter.

1.2 Background of the Project

Taters Enterprises, Inc. (TEI) is the franchisor of two (2) different snack chains with a total of forty-one (41), either an inline store or a kiosk, branches nationwide.

TEI has been managing to keep up with the current ICT trends as they do use online chat applications such as Glip, which only the Marketing Department is using as of the moment, to keep in touch with project team members. They are also considering using Glip company-wide to enhance interdepartmental communication. They have also been using various software such as, Aloha and Web POS for sales, Integra for payroll, and SAP for accounting. With regards to data analytics, they lack actual data as they do not strictly document each project properly and lack a single data repository. As for digital transformation, they are taking steps into this trend as they have been developing systems, such as a Human Resource Information System, Management Information System and a Task Management System to be specific, to be used by the whole organization as well as connecting them to the internet.

Despite all available technologies, they do not capitalize on it as they currently manage projects manually. The TEI project management process starts with meeting up with all concerned departments to assign project activities and tasks. Once the project is kicked off, there is no systemized way of monitoring and controlling of the project tasks as they have no platform to do so. Contributing to this, TEI does not actively document all projects to aid the project managers in monitoring and controlling the project. If there are project documents available, the only technologies that TEI uses in project management are Microsoft Office - Excel for Gantt charts and Word for reports.

TEI's vision for the current year is to develop a unified online portal that would provide access to all the current information systems being used by the organization, and those that are being developed, including the Project Management System (PMS). This portal will then produce a consolidated dashboard that will obtain data from the different systems, hence the term the organization coined as *One Data*.

1.3 Statement of the Problem and Opportunities

TEI's main business operation revolves around a series of projects with the coordination of their seven (7) departments. With that being said, it is inevitable to experience delays in project execution due to various reasons. In addition, an analysis in the Asturian Case by Sonia Cousillas (2010) has concluded that the most difficult target to reach is closing the project on time. Based on a series of interviews with different departments of TEI, the main reasons for project delays are the lack, or almost absence, of a systematic monitoring method for the project, poor dissemination of project updates and concerns, and inadequate project documentation. These three factors correlate with one another wherein they are all significant in the project management process and they are factors that are likely to result in quality issues that may affect the success of the project (Schwalbe, 2011). Specifically, lack of supervision, miscommunication among team members and customers, and inadequate documentation are factors on project failure that were concluded after conducting a study on real project failure factors by Richard Amponsah (2012).

Consequently, the three mentioned causes for project delays affect each other wherein project managers, departmental supervisors, and top management cannot accurately monitor projects due to the absence of project updates which contribute to the lack of proper documentation all throughout the project duration. It was estimated that only 5% of their projects have produced and are following a Gantt Chart, while almost 100% of the project tasks are not being regularly updated by the team. Project updates only arise when the issue or concern is brought up and is retrieved by asking the team member/s responsible for the certain issue, either via Email or verbal questioning. This in turn leads to project delays as there is no schedule to follow except for the overall project's target deadline, there will be numerous miscommunications among departments and activities will not be properly and timely accomplished. Due to the fact that projects are not properly documented, the workload of the employees are not taken into account which results in a difficulty with handling multiple projects by blindly being assigned to a new project without any formal consideration. The employees will have to assess the projects and project tasks which should be prioritized over the others. At the minimum, every project should have a planned schedule and a series of progress reports, whether formal or informal, in order to set the direction and focus of the team members to accomplish all project activities at a given period of time (Schwalbe, 2011). Unfortunately, TEI does not strictly implement this practice.

A project management system will provide TEI an opportunity to entertain more projects simultaneously as monitoring and controlling of projects will be more systematic and documented. With these documents, TEI will be able to replicate successful projects and rectify identified problems.

1.4 Conceptual Framework

Kernel, the project management system that was developed, is divided into four (4) modules - Project Initiation and Planning, Project Monitoring, Project Control, and Project Closing. It is divided in such a way that it follows the life cycle of project management. In addition, the modules are also designed to solve the problems identified by the researchers. Value-added functions are indicated with yellow stars. An array of features consists of notifications, data visualization, project logs, and user permissions. The system will be used by all employees under all departments of TEI. Lastly, the system was developed with the use of certain tools and technologies such as, PHP, mySQL, CSS, Bootstrap, Workbench, Atom, and Github *(Refer to Appendix A for Conceptual Framework)*.

1.4.1 Modules, Functions, and Features

Kernel is flexible enough to handle any TEI project in any department. They would be able to make a project, input its details, tasks, and the people assigned to them, as well as their respective target dates. While the project is ongoing, the project team members would be able to see the actual status of the project and at which task the project is currently on and which department is handling said task. Project team members would also be updated through the system as well as through Email of project status changes. Once a project is finished, project owners can save the project as a template to be used for future projects and these templates can be edited as well. Kernel is also able to track project team performance as well as departmental and individual performance with regards to the project/s. Through TEI-given Key Performance Indices (KPIs), the system is able to tell the completeness and timeliness of a project team, department or individual. These KPIs can be used to assess whether a project member/s or project team was successful in meeting their targeted indices and if the project execution was up to TEI standards.

Project Initiation and Planning

This module covers all preparations before the project is actually implemented, specifically the project description, process identification, and role assignment to the project team. On this module, all processes in the system can be modified.

Project Profile

Project profile takes care of the creation of the project and its details including the project title, project objective, project duration, project launching and project end, project tasks and who are the people assigned to these tasks. This allows the project owner to provide an overview of the project to the project team.

Project Templates

Project templates enable the users, specifically the project owners, to recreate past projects without having to encode a new set of activities, tasks, and checklists from scratch. At this stage, the users are allowed to conduct modifications to the processes and its time frame. Archived projects may also be transformed into a template.

Project templates are often seen in off-the-shelf PMS', however, Kernel's templates would be editable depending on certain changes that project managers see fit to better the process to meet their KPIs of timeliness and completeness. If certain projects are able to be completed with decreasing days of tasks, or if certain processes require more days to be completed; these changes can be applied to these templates.

Scheduling

Scheduling enables the project owners and assigned departments to plot their activities with their corresponding time frames. This advises project owners of the feasibility of the project in terms of time as it allows them to see if their project launch date is

achievable. This also dictates when tasks should be started, finished, and who is assigned to perform it.

RACI (Responsible, Accountable, Consulted, and Informed) Chart

TEI follows RACI as their responsibility assignment matrix in projects. They assign RACI to each and every task and the system is able to capture that. This allows the team members to be well-informed with who to follow-up for updates and who to inform for the succeeding tasks. In addition, this also help in providing permissions to certain features as not all tagged as responsible can do what the consulted can, and so on. This allows control in what users of the system can do.

The role assignment is done by the department heads and supervisors, and on occasion by executives. Each task is assigned one (1) employee as responsible, and multiple employees under accountable, consulted, and informed. It is prohibited to assign any executive member as responsible for a task.

The RACI chart allows access to certain users that have certain permissions. This controls the capabilities of all project team members as not all members have the same capabilities as others, depending on their role within the project. Those Responsible, Accountable, Consulted, and Informed each have their different functions within a project. These permissions are not seen in off-the-shelf systems as it usually allows the same capabilities to everyone involved in the project.

Gantt Chart

Gantt charts are used to visualize all the information from the scheduling function. Gantt charts reflect the tasks and its time frame. The system translates all text data from the schedule and generates a Gantt chart, basically a visual representation of the schedule input.

Workload Assessment

Workload assessment informs supervisors and project owners of how many projects a certain individual is currently handling and their current progress, whether the individual's participation is just about to begin, is currently in progress, or is about to end. The tasks that are included are those of which that are planned, ongoing, and delayed, whether the employee is assigned as responsible, accountable, consulted, or informed. This will help supervisors with their distribution and assignment of tasks on projects. They will also be prompted if they persist to assign a task to an individual whose project workload threshold is reached therefore advising the project owner or supervisor to assign another individual.

This empowers managers and supervisors to monitor and control workload of their department members. This allows them to not overwork or overload their department members to ensure that each project task assigned to them pertaining to the different projects they handle will reach their desired KPIs of timeliness and completeness. PMS systems that are available in the market today do not have these capabilities as they only monitor project progress and nothing pertaining to the people within the project.

Project Monitoring

This module provides a platform for projects to be properly tracked based on progress and timelines. This also ensures that everyone involved in the project are informed with the status of the project, and if there are any adjustments to the target dates. This also provides insight for succeeding task performers on when they could initiate their task, and who to follow-up on.

Task Prioritization

Task prioritization provides insights to the individual on which task they should perform first based on the given time frame of the task and the whole project. There are instances wherein employees

are involved in multiple projects and have tasks lined up, and this function helps them decide which tasks to accomplish first. There is list of all projects the employee is currently working on as well as their tasks and their respective due dates and from there, the employee can assess which tasks to accomplish first. The tasks are ordered according to their target end date. Tasks that are due in two (2) days will be the first ones visible in the dashboard and in the tasks page.

Project Progress

Project progress allows users to declare complete tasks and is able to automatically inform succeeding tasks that their prerequisites are finished. The system requires reasons for delays once it detects that an individual finished a task beyond the expected time frame. Moreover, the system also prompts task performers that their tasks are approaching their deadline based on the set threshold. This also tracks the overall progress of each project and provides information to either the top management or the project owner to support business decisions.

Document Tracking

Document tracking covers the exchange of documents involved in the project. This function ensures that everyone involved in the project has access to the same unified version of documents. This also prevents repeatedly printing of documents as it can be downloaded from the system. It also covers receiving confirmation when documents are required to be viewed by individuals in the project. It also serves as a central document repository that is specific to a certain project.

Team Gantt Chart

Team Gantt chart provides an overview of all the tasks assigned to a department on a project. It displays an exclusive Gantt chart of activities of a single department. This aids departments to plan their activities and time frame accordingly.

Team Gantt charts help departments handle their workload as it showcase all projects and project tasks their department are involved in. Team Gantt charts also help the department plot out their activities to reach their deliverables and target dates in their respective project tasks. Off-the-shelf systems have the capability of generating Gantt charts but mostly through third-party tools, however, these Gantt Charts are of the whole project and not individualized per department.

Project Control

Project control covers the knowledge application and evaluation of completed projects to provide insights that will improve business processes and prevent any problems and delays from reoccurring.

Request for Change

Request for Change covers the requests of project stakeholders about certain processes that need more time or need a new performer which can improve the performance of future projects with the same processes. Requests would require approval from supervisors, department heads, project managers, or executives.

There are two types of change requests, change performer and change end date. The ability to request for a change may be submitted by any task actor as long as they are assigned "Responsible". Submissions is disabled two (2) days prior the target end date as a form of control.

Performance Assessment

Performance assessment covers the evaluation of the project after it has been launched. The system is able to measure the timeliness and completeness of projects. The measures and its corresponding computation varies from each department. The system can also provide information on which department is causing most delays which top management and supervisors can use in assessing the actual reason for the delay. The system can tell which department causes delays in projects as it checks if the target deadline was met

and if there were prerequisites that were affected. This provides insights for process improvement that will affect future projects.

This is where KPIs are monitored as each task's timeliness and completeness would be assessed. It is drilled down to each individual then collated to each department and eventually as a whole project. These KPIs are then used for process improvement as well as performance assessment of the project. As the system accumulates more data through time, there is a possibility that the system would learn that certain tasks cause delay and should be edited to better improve the process in order to meet the expected KPIs. Off-the-shelf systems do not have this capability as their main focus is the project at hand. The KPIs were provided by TEI as they have the same KPIs of timeliness and completeness, however, they are measured differently per department and per project.

Project Closing

Project closing covers the handling of completed projects. This is the accumulation of knowledge acquired from the project which can be used as reference for future improvements.

Report Generation

Report generation provides top management information on how the company and each department are performing in terms of projects. This also provides documents to explain the reason for any delays or problems that may have occurred. It also provides a basis for them if a process is encountering problems repeatedly which would need improvement.

Project Archives

Project archive is where projects are stored when they have been launched, or not executed at all. This provides access to past projects that might need replicating without having the need to encode each process again. It allows past projects to be converted to templates for it to be modified and then executed.

Completed projects are be stored in the archives. Project Owners are able to convert these projects to templates to be used in the future as well as make certain modifications to better improve the project and its respective processes. PMS' in the market today do not have the feature of being able to replicate successful or finished projects. This lessens the work of making a new template for somewhat same projects with slightly different processes.

Features

Kernel provides notifications whenever there is movement in the project such as moved and approaching deadlines, task completion and task assignments. Data visualization aids users to immediately assess the progress and performance of projects. It turns complex project data into easily understandable information through the use of charts and graphs. Project logs record all interactions within the project. It records the user, time and date for when action has been performed. User permissions restrict users who are not involved on certain projects and have limited to no access as each member and department have their own functions within different projects. In addition, only specific users are able to perform approvals on a project based on user hierarchy.

1.4.2 Problems

Difficulty in handling multiple projects and inequitable workload distribution are addressed by the Project Initiation and Planning module, specifically the scheduling, Gantt chart, and the workload assessment functions. The scheduling and Gantt chart provides aid to individuals who are having difficulty in handling multiple project as they have the system to refer to about their tasks and its corresponding time frame; this way, no project is overlooked as all information is readily available. Consequently, notifications also provide reminders for the users. On the other hand, the workload assessment function alleviates the problem regarding inequitable workload distribution as it provides a reference for project owners about the current workload of a department or an individual which will help them assess if a new project can be entertained or if the potential individual is capable of fulfilling the tasks.

Lack of project transparency, document mismanagement and incapability of handling project updates are addressed by the Project Monitoring module. The Project progress function provides information to everyone involved in the project and its current status which alleviate both the lack of project transparency and incapability of handling project updates. Moreover, the document tracking function aids project stakeholders in storing documents that are related to the project. It provides a uniformed version for everyone as well. With that function, it solves the problem regarding document mismanagement.

Lack of monitoring and controlling is addressed by both the Project Control and Project Closing modules. Both modules provide insights to the users on how they can improve future projects by providing information on where delays have occurred, what the reason are for those delays and which departments are causing the delay. Users are also provided the information if a given time frame is not enough to a certain task. With the help of all the functions under those two modules, especially the Performance Assessment function, the system is able to reflect all necessary data and determine the cause of delay or error, thus providing a basis for project and process evaluation.

1.4.3 Tools and Technologies

TEI hired, and are still hiring, developers whose expertise is the PHP: Hypertext Preprocessor (PHP) language. This language would make integration of all their systems less complicated to achieve their ultimate goal of making an online portal they call *One Data*, which would share a single database across all the systems they have developed and would be developing in the future to consolidate and provide performance insights to the top management of TEI. This would also be helpful as TEI's Management Information System (MIS) Department knows the programming language well and would have extensive knowledge of the source code and they would also be able to edit the code in the future to add modifications, modules, features and functions. Using PHP also entails that the system would be web-based, this would keep TEI within the trends of interconnectivity in team collaboration. This also automates the processes of TEI's project management. With the help of Bootstrap, the template for what the system's interface looks like can easily be

designed. TEI has specified that they wanted to use the AdminLTE template. Cascading Style Sheets (CSS) was used to modify the Bootstrap template. Atom.io is the programmers' choice of Integrated Development Environment (IDE) due to familiarity of the software. GitHub was used for versioning and trading of source codes from one developer to the other. Lastly, MySQL was used for the system's database as requested by TEI; since their goal is to combine multiple systems, they aim to use one big database. TEI's MIS Department aided the developers in the naming conventions and database design to make sure it conforms to the company's regulations. As systems, such as this Project Management System and the Task Management System of the other group, reach its completion, TEI will consolidate all the Dashboards of each system into one mother Dashboard to present the users immediate information of all the systems in one screen.

As for how Kernel would interface with the existing systems TEI currently has, the actual integration of the systems would be handled by TEI, but it would interact with the proposed task management system to be done by another team, in the sense that Kernel would be limited to only project tasks while the task management system would be limited to day-to-day tasks, such as ticketing. As TEI aims to develop *One Data* by combining Kernel with the other systems in place and to be developed, they request the developers preferably use certain technologies such as PHP and MySQL to make the integration process easier.

1.4.4 Users

The users of Kernel encompass the entirety of TEI which is composed of seven (7) departments namely Facilities Administration, Finance, Human Resources and Office Admin, Management Information System, Marketing and Business Development, Procurement, and Store Operations which are composed of more or less seventy (70) employees and three (3) top managers. They all have access to each and every function and feature and are required to use the system as specified by the top management. Users will access the system using their corporate email address, which will also serve as their username. The actual users of the system have expressed their support towards the implementation of the system as it would aid them in making projects more successful. Advertising and Promotions Head, Mr. Jiggy Villamin had said about the added work of

encoding in the proposed system is, *"But if what, it would only take ten minutes of my time every day just to set that, but it would ensure me that I will get my deliverables on time, that's not really a problem"*. He would rather add ten (10) more minutes of his time, every day, doing the right thing rather than doing it wrong and a whole lot quicker (*Refer to Appendix I for March 12, 2018 Interview*).

1.5 Research Objectives

General Objective

The project aims to develop a Project Management System to aid in monitoring and controlling projects.

Specific Objectives

The general objective can be detailed into three (3) specific objectives that would work together to achieve the goal of the project as follows:

- To identify and assess the problems encountered in managing projects and their corresponding causes,
- To design a solution that will support the project team in managing their projects, and
- To develop a systematized way of monitoring and controlling projects.

1.6 Significance of the Project

By utilizing a PMS, it will help ease the delay of project execution. TEI has no standard operating procedure when it comes to planning projects and managing them. They tend to go about their own project tasks and they hardly ever update the other concerned departments on the current project status unless their attention is called. With the help of the PMS, project status as well as project tasks that were done and those that need to be done will be seen by each and every member that is part of the project, providing interdepartmental transparency and avoidance to miscommunications.

By automating some of the processes, project members would have to update project tasks which would then update project status. By having an update on the project status, the project owner can gauge whether or not the project would be delayed which could give them ample time to rectify any task that could help speed up the delay. With proper use of the system, projects will be documented, which can then provide data that will aid in the analysis and improvement of their current processes.

It also provides interdepartmental transparency within projects so as to have all concerned departments in a single project on the same page about the current status and of its tasks. It would also help in knowledge transfer; In circumstances where the supervisors knowledgeable on the complete process or team members who have a vital role in the project, leave the company, replacements and the teams left behind can easily adapt to the loss as the process has been documented. The system would also provide project owners, department heads and administrators a platform to monitor and control projects as they would have a bird's eye view of which task have yet to be done and which departments cause delays. Lastly, the proposed PMS will provide TEI with project documentation, something that TEI lacks in their current processes. Documenting projects give more leverage for future projects, help gauge what went wrong and where improvements can be made.

The ICT trends discussed above will help support the project management processes of TEI as digitizing the business processes will serve as systemizing it which helps in documenting, monitoring and controlling of these processes. This also allows for collaboration and transparency among project team members as they would have access to the project's progress and documents with it being connected through the cloud. As the system accumulates more and more data, it would be able to pinpoint areas of improvement by analyzing which processes and which departments cause delay based on historical data.

The proposed PMS would also help TEI get one step closer to their vision of having *One Data* in the future.

1.7 Scope and Limitations of the Project

The proposed project management system that will be made for the company is flexible, meaning, the system should be able to adapt to the needs of the user depending on the project they have. Although not all departments have their own

departmental projects, all departments will still be part of the scope of the system since there are projects, such as opening of a new store, where all departments have their own activities and tasks that they need to accomplish with regards to the completion of the project. In addition, all processes, activities, and tasks involved in a project in all departments will be included in the scope. The resources that the PMS will handle are only that of manpower or people resources; financial resources will not be integrated to the system.

The limitation of the project is the monitoring of the day-to-day tasks of an employee and the ticketing for requests, concerns, and processes that may occur outside of the project. Also, handling of tasks' criticality will not be part of the system as it will be handled by the group making the Task Management System. All processes of all the departments that are not related with the project they handle, such as, the payroll for Finance Department, market research for Marketing Department, ticketing for Wi-Fi connectivity issues for MIS, repairing of broken air conditioner for Operations, will not be included.

2.0 Review of Related Literature

This chapter discusses the concepts related to ICT and project management, the project management systems that were reviewed to serve as a basis for comparison for the proposed system, and the methodologies considered in developing the system.

2.1 Review of Related Concepts

This section provides further discussion on concepts related to the capstone project, specifically a detailed discussion on the ICT trends mentioned in the previous chapter, projects and project management, and project management phases, inputs, outputs, tools, and techniques.

2.1.1 ICT Trends in Business Management

Digital Transformation

Digital Transformation, also known as Digital Business Transformation, is transforming the business and the organization, including their processes, to optimize the opportunities that digital technologies present. This entails the organization to be more agile, people-oriented, both internal and external customers, and innovative. Digital business transformation areas are points where digital transformation can be done to achieve the goal of the company. Among these areas are business activities/functions and business processes. This is where automation of processes come in as processes are digitized (i-Scoop, 2018). As businesses embrace the digital revolution, the only challenge they face is how fast and how far they can go to the path of digital transformation.

Digital transformation started in the late 1990's with the increase in digital products, such as music and entertainment, and infrastructure such as telecommunications and software. However, these products were seen only in selected industries, music, entertainment and electronics to be specific. The 2000's brought empowerment to users as they had more access to more information as digital distribution and web strategies, such as e-commerce, were increasing. As 2010 came, the digital transformation zeroed in on transforming business models using

mobile revolution, social media and analytics as the main staples to drive the transformation.

When transforming the business, organizations have to reconfigure key areas such as what they deliver to their customers and how they deliver these products or services. In order to do that, organizations need to reshape their products and services and realign their operational model to customer preferences by integrating business activities with how data relating to these activities would be managed (Berman & Bell, 2011).

Cloud Computing

Cloud computing as a service provides networked storage space and computer resources. They stated Email services like GMail and Yahoo! as examples, as it hosts your mail on a server which users can access through the Internet, anywhere and anytime. The only difference being that the cloud allows you to access any information of your choice as long as it is within the cloud. There are three cloud computing models that cloud providers offer, mainly, Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS). These differ in how you can control your information (Huth & Cebula, 2011).

Software as a Service (SaaS)

SaaS allows subscribers access to both resources and applications. As multiple users are serviced by a single instance of the service that runs on the cloud. Costs for cloud providers are lowered as they only need to host and maintain one application. An example of this would be software licenses such as Microsoft and Google (Torry Harris Business Solutions, n.d.).

Platform as a Service (PaaS)

PaaS provides the subscriber with an integrated platform for development of web-applications (ESDS, 2014). With this model, subscribers are given the freedom to develop applications with the predefined combination of OS and

application servers, an example of this would be the LAMP (Linux, Apache, MySQL, PHP) platform. An example of PaaS would be Google's App Engine.

Infrastructure as a Service (IaaS)

IaaS gives subscribers basic storage and computing capabilities. All hardware needed would be provided such as servers, networking equipment and data center spaces. Subscribers would deploy their application or software to the infrastructure to reach their desired customers. An IaaS example would be Amazon.

Aside from the models mentioned, there are also different kinds of clouds wherein you can deploy your softwares, specifically, Public Cloud, Private Cloud, and Hybrid Cloud. These depend on the business type, whether the subscriber is a home user or a small business owner. Public Cloud are accessible by any subscriber who has access to the cloud, these are owned and operated by third-parties. Private Clouds are exclusively for a single organization. Private Clouds have two (2) variations, On-Premise Private Cloud, which is hosted within one's own data center, and Externally Hosted Private Cloud, which is hosted externally by a cloud provider. The Hybrid Cloud combines both the Public and Private Cloud into one (Torry Harris Business Solutions, n.d.).

Analytics

Data Analytics is said to be the "*extensive use of data, statistical and quantitative analysis, explanatory and predictive models, and fact-based management to drive decisions and actions*" (Davenport & Harris, 2007). It uses analyzed data to support decision-making. It is getting information and deriving what to do with the information at hand (National Academies of Sciences, Engineering, & And Medicine (U.S.), 2017, p. 61). Web 2.0 has allowed users to be content providers thus making it data-driven. This helps analytics as it heavily relies on data. There are four types of data analytics, mainly, Descriptive, which points out what is actually happening, Predictive, which figures out what is likely

to happen, and Prescriptive, which provides insight on what should be done depending on the scenario. These all attribute to better decision making as the decision to be made would have supporting evidence that the decision maker is making the right choice (Corcoran, n.d.).

Descriptive

This is the most common form of data analytics as it aims to compile and understand data that already exists. It uses historical data to identify patterns and trends. Going side-by-side with Descriptive analytics is Exploratory data analytics, as it goes further than Descriptive analytics. It searches through the data for correlations and relationships to generate a hypothesis. Data to be used in this type of analytics are discrete and continuous data. Discrete data are data that are finite or countable, may it be numerical or categorical, while continuous data is taken through observations within an interval of time. These data are then summarized, either by frequencies, distributions, or tabulations to make calculations of occurrent values, and central tendencies, such as mean, median, and mode. Presenting these data are usually done in graphs, such as bar graphs and scatter plots (National Academies of Sciences, Engineering, & And Medicine (U.S.), 2017, p. 65).

Predictive

Predictive analytics goes deeper than both descriptive and exploratory as it uses the data to determine patterns and predicts what will happen in the future. It is used to test certain hypotheses. Tools that can be used in Predictive analytics are machine learning, linear regression, and nonlinear regression.

Machine Learning

This method is used for out-of-sample predictions and addresses dealing with a huge set of data. It basically involves developing techniques to teach computers to learn without putting it into code. There are three (3) types of classes, Supervised, a teacher gives examples to the computer, Unsupervised, the computer itself finds patterns without examples, and Reinforcement, where a software agent finds a way how to optimize without giving examples (National Academies of Sciences, Engineering, & And Medicine (U.S.), 2017, p. 66).

Linear Regression

Linear regression summarizes relationships between two (2) quantitative variables. This is usually used for predicting, forecasting, reducing errors, and quantifying the relationship between data (National Academies of Sciences, Engineering, & And Medicine (U.S.), 2017, p. 66).

Nonlinear Regression

Nonlinear regression uses observational data that are modeled using nonlinear combinations of parameters that depend on independent variables. This requires a lot of computation and should be iteratively done (National Academies of Sciences, Engineering, & And Medicine (U.S.), 2017, p. 67).

Prescriptive

This is the analytics that answers the question of what to do with your data. It provides recommendations to support decision-makers with the best results based on the trends found within the data sets. This is also known as decision making under certainty which is based on the methods of Stochastic modeling and mathematical optimization.

Prescriptive analytics has two (2) key areas, Stochastic Models of Uncertainty and Mathematical Optimization Under Uncertainty (National Academies of Sciences, Engineering, & And Medicine (U.S.), 2017, p. 71).

Stochastic Models of Uncertainty

This area is done before optimization as it determines the best set of decisions through the Stochastic models and the processes associated with the problem. It provides context in formulating a solution to the problem by capturing the relationships between the actions done and its outcome (National Academies of Sciences, Engineering, & And Medicine (U.S.), 2017, p. 73).

Mathematical Optimization Under Uncertainty

Mathematical optimization determines which among the set of decisions would generate the best result with context given by the Stochastic model (National Academies of Sciences, Engineering, & And Medicine (U.S.), 2017, p. 74).

2.1.2 Project Management

According to the Project Management Institute (n.d.), the application of knowledge, tools, skills, and techniques is basically the definition of project management. Project management is applied to project activities to meet the project requirements. Certain steps and tools and techniques are used to have a successful implementation of project management.

2.1.2.1 Project

A project as defined by the Project Management Institute (n.d.), "is a temporary endeavor undertaken to create a unique product, service, or result." Most of the time projects are made to take advantage of an opportunity, or to solve a problem. Certain attributes help define a project. A project can be large or small and

can take a short or long time to complete depending on the scope. A project will end when the objectives have been met or it has been terminated. There are six attributes to further help define a project are discussed as follows:

- A project has a unique purpose. Having a specific objective or goal is expected of every project. The objective can serve as a basis for further discussion about a project.
- A project is temporary. As mentioned earlier, all projects are temporary endeavors, meaning, each project has a definite beginning and end.
- A project is developed using progressive elaboration. In the beginning, projects have broad definitions, however, as it progresses, the definition of the project and specific details become more understandable.
- A project requires resources, often from various areas. Employees, software, hardware, and other assets are considered as resources. Often times, the employees involved in a project are not just from one department, and resources will constantly be used to achieve project objectives.
- A project should have a primary customer or sponsor. A project sponsor most of the time is the customer. A project sponsor provides the funding and budgeting, and also the direction to where the project will lead.
- A project involves uncertainty. There are risks involved in every project, and also unforeseen external factors.

2.1.2.2 Processes/Phases

There are five (5) phases in the project management life cycle, Initiate, Plan, Execute, Control, and Close.

Initiate

Project management starts with the initiation process wherein the project is to be defined. During this process, the senior managers are to determine the scope, time and cost constraints of the project as well as selecting the project sponsor and project manager (Schwalbe, 2011). The main goal of this process is to formally

select and start projects. It is to be noted that the initiation process does not involve any work to be started on the product of the project but rather it focuses solely on the project's objectives and what is needed to achieve it (Newton, 2015).

Plan

The main goal of this process is to estimate the time, cost and resources needed for the project to avoid risks and issues down the road. Within this process, the deliverables are identified as well as the activities to produce these deliverables. The planning process includes developing the schedule of the project and the budget needed. This process is used to develop an understanding of the project, how the project will be executed and where to get resources to execute the project (Newton, 2015).

Execute

This process puts into action the project plan that was developed in the planning process. This process includes performing the necessary activities to meet the objectives stated in the project plan as well as managing resources and the project team. Changes to the scope are to be made as the project execution moves farther along as unexpected internal and external factors arise. Within the execution process these changes are to be documented as Change Management (Newton, 2015).

Control

The controlling process is where actual results taken from the execution process are compared to the expected results stated in the project plan and the variances are then controlled by taking corrective action to keep the project on time and on budget (Newton, 2015).

Close

The closure process is the formal completion of the project deliverables as well as turning them over to the customers after getting the final approval from project sponsors and the customers.

This also marks the termination of any activities done by the project team and the completion of the documentation of the project and archiving these documents (Newton, 2015).

2.1.2.3 Inputs and Outputs

Initiate

The initiation process produces a business case that entails the reason of why the project was initiated as well as what problem it seeks to solve, the cost-benefit analysis that will aid top management in deciding whether to go through with the project or not and what resources the project will consume. Aside from the business case, the project charter is also another output of this process. The project charter describes the project in detail, this includes the requirements needed for the project as well as the scope of the project. The project charter defines the objectives and the budget (Newton, 2015).

Plan

The main inputs of the planning phase are the project charter and business case completed from the initiation process. The planning phase produces the scope statement, work breakdown structure (WBS) and the project management plan. The scope statement basically describes what the project encompasses, what work would be done and what work is not to be done for the duration of the project. The WBS helps decide how to do the work needed in the project and also aids in making the project schedule (Schwalbe, 2011). The WBS would further be discussed in the Tools and Techniques section of this chapter. The main output of the planning process is the project management plan which helps guide the execution of the project and project control. It documents the plans, scope, cost and schedules that have been approved by top management (Newton, 2015).

Execute

The main input of this process is the project plan and the main output of the execution process are the project deliverables that

were specified in the project plan. Aside from the project deliverables, change management documents, which entails changes done to the original project plan as external and internal factors that were unforeseen during the planning process, are also expected outputs of this process (Newton, 2015).

Control

The controlling process requires the project plan and progress reports to see the variances between the expected results from the actual results taken from project execution. The controlling process produces updated progress reports, project plan updates and change requests as well as the deliverables stated in the project plan (Newton, 2015).

Close

The closure process produces the final deliverables as well as their respective documentations. These documents and deliverables are archived as reference for future projects as well as lessons learned by the project team (Newton, 2015). The final output of the project is the final report that entails all details of the project which is to be presented to top management and project sponsors (Schwalbe, 2011).

2.1.2.4 Project Metrics

Key Performance Indicators (KPI) are present to monitor, evaluate, and provide insight to the project's performance, as well as, project team member's. According to Denley (2015), KPI is a method to measure a performance against an identified objective. In making KPIs, it is important to understand what KPI should or should not be measured. KPIs should be quantifiable metrics to be measured accurately. There are four (4) common metric categories, namely: Timeliness, Budget, Quality, and Effectiveness. The following are more specific KPIs under each category:

- Timeliness
    - Cycle Time. The time required to accomplish a particular task or activity.

- ○ On-time Completion Percentage. Checks the number of projects wherein the projects were finished given a deadline.
- ○ Time Spent. The amount of time you spent in completing a project, task, or activity.
- ○ Number of Adjustments to the Schedule. Counts the number of times the completion date of the project was adjusted.
- Budget
  - ○ Budget Variance. Difference between the actual and proposed budget for a certain project.
  - ○ Budget Creation Cycle Time. Measures the time it took to finish formulating the project's budget.
  - ○ Line Items in Budget. Tracks the individual expenses of a project team member.
  - ○ Number of Budget Iterations. Counts the number of times the budget was revised before final approval.
- Quality
  - ○ Customer Satisfaction. Measures the number of customers that are coming back. This is essential to projects dealing directly with its customers.
  - ○ Number of Errors. Number of times things were needed to be redone during the project development.
  - ○ Complaints. Tracks the number of complaints coming from customers, stakeholders, or project team members.
- Effectiveness
  - ○ Number of Project Milestones Completed On Time with Sign Off. Measures the number of activities that were completed on-time and was approved by the project owner.
  - ○ Number of Returns. Counts the number of times certain product, material, or equipment was returned to you due to some reasons.
  - ○ Training Needed For Project. Tracks the number of hours, days it takes to finish training.

2.1.2.5 Tools and Techniques

Tools and techniques are used to assist project managers in the overall planning, executing, monitoring, controlling, and closing phases of any project or program. The main reasons for using certain tools and techniques range from brainstorming ideas, organizing and/or summarizing an array of data and information, visualizing the project flow, formulation/initiation of contingency plans, and proper project documentation. There is not an existing tool that captures everything needed in managing a project and with this, there is a long list of tools and techniques to be discussed, but it would be more viable to discuss at least five important tools and techniques that may be applicable in every project, namely the Work Breakdown Structure (WBS), Gantt Chart, Program Evaluation Review Technique (PERT), Responsible-Accountable-Consulted-Informed (RACI) Accountability Matrix, Progress Reports, and Project Management Software.

Work Breakdown Structure (WBS)

A deliverable-oriented grouping of activities involved in a project is a Work Breakdown Structure (WBS). The WBS helps in organizing and dividing deliverables between the people involved in the project. It is a basis for planning and managing project schedules, resources, changes, and cost. A good WBS includes the scope of the project, therefore, all activities not in the WBS should not be done. Often times, the WBS is organized by the project's phases and the project management process group - initiating, planning, executing, monitoring and controlling, and closing. WBS can be in form of chart or in a list depending on the preference of the user. There are five (5) different approaches in making the WBS namely, Using Guidelines, Analogy Approach, Top-down Approach, Bottom-up Approach, and Mind-mapping Approach. WBS alone is insufficient, and a WBS dictionary is required to support the WBS. WBS Dictionary describes in detail the deliverables in the WBS, it includes the responsible organization, resource requirements, estimated costs, and other information *(Refer to Appendix B for Sample Work Breakdown Structure).*

Gantt Chart

In 1917, Henry Gantt devised a horizontal time chart which is mainly used for project scheduling. It is a standard graphic representation of all tasks to be performed in a project plotted in days, weeks, or months whilst showing the start, end, elapsed, and completion time of each task. It provides an overview of the flow of tasks of the project and its dependencies to one another. It can also show the comparison between the actual task/s completion from the planned task/s completion. It is not just a simple scheduling tool, but it can also be used in estimating resources and costs within a project. The information gathered from a Gantt Chart are that of tracking project progress, success and failure points, and comparison between actual and planned schedules and costs *(Refer to Appendix B for Sample Gantt Chart).*

Program Evaluation Review Technique (PERT)

PERT was developed by the United States Navy in the late 1950's to administer the Polaris submarine missile program. It is used to define and address risks by defining, planning, and analyzing tasks involved in a project with proper scheduling, organizing, and coordinating of tasks with one another. This technique makes use of the critical path method, or sometimes called the PERT charts, as foundation for schedule estimates and task dependencies. A critical path method simply illustrates the activities in a project in chronological order, activities that can be done in parallel, and individual activity durations. Analyzing the critical path method is the essence of PERT, as it is used to formulate the optimistic, most likely, and pessimistic time for completion, or better known as the Three-Point Estimate or probabilistic time estimates *(Refer to Appendix B for Sample PERT Chart).*

Responsible-Accountable-Consulted-Informed (RACI) Accountability Matrix

The RACI Accountability Matrix is used to identify the roles and responsibilities of project stakeholders by assigning specific tasks to the rightfully skilled members. It is a helpful tool in task management and control in knowing what each stakeholder's

involvement in the project is and what are their key deliverables. In constructing the matrix/diagram, there are three components – the leftmost column being the list of tasks/deliverables, the topmost row being the role or a specific member's name, and the rest of the areas is for cross-referencing the responsibility of each member to each task. The RACI acronym is further defined as follows *(Refer to Appendix B for Sample RACI Accountability Matrix)*:

- Responsible. Stakeholders who are highly involved in each activity and is committed in accomplishing each activity and managing its resources.
- Accountable. An individual whose main role is to take credit for the success or take blame for the failure. It is sometimes called the activity manager.
- Consulted. Stakeholders whose opinions are deeply taken into consideration in the decision-making process.
- Informed. Stakeholders who are always updated with the progress of a certain activity.

Progress Reports

Progress Reports are regular or routine documentation of updates and information regarding the current status of the project, planned activities, activity accomplishments, issues, and comments or notes that provide relevant information to stakeholders in a timely manner. These reports are used to identify and address the potential and current problems regarding cost, schedule, and quality. There are five types of progress reports and are discussed as follows *(Refer to Appendix B for Sample Progress Reports)*:

- Current Period Reports. It is the status of the project at the present time.
- Cumulative Reports. It is the report history of the project at a specific duration of time in order to identify trends and patterns.
- Exception Reports. It is a report that is only produced when there are issues and/or problems that have risen. Consequently, it summarizes these issues and problems and suggests the corrective action towards each concern.

- Stoplight Reports. It is more like a tool for reports in which it makes use of the colors of the stoplight to indicate status. Green indicates that the project is completely controlled. Yellow means there is a problem or two that needs to be addressed or is being addressed. Red means that the project is experiencing more problems than accomplishments and is currently uncontrolled.
- Variance Reports. It is a report that indicates the project's overall pace as it is compared to the initial agreed schedule; it may be ahead or behind of schedule. Aside from schedule, it may also compare costs, resources, and quality.

Project Management Software

Project Management Software and Systems may be the most helpful tool in administering project management. It cuts processing time by automating processes which include project scheduling, cost management, communication and coordination, activity management, risk management, and reports management. It also has the ability to instruct collaboration and synergy among the project team members as it provides transparency and a sense of urgency by prioritizing near deadlines on certain tasks *(Refer to Appendix C for Sample Project Management Systems)*.

2.1.3 Project Management Systems

Project management systems aid organizations with their projects by providing them ease of access and use to what used to be a manual task and process to a digital and convenient application (Hoebler, 2015). These systems provide visuals for project managers and project stakeholders to align timelines. Gantt charts are the most common visual representation that project management uses for project planning and scheduling and is used by most PMSs today. PMS also has dashboards that present the progress of projects, visual metrics and key performance indicators (KPI) of ongoing projects to be able to provide a quick overview that may lead to well-informed decisions (Karlson, 2015).

2.1.3.1 Benefits of Using Project Management Systems

Today, applications and software help people finish their tasks properly and on time. Software make it easy for people to lessen human errors and provides platforms that show important information to help make important decisions. Moreover, there are a number of benefits that a project management system can provide. According to Windsor (2018), PMS offers a centralized project reporting platform for the project stakeholders. This provides up to date progress to everyone involved in the project. In addition, PMS presents improved task management and visibility that provides the project team what tasks they are responsible for and how it will affect other tasks within the project. Another benefit is the assistance with monitoring the project. This helps a project stay on schedule and presents an idea how an individual task can influence the overall schedule of the project (Collins, 2016). Lastly, PMS presents various information that will help optimize decision making. It allows the project stakeholders to make necessary adjustments based on all the data captured by the PMS (Hurst, 2017).

2.2 Review of Related Systems

Leading project management systems were studied and compared as a reference for the conceptualization of the project. The project management systems that were considered were, Asana, Basecamp, Jira, Microsoft Project, Smartsheet, Trello, Wrike, and Zoho Project.

Asana

Asana is one of the most popular project management systems in the market. Asana mixes project management with task management into their system that pushes communication and collaboration within the project team. Aside from creating projects, users can make tasks within the project. As Asana is a web-based project management system, it makes following the progress of your project easier as well as communicating with your project team as Asana provides real-time communication between project members. Asana has no built-in feature of producing Gantt Charts however it allows users to integrate their project management system with various established applications such as Gmail, Microsoft Office 365, Google Calendar, Jira, Salesforce and Instagantt, which

provides Gantt Charts. As for pricing, Asana has three (3) categories; a free version which caters to teams of fifteen (15) members that allows users use of basic features such as basic searches and dashboards. The premium category costs $9.99 (roughly PHP 500) per member per month to be billed annually and $11.99 (roughly PHP 600) per member per month when billed monthly. The premium package consists of the free package features plus advanced searches and reporting, custom fields, task dependencies and priority support among others. The premium package also has no team member limit. Lastly, the enterprise package consists everything that the premium package has with the addition of advanced admin controls, custom branding and same day support. In order to find out the price of the enterprise package, users must contact Asana directly as it is priced by quote. Asana has been tried and tested by Uber, Airbnb, Dropbox and Tesla *(Refer to Appendix C for System Screenshots)*.

Basecamp

Basecamp is one of the first products of Basecamp, formerly known as 37signals. Basecamp began its production in 2003 and was launched in 2004 as a web-based project management tool. The system is for all types of businesses, may it be freelancers to even big enterprises. Basecamp, as all project management system, only has the basic functions like to-dos to track activities, message boards to make announcements, campfire to chat with project members, schedule to mark deadlines and milestones, docs and files for easy sharing of documents, and automatic check-in to get updates from project members. As a project management system, Basecamp could be lacking for some, compared to big project management software names out there, Basecamp offers minimal customization, limited integration of developer's API, and also Basecamp is not really mobile friendly. However, Basecamp has been trying to improve and a number of third party tools can be integrated with the system, these third-party tools includes, but not limited to, Zapier for mobile and desktop applications, Timeneye for time tracking, AssessTEAM for feedback of employees, Ganttify for creating Gantt Charts, Instabug for software development, and SupportBee for customer service and support. Some of the major clients of Basecamp are NASA, WWF, Adidas, and Twitter *(Refer to Appendix C for System Screenshots)*.

Jira

Jira is a web-based project management software that allows users to manage projects from the moment of conceptualization to project launching. Jira allows users to plan and track projects as well as create user stories, plan sprints and

assigning of tasks to team members. It is flexible in terms of planning, it can accommodate mixed methodologies. Prioritizing tasks to be done and releasing of reports that are real-time and easily understandable for users to analyze. Jira does not have their own generation of Gantt Charts however they are capable of integrations with over 3,000 established applications such as Salesforce, Github, Gantt-Chart for Jira and a lot more applications from the Atlassian Marketplace. As for pricing, Jira has two (2) categories, cloud based and self-hosted. For Cloud based, a team up to ten (10) users would cost $10 (roughly PHP 500) monthly flat fee and a team up to 11-100 users would cost $7 (roughly PHP 350) per user per month. If a team exceeds 100 members, price is to be quoted. For self-hosted, prices range from a server of 10 users costs $10 (roughly PHP500) one-time payment to a server for more than 10,000 users costs $39,000 (roughly PHP 2,000,000) one-time payment. For data centers, prices range from 500 users at $12,000 (roughly PHP 600,000) per year to 50,001 users at $450,000 (roughly PHP 23,000,000) per year. Jira currently has over 51,000 customers such as eBay, Spotify and Cisco *(Refer to Appendix C for System Screenshots).*

Microsoft Project

Microsoft Project (MS Project) developed by Microsoft, the same company who made the known Microsoft Office, an office suite that provides a word-processing application, spreadsheet application and presentation application namely - Word, Excel and PowerPoint respectively. MS Project was designed by Microsoft to be used by business professionals. MS Project is meant to be installed locally to a machine and is intended to be used by the project manager to monitor a project. MS Project, as many will say, is an optimized spreadsheet or Excel application that focuses mainly on project management. It makes capturing data and input from the project manager easy and convenient. MS Project also provides instant visualization of the data that the project manager has provided. Project timelines, assigning resources to tasks, tracking the project progress and many more. MS Project offers extensive data capture but should be manually encoded by the project manager. It then uses this information to provide visual representations and basis for decisions for the project manager. The user experience of MS Project is very similar to a spreadsheet. Numbered cells are used to capture and present encoded information to the user. MS Project is very dynamic to a point that most of the features are not customized to an industry or organization. In addition to that, MS Project offers little to no customization. The organization will have to adapt and learn how to operate and fully utilize this software.

A single license of Microsoft Project Standard 2016 for a single user will cost $560.00 (roughly PHP 28,000.00) while a single license of Microsoft Project Professional, which adds a number of useful features, will cost $940.00 (roughly PHP 57,000.00) for a single user. Although there is an option to avail access to this software through Microsoft's online service - Project Online Professional, it will cost $30.00 (roughly PHP 1,500.00) per user, per month which is just a fully installed, desktop application and not cloud-based. This just opens the availability of the software to multiple devices of a single user. MS Project currently has over 20 million users from multiple companies like British Airways, Kraft, BMW, Toyota and Intel to name a few *(Refer to Appendix C for System Screenshots).*

Smartsheet

Spreadsheets are widely present in any organization, and adapting a similar interface allows users to easily adapt and learn the software, but the only difference in Smartsheet is that it has more capabilities and is more customizable than regular spreadsheets. It is a web-based project management software designed for any sized business to initiate collaboration with the use of project templates, Gantt Charts, task and sub-task lists, budget variance, resource management, change notifications, custom reports, file sharing, customizable dashboard, and version control, which can all be viewed real-time in any device. The key functions of Smartsheet are planning, tracking, automating, and reporting work. These functions can cater to the majority of the departments in an organization. Smartsheet can be integrated with more or less fifty-seven (57) applications; Google Apps, Salesforce, AppSheet, and Microsoft are only some of the biggest integrations it is able to do. There are four pricing packages which are all billed annually and are charged per user and per month except for one - An individual plan at $14 (roughly PHP 700), team plan at $15 (roughly PHP 750), business plan at $25 (roughly PHP 1, 250) and the enterprise plan with a customized quote. It now claims that it has over 3 million users in 70,000 organizations across 190 countries. Some of its clients are Cisco, Aramark, World Vision, Colliers International, Netflix, and Hilton *(Refer to Appendix C for System Screenshots).*

Trello

Trello is a web-based PMS made by Fog Creek Software. On the surface, Trello is fairly easy to use. Navigation is straightforward and action buttons are displayed where a user will expect them to be. Trello's implementation of a project management software is very modern. They opted not to use the

traditional Gantt Charts, but instead use what they call Boards. These boards are similar to projects and those can contain, what they call, cards. Cards are similar to tasks in a project where you can set who is responsible for that card, when the task should start and end, and so on. Trello also takes pride of its user experience which is much similar to social media platforms - Facebook to be exact. The way Trello implemented its notification feature, tagging, and project activity log is close to how Facebook implements theirs. This way, users who are familiar with using the platform will not have difficulty using Trello. Trello can handle any kind of projects but is not optimized for business use. What Trello lacks the most is the capacity to generate reports and KPIs. Trello is offered for free with no limitations on its main features. Upgrading a user to Business Class will cost $9.99 (roughly PHP 500.00) per user per month which enables more features most notably the capability to be integrated with other software such as Jira, Salesforce, Dropbox, etc. *(Refer to Appendix C for System Screenshots).*

Wrike

Wrike is an online project management software for any sized businesses that aims to speed up and improve efficiency of work. It has a 3-pane layout interface that allows users to view project operations and other important data in one screen. Within this view, users can collaborate with their team members through updates, file sharing, monitoring and controlling work progress, and standardized change requests/proposals. Other tools for collaboration include an interactive Gantt Chart, performance charts, task discussions, report generation and auditing, and integration with other applications. Wrike can easily integrate with Dropbox, Salesforce, MS Project, Google Apps, and many more. Wrike prides itself in being able to produce extra time by cutting time in certain work processes including meetings, emailing, reporting, and data gathering. There are five pricing packages which are all billed annually and are charged per user and per month except for two – A free plan with absolutely no cost for up to 5 users, professional plan starting from $9.80 (roughly PHP 490) for 5-15 users, business plan at $24.80 (roughly PHP 1, 240) for 5-200 users, marketers plan at $34.60 (roughly PHP 1, 730) for unlimited marketing/creative users, and the enterprise plan with a customized quote for unlimited users. Some of its clients are EA Sports, Stanford University, HTC, Google, Adobe, and Hawaiian Airlines *(Refer to Appendix C for System Screenshots).*

Zoho Project

Zoho Projects is an online project management application for various types of businesses like freelancers, small and medium-sized businesses, and enterprises. Zoho Projects was developed by Zoho Corporation, which is home to almost 35 more web-based applications. Some of the features that are included in Zoho Projects are dashboards, task dependency, Gantt Chart, project templates, document sharing, calendar, project custom fields, and email integration. Zoho Projects can also be integrated with most, if not all, the products of Zoho Corp. like Zoho Mail, Zoho Docs, and Zoho Reports. Also, the application is open to other APIs, and can be integrated with third party softwares to have a more customized and personal application that may suit your business needs. Zoho Projects has 4 business plans to choose from. First, is the Free version which includes 1 project, 10 MB of storage, maximum of 5 users, and limited features of IssueTracker. Next, is the Express for $25 (roughly PHP 1200) it includes 20 projects, 10 GB of storage, and unlimited number of users. Third, is the Premium which costs $50 (roughly PHP 2500) wherein a customer can have a maximum of 50 projects, 100 GB of storage, unlimited number of users, and pages and chat is also included. Lastly, the Enterprise, for $100 (roughly PHP 5000) and it includes unlimited number of projects and users, 100 GB of storage, and pages and chat is also included. Some of the biggest clients of Zoho Projects are Raw Engineering, Cloud Camper, and Abacus Concepts *(Refer to Appendix C for System Screenshots)*.

Synthesis

The systems mentioned above each have their own strengths and weaknesses. Asana, Basecamp, and Trello have strong team collaboration, although, they cannot visually display the created schedules. Jira, Microsoft Project, and Zoho Project are both highly customizable, however the former is very complicated to understand and master, while the latter has an overwhelming need for third-party applications. Smartsheet and Wrike have detailed reporting schemes, however, they are unable to measure performance with a customized formula. In reviewing project management systems, the developers have created an image of a system that will cater to TEI-specific needs *(Refer to Appendix C for Project Management Systems Comparison Table)*.

2.3 Review of Related Methodologies

Agile Software Development is one of the methodology umbrellas in developing a software. It is composed of methods with an iterative workflow, gradual delivery of software units/modules in short iterations, continuous stakeholder engagement, and quality software outcome. Agile is defined to be active, responsive, and alert, which are all factors that are reflected in each methodology. In February 2001, the Agile Software Development Manifesto was developed and included four sets of values in describing the true essence of what agile meant. The four agile values are, team interactions over processes and tools, quality and working software over adequate documentation, customer involvement over contract negotiation, and responsive to changes over following the initial plan. Some of the methodologies classified under agile software development are Dynamic Systems Development Method, Extreme Programming, Feature-Driven Development, and Scrum.

Dynamic Systems Development Method

The first version of Dynamic Systems Development Method (DSDM) was developed due to the lack of discipline in the Rapid Application Development Method. In 2007, DSDM released its latest version which is known as DSDM Atern. DSDM puts emphasis on time and quality over the actual functions of the system. DSDM implements the MoSCow method in prioritizing the requirements of a project. Must haves (M), should haves (S), could haves (C) and won't haves (W). This methodology may be used in all project sizes with any sized teams as well. DSDM sets itself apart from other agile methodologies due to the fact that reports are formalized, and requirements are tracked.

DSDM is made up of seven (7) phases; the pre-project phase wherein projects are suggested and selected. This phase determines whether or not to go through with the project. The second phase is the feasibility study where the problem is defined as well as its proposed solutions. Assessing of costs whether it is feasible for the company to achieve is done in this phase. The third phase is the business study where the basis for all work that would be done is stated. The fourth phase is the functional model iteration (FMI). This focuses on designing the business aspects of the system. The fifth phase is the design and build iteration (DBI) where the system is actually developed. The iteration phase follows the 80%/20% principle wherein 80% of the solution should be resulted from 20% of the total time. DSDM practices having early deliverables in order to make time for more thorough testing. The sixth phase is the implementation where the

system is turned over to the client. The last phase is the post-project phase wherein the deployed system's performance is measured. Additional enhancements are also measured, this usually takes place six (6) months after project completion *(Refer to Appendix D for DSDM Framework)*.

Extreme Programming

Extreme Programming (XP) is an agile development process, it focuses on collaboration between managers, customers, and developers, and it also gives emphasis on teamwork. Change is inevitable in software development, and these changes can sometimes have big impact on wasted resources, therefore, one of the main purpose of XP is to minimize wasted resources through having multiple short development life cycles instead of long ones. This methodology is fit for small projects with a team of less than twenty (20). XP is done according to values, and rules and practices. The five values to follow when implementing XP are simplicity - what needs to be done will be done, no more, no less. Also, in XP they believe in minimalistic and clean design; communication - as mentioned earlier, XP emphasizes on teamwork, therefore, communication is key. It is important that constant communication happens between the customer and the developers, to lessen misunderstanding as well; feedback - in the early stages of development, testing is already done and giving feedback or critic is highly encouraged by XP; respect - everyone is expected to respect the opinion of different people with the software that is being developed; and lastly, courage - changes can be scary at times especially with how fast technology is moving right now, however, everyone should have the courage to embrace those changes. Now, the five (5) rules to follow when practicing XP are the following *(Refer to Appendix D for Extreme Programming Framework)*:

- Planning. Users stories are made in the planning stage. User stories are used to make time estimates for meetings, planning, and releases.
- Managing. Managing bottlenecks and having control measures are key in this rule. Avoiding bottlenecks, and over workload by managing requirements and the people is part of managing.
- Designing. It is believed that complex designs take more time than simple ones, therefore, it is expected that the design model is simple and follows one (1) of the values of XP. Spike solutions - a program to explore potential solutions, are required by this rule.
- Coding. For coding, this rule states that customers are expected to be part of the development team as a consultant, or similar, the customer is always

expected to be available for consultation. Coding standards should also be agreed by everyone involved in the project.

- Testing. A rule stating that all codes must undergo testing, especially, unit testing. Acceptance testing is also required to be accomplished.

The following are thirteen (13) standard practices that best describe Extreme Programming:

- Customer Team Management. The customer is part of the development team and is responsible for defining and prioritizing features.
- User Stories. Scenarios that will show the different requirements of the system. Based from these stories, the priority and estimated cost of each function will be determined.
- Short Cycles. Iteration is the core practice of XP. Ideally, the system should have small releases every two (2) weeks. At the end of each release, feedback is collected, and a release plan is made. Each iteration lasts from one (1) to six (6) weeks.
- Acceptance Tests. Acceptance testing should always be done from different users to further enhance the user interface and user experience of the system.
- Pair Programming. As the name suggests is done by pair in one development effort on one workstation.
- Test-Driven Development. Test cases should be prepared before coding. In result, a completed test case will be the guide in system development.
- Collective Ownership. All codes, modules, and features of the system are never owned by a single developer, but rather the whole team, therefore, anyone from the team can make changes if necessary.
- Continuous Integration. Developers who made an improvement or added a new code should always integrate it into the larger system at all times.
- Sustainable Pace. It is a rule of XP that a team is only allowed to work for forty (40) hours a week and no overtime is allowed. XP thinks that developers are less productive when tired.
- Open Workspace. XP believes that information dissemination can be made easier and more accessible when everyone on the team works together in an open room and are within earshot of each other.
- Planning Game. In this practice, customers rate the importance of a feature, while the developers, decide how much that feature will cost.
- Simple Design. The system is designed to be as simple but expressive as it can be, and the XP team encourages a minimalistic design.

- Refactoring. Constantly, every hour, XP team always try to improve using refactoring techniques, such as, improving codes, to simplify codes.

Feature-Driven Development

Feature-driven Development is an agile software development model that focuses on quality of the entire project by conducting frequent quality checks for each step and delivery of results to prevent late discovery of errors and change in requirements. It provides insights to the client by continuously producing results for the clients to see. This model can cater to more complex projects with it being highly iterative with each iteration taking up two weeks. By catering to complex projects, the methodology requires multiple teams composed of a large group. FDD is divided into five steps - Develop an overall model, build a features list, plan by feature, design by feature and build by feature *(Refer to Appendix D for Feature-Driven Development Framework)*.

The process starts with the client and the developers discuss the overall domain of the project then generates models that will focus on one problem and later on combining all models to create the overall model that they will use for the project. Following that, the next step would be for the developers to break down a functionality and identify the necessary features for that functionality. A feature will also entail activities for it to be properly developed in which the team will also discuss. After which, they proceed to the next process, they conduct planning on which order the features will be developed. They identify which is the priority and usually, these are the features that are most relevant and important to the clients. Tasks are also divided among the team for them to identify which feature they will be working on. Right after that, the developers then proceed to designing the domain classes that will be used for the feature of a certain iteration they are working on. Method and class prologues are produced in this step and a design inspection is conducted. Lastly, the developers begin to code and test their assigned features. The codes are inspected and would require the approval of their Chief Programmer before they can finally be compiled to the main build. After which, another iteration will begin starting on the fourth step until they finish the project.

Scrum

In 1993, Jeff Sutherland developed the Scrum methodology which is designed to quickly deliver value and project deliverables in an iterative process. The project deliverables or list of tasks are subdivided into smaller units in order to easily

monitor each task, or more commonly known as a "Divide and Conquer" approach. It ensures an environment where the team members are well-informed and have a platform for disseminating information on the overall progress of the project. All kinds of projects are suited for this methodology. There are three main roles involved in this methodology namely, the product owner, the scrum master, and the team. As the names imply, the product owner is an individual responsible for defining the scope of the project and coordinates with the stakeholders, the scrum master is responsible for all activities and decisions that take place in an iteration, and the team is responsible for accomplishing the actual work within each iteration that contributes to the entirety of the project.

The first step in a Scrum framework is to define the scope of the project by closely coordinating with the project sponsors in gathering all necessary requirements in order to provide direction for all stakeholders. The scope is now translated into the product backlog wherein all the project specifications are listed in the form of user stories. After the product owner designs the project using information found on the product backlog, the project now enters into the first cycle of iterations, or better known as a sprint. To formally enter a sprint, the team must go through sprint planning which would not exceed two (2) hours. During sprint planning, the team plans a list of tasks to be done and deliverables to be accomplished at the end of the sprint. Everything that was discussed in each sprint planning is documented in a sprint backlog, specifically the product backlog items chosen to be accomplished and how they are supposed to be accomplished during the sprint. The sprint is then executed while being guided by the sprint backlog. There will be a fifteen-minute meeting every day to synchronize and plan activities to do within twenty-four hours, which would be coined as a daily scrum. Each team member explains three points during the daily scrum – what he/she did the previous day to help the team meet the goal, what he/she will do today to meet the goal, and possible issues that may prevent the team from meeting the goal. At the end of each sprint, a sprint review is done to gather feedback and apply changes to the product backlog if necessary. After the sprint review, a sprint retrospective is done to evaluate the team and their performance to adapt improvements on the next sprint. Once the team executes its last sprint and is accepted by the stakeholders, it then releases a usable software to be delivered to the client.

One of the advantages of scrum is that it can produce value to the stakeholders after each sprint rather than during the end of the entire project. It also eliminates risk and enhances team collaboration with the use of repetitive team meetings in sprint planning, daily scrums, sprint reviews, and sprint

retrospectives. Scrum is simple to understand, yet difficult to master. One of the down sides of scrum is that, it requires a high level of commitment from the team in order for it to be a success and one of the key issues in project management is the individual culture within a team which may imply that not everyone has the same practices and preferences *(Refer to Appendix D for Scrum Framework).*

Synthesis

Reviewing other agile methodologies shined a brighter light on the researchers' chosen methodology to be applied in the project. Although Scrum is the most popular methodology, the researchers found it unfit for the project due to the complexity of the sprint, or also referred to as the iteration. The FDD had familiar practices, but it requires generally a large team, which is inapplicable to the researchers' group of four (4). DSDM and XP are also good frameworks to follow because of the practices and principles involved such as, the MoScow method, user stories, and having an open workspace *(Refer to Appendix D for Methodologies Comparison Table).*

3.0 Methodology

This chapter details the researchers' chosen methodology that was applied to the capstone project, which is the Rapid Application Development Methodology, under the umbrella of Agile Methodologies. Each phase of the methodology is discussed and further associated to specific activities accomplished throughout the entire project duration.

3.1 Description

Rapid Application Development (RAD) is a type of agile software development methodology which is focused on application prototyping and iterative development throughout its stages. This methodology is best for small and highly motivated teams that will handle a small project with a defined scope that may be broken down into smaller parts.

The five (5) core elements needed for proper implementation of RAD are, prototyping, iterative development, time boxing, team members, and management support. Prototypes are used to jumpstart the process. This is where the developers create an image of the project that would be aligned with client requirements. It is often a lightweight version of the entire project, ensuring that it captures all necessary features and functions. It is also used as a tool to further refine the client requirements and to identify the areas to prioritize. Prototypes are continuously enhanced by adding a more intensive execution of the certain functions, which is also called an iterative development. During the development phase, it is important to avoid scope creeps or the tendency for the project scope to become bigger and bigger (Schwalbe, 2011), which is the main purpose of time boxing. Time boxing is the process of limiting the features of the application for future versions in order to focus and deliver the main features settled with the client. Without time boxing, it defeats the purpose of having a fast-paced agile methodology wherein the project will continue to extend as the scope extends. To put the project altogether, a small, highly skilled and experienced team is needed to materialize the project. In addition, high involvement and support of the management and/or client is needed to avoid extended iterations.

The RAD Methodology was chosen for this project due to its ability to cater to the fast pace of the project at hand while at the same time not affecting the quality of the project deliverable. RAD allows the developers to iteratively go back to the client for feedback all the while being able to move in other phases of

the project. This also permits the users of the actual system to be as involved as possible with the development of the system to ensure it is up to their standards.

3.2 Steps and Tools/Techniques/Inputs and Outputs

The RAD Methodology Framework encompasses four (4) steps: Requirements Planning, User Design, Construction, and Cutover *(Refer to Appendix D for RAD Methodology Framework)*.

3.2.1. Requirements Planning

Requirements planning is the first phase in RAD. Understanding the organization's current problems, familiarizing with the organization's current system, and proposing a solution are the general objectives of this phase. The team secured and signed a contract, specifically a Non-Disclosure Agreement (NDA), with the organization to ensure a safe information exchange that would only be used for academic purposes *(Refer to Appendix L for Non-Disclosure Agreements of Team Members)*. In order to meet these objectives, the development team and the client of the project have regularly met and discussed until everyone on the team agrees with the objectives, functionality, and scope of the project that they were able to come up with. All exchanges, may it be via a face-to-face meeting or an email questionnaire, are recorded, granted that the team receives appropriate permission from the interviewees *(Refer to Appendix I for Interview Transcripts and Appendix J for Certificate of Interview)*. Some companies use tools like IBM's Rational Rose or Microsoft's Visio to help them in requirements planning. The three main activities for this phase are:

- Research Current Situation. Researching the current environment and the current situation of the company initiates the requirements planning phase. The developers reviewed the current system and similar systems. The data gathered regarding the existing system is reflected and further discussed in Chapter 4 *(Please refer to Appendix G for the BPMN of Existing Processes, Appendix H for the Ishikawa Diagram, and Appendix I for the Interview Transcripts)*.
- Define Requirements. The scope of the proposed system, its module, functions, and features are all developed in this activity.

The detailed discussion of the proposed system can be found in Chapter 5 *(Please refer to Appendix A for the Conceptual Framework and Appendix N for the BPMN of Proposed Processes).*

- Finalize Requirements. An estimate duration of the implementation of the system is made, along with a formal document that includes the scope of the proposed system. The final requirements are stated in Chapter 1 *(Please refer to Appendix A for the Conceptual Framework and Appendix F for the Gantt Chart).*

3.2.2. User Design

During the second phase, the main objective is to analyze business activities and data with regards to the proposed system, to develop proposed screen layouts, and to plan for the transition from the current to the proposed system. The steps for doing the User Design are producing detailed system area model, developing an outline of the system design, refining the system design, preparing implementation strategies, finalizing the system design, and obtaining approval for construction. In this phase, the developers used a Joint Application Development (JAD) technique and hand drawn screens to serve as storyboards for the flow of the system. This phase also saw the developers creating test scenarios to test the certain modules they would be creating in the next phase. JAD sessions were done between the customer and the project team in order to discuss and reach an agreement regarding the main scope, objectives, and specifications, and limitations of the project. JAD follows six (6) guidelines to be followed in each session; simplify the agenda into a workshop, identify participants and concerns, quantify information, clarify requirements, unify outputs, and satisfy the customer/s. This was also in-line with the concept of using a participative design that ensured that the customer was included during the designing face and their comments and suggestions were taken into account in the final output.

3.2.3. Construction

This is also considered as the Development Stage. As the name says, this is where the developers completed the construction and development of the system by converting the prototype into the final output and adding the necessary functionalities with actual coding. Within this phase, there was

an iterative cycle for development, testing, and evaluating or requirements refining. Each cycle lasted between one day and three weeks. The cycle began once a prototype has been successfully developed. The developers then tested the prototype guided by the test plan and test scripts produced in the User Design stage *(Refer to Appendix S for the Case Scenario and Appendix U for the Test Cases)*. After testing, a focus group meeting was done in order to determine the necessary changes and an update of requirements for the next iteration. The focus group meeting discussed the concerns that arose during testing and what the necessary action should be with the help of producing a list of issues to be addressed rated by priority, and a new set of test scripts. The development of the prototype then started again, and so as the cycle. The cycle lasted up to three (3) weeks. The management served an important role wherein they had to ensure that the project was on track and continuously progressing according to the plan, whilst also keeping the client informed and the team motivated. In addition, corresponding user documentation, such as the technical manual, user manual, conversion plan, and installation plan are also produced after the completion of the system.

3.2.4. Cutover

This is also considered as the Deployment or Implementation Stage. Final User Testing or also known as User Acceptance Testing (UAT) is done in this stage where a complete system review is done with the stakeholders to assess if it meets their expectations and requirements. If the system failed the expectations of the key stakeholders, it will return to the iterative design loop for modification. On the other hand, if the system meets the expectations of the stakeholders, system installation, data conversion, and user training of the system is done. The developers had conducted their UAT with the actual users of the system and they had signed off their approval of the system *(Refer to Appendix V for the UAT Forms)*. The developers have also observed the operation of the system to lookout for potential enhancements and were on standby for troubleshoot concerns. The developers will then handover all related assets of the system which includes, the working system and all data used in creating the system. The objective of this stage is to integrate and align the system to the business of the key stakeholders.

After successfully implementing the system, the organization plans on integrating it with other systems such as, Task Management System, Integra, and systems that are currently under development, for their goal of *One Data*. The organization will be responsible for creating a shared dashboard for the integrated systems. The data from the Project Management System will offer an overview of all projects currently in progress and to be initiated, that may be broken down into separate departments, depending on the logged user.

3.3. Gantt Chart

The project will run through three (3) academic terms, roughly 3-4 months each, which will last for approximately a year. The first term will solely be occupied with the requirements planning phase to ensure that there is a clear image before moving forward with the project. During the transition to the second term, it will slowly begin the user design phase. The database design for the project management system is the most important activity in this phase as the overall design should be based on the database structure, which will occur hand in hand with TEI. The second term, the cycle of the user design and construction phases will reiterate until a proper output is achieved. The earlier part of the third term will consist of further construction of the phase and will move on with testing and user acceptance. The rest of the term is reserved for the implementation phase and further documentation *(Refer to Appendix E for the Gantt Chart)*.

4.0 The Existing System

This chapter details the organization, its current systems and projects that would be included in the scope of the project, and discussion of identified problems and sample scenarios. The projects that would be included at the minimum are that of, new store opening, new product launching, promotion launching, software development, onboarding, and offboarding. The identified problems are categorized into two, method and machine.

4.1 Organizational Profile

Taters Enterprises, Inc. (TEI) falls under the Food and Beverage Industry by being the franchisor and founder of Taters Snack League Fast Food Chain and, along with its sister company, Chimara Neo-Vegan Café. The company started in 1994 when the first Taters Snack League branch opened in Greenbelt, Makati. The following year (1995), they expanded to Visayas, particularly in Robinsons Bacolod and Ayala Center Cebu. In 2011, they have successfully spread throughout the whole Philippines by opening branches in Mindanao, specifically in Davao, Digos, Tagum, and Cagayan De Oro. TEI has been operational for moreover twenty-three (23) years and currently have forty-one (41) branches all over the Philippines, thirty-nine (39) of which are of Taters Snack League branches and the remaining two (2) are of Chimara Neo-Vegan Café. The company has garnered a number of rewards and recognitions throughout their existence in the industry, one of them being the Philippine Quality Challenge in 2014. They are fueled by their Vision and Mission which states that:

Vision

> TEI's goal is to establish a distinguished market presence as the leading franchise fast-food chain in key entertainment and leisure centers of Asia.

Mission

The organization may achieve its vision by also undertaking the following:

- To continuously develop the finest quality food products and provide superior services that exceed consumer satisfaction,
- To cultivate a dynamic, quality oriented, customer-driven business culture that will support and foster professional growth, develop teamwork, instill positive values, improve skills and efficiency and inspire creativity,

- To generate profitability and equitable return to our investors, partners and franchises, and
- To share company resources in the development and advancement of educational and social projects that will improve the well-being if our country community, our employees, their children and less-fortunate, deserving youth of our society.

When Taters Snack League first opened, they only focused on three (3) products: popcorn, fries, and peanuts. Since then, they have widened their food choices and are now offering a variety of snacks such as, popcorn, nachos, burgers, hot dogs, fries and onion rings, fresh potato chips, chicken fingers, dips/flavorings/toppings, drinks, and many more. Aside from the products they offer, they also provide catering services. Their main target market are moviegoers since they are almost always strategically located near the cinema area or within the cinema floor. They are constantly competing with other well-known cinema snacks franchisors offering identical products such as Robinsons MovieWorld and Ayala Snack Bar. Some indirect competition comes from Potato Corner, N.Y.F.D. (New York Fries & Dips), Muscle Beach, and even McDonald's.

TEI has recently elevated their organizational chart from a lateral structure. They have seven (7) departments classified under three (3) groups which directly report to the Company President. The three (3) groups are the Finance Group which only composes of the entire Finance department, Support Services Group which has the Facilities Administration, Human Resources and Office Admin, and Management Information System, lastly the Business Operations Group which has Store Operations, Procurement, and Marketing and Business Development *(Refer to Appendix F for the Organizational Chart)*.

4.2 Description of the System

TEI has a general procedure for managing projects. They are divided into two, the new store opening project which is composed of all seven departments, and departmental projects which involve only the concerning departments. Some of the departments do not solely own a project, but they may have some kind of participation in others. The projects that would be used as a reference to determine their nature in the organization are new store opening, new product launch, promotion launch, system development, employee onboarding, and employee offboarding. These projects are those commonly performed by the organization.

Currently, TEI does not have any existing system to provide aid in managing their projects. This coincides with their lack of monitoring employee performance in terms of how many projects they work on. The rough estimate of projects that an employee works in a given time are around three (3) to four (4) however there is no substantial evidence to prove this as per the interview conducted with TEI *(Refer to Appendix I for Interview Transcripts)*. This also goes for their monitoring of the average number of tasks an employee handles per project. What they do have right now are systems focused mainly on finances. They use SAP for the financial functions of the business such as sales records from the stores. They also use Integra Payroll Master for the payroll of employees for both the head office and stores. For their point of sales systems in stores, they use WebPOS for their PoS systems as well as consolidate sales records from stores.

Project Management

TEI projects generally have two types of actors which are all within the organization, the project owner and the project team. The project owner is responsible for overseeing the entire project and to initiate meetings to disseminate the project tasks. The project team may be solely within one department or throughout the whole organization.

The process starts when a project is initiated by the project owner, which is followed by a meeting with concerned departments. In this meeting, all project tasks are identified along with the corresponding department/s responsible for it. The department/s with an assigned task will then breakdown the tasks and distribute them to their sub departments until they are assigned to a specific employee. Ideally, the output of the meeting is a Gantt chart of activities, but this is only strictly followed in a new store opening project. If a Gantt chart is present, it is passed around to the team members manually, file-per-file, and only when requested. The Gantt Chart is then only used as a reference for the series of activities to be accomplished before the target deadline. There are also times wherein the responsible department only begins to create a Gantt chart when requested by top management.

In reality, the team members do not regularly communicate with other members and departments involved in the project after being assigned tasks. Each member and department fulfill their tasks as if they were working on the project alone, without seeing the need to consult those responsible for the prerequisite

tasks and to inform those responsible for the post-requisite tasks. The consulting and informing actions only get triggered when there is an evident delay in the project that may affect the timeline and the target deadline. If the delay in tasks cannot be recovered by compromising activities and sacrificing the quality of the output, the target deadline will be adjusted to meet the time needs of the delayed activity/activities. The process ends when the project is launched, ensuring that all project tasks have been successfully accomplished.

Ideally, the performance of all projects is measured using specific Key Performance Indicators (KPI) identified by each department. Measuring KPI is only done occasionally, depending on the amount of documentation the project presents. The departments which have identified their KPI's and the computation for it only calculate for individual performance. Knowingly, these KPI's may also be adapted to the project as a whole, although TEI does not have a strict way of measuring project KPI since they do not have adequate project data and documentation to support their performance *(Refer to Appendix H for BPMN of Existing General Project Management Process)*.

Store Opening

The goal of TEI is to establish a market presence, and by doing so, they will need to open new stores around the Philippines. Once TEI achieves its capability to expand and open a new branch, either a kiosk or an in line store. They vary on the products to be sold, target market, store space, equipment, and other requirements.

A store opening usually lasts from sixty (60) to ninety (90) days, the Franchise Development Head under the Marketing Department, starts preparing the project income statement and the capital investment, next they receive a lease offer from a mall and review the lease offer and its feasibility. They then send a counter offer to the mall and wait for the revised offer to review it again. Once TEI is satisfied with the offer, they proceed to signing the agreed lease offer and start looking for a possible franchisee. If there is any franchisee who is interested, that franchisee should send a letter of intent to the Marketing Department, who will then undergo an interview and evaluation. If the franchisee passes the evaluation, TEI issues and signs a franchise agreement, and provides a franchise certification. The franchisee should pay for the franchise reservation fee to be received by the Finance Department. In the event, however, that there is no possible franchisee or the candidate failed the evaluation, the new store to be opened will be company-owned stores. As soon as everything has been settled with the franchisee, a kick off meeting will be conducted to discuss and formally

start the logistic processes that need to be done. The processes in the Marketing Department has no KPIs to measure their performance. Subsequently, the Procurement Department procures for the initial assets, and the Facilities Administration finalizes the quotation for the logistics, and the Finance Department plans the training calendar for bookkeepers.

The next seven steps in the process will be handled by three different departments, and is a definite prerequisite of one another, the Marketing Department will gather all corporate registration requirements, such as the Securities and Exchange Commission (SEC) registration and the Department of Trade and Industry (DTI) registration. After gathering all requirements, they will initiate the registration process, the waiting time for these processes varies depending on the government sector, and no definite time is given. Next, the Finance Department will register stocks and transfer books for the new store and hand it over to the Marketing Department to acquire necessary permits, such as, Mayor's Permit and Business Permit; the requirements for the different permits may vary depending on the type and location of the store. In some provinces, particularly, Cagayan de Oro, they require a certificate of planning for network infrastructure to be signed by an engineer. Factors, such as, local government requirements, or mall requirements can affect the resources a new store needs, for instance, one store requires a Point of Sale (POS) system even for kiosks type of store, and others do not. Once all permits are obtained, the Finance Department will acquire the certificate of registration and the Human Resource (HR) Department will collect and forward all permits and requirements to the mall. After that, the Finance Department will open a depository or checking bank account for the new store.

The last seven (7) steps, jump from one department to another and it is very crucial for updates to happen, however, currently in TEI, there is no actual way of knowing whether a process is done, unless you ask the person in-charge. When everything is settled with the Finance Department, the HR Department will take over to initiate employee recruitment and conduct a two (2) week training for the newly hired employees. At present, the HR Department does not have their own set of KPIs. The Marketing Department will subsequently initiate the pre-construction activities and proceed to the actual construction, and the Procurement Department will receive all equipment and utensils, it will come back again to the Marketing Department for them to monitor utensils and install equipment. Afterwards, it will proceed to the MIS Department to monitor peripherals installation, and the Store Operations Department will receive the initial inventory. The MIS Department is the only department involved in the

store opening that has their own KPIs that they implement to assess their performance. Next, general cleaning, and final mall inspection will be done by the Marketing Department, as soon as the inspection is done, the store will be turned over to the Store Operations Department. After the turn over, the Store Operations Department will conduct a staff meeting, final preparations, and a dry-run of the operations. The last process is releasing of actual figures of Capital Expenditure *(Refer to Appendix K for Capital Expenditure)* done by the Finance Department, and then the store will finally open *(Refer to Appendix H for BPMN of Store Opening Project Process)*.

New Product Launch

In the previous year, the Marketing Department launched at least one (1) new product. This is done yearly at a quarterly basis, this serves as the trigger event for the new product launch process, as well as the promotion launch. The Marketing Department starts to conceptualize the new product through a brainstorming meeting. Once the product has been conceptualized, tasks are then distributed throughout the department. The Marketing Department conducts research on the new product and the market trends. After conducting research, the Research and Development sector of the Marketing Department starts developing the product prototype. Once the prototype is done, they would then seek approval from the Board of Directors. If the Board rejects the prototype, the Marketing Department revises the prototype and once again seeks the approval of the Board of Directors. However, if the prototype is approved, the Marketing Department proceeds to market testing where they have actual customers test the new product. If the market testing fails, the Marketing Department goes back to revising the product and seeking approval from the Board of Directors. If the market testing passes, the Marketing Department informs concerned departments about the new product. They then proceed to designing the promotional material and forwarding the material design to their suppliers. While this is happening, the Procurement Department orders the required ingredients and the MIS Department updates the Point of Sales (POS) System by adding the required button for the new product. Once the Marketing Department receives the promotions material and ingredients from their suppliers and distribute them to the stores. Simultaneously, the Human Resource Department prepares materials and conducts an online training through Google Classroom to teach the store staff the procedures on preparing the new product. Store staff are then evaluated in the same platform. The process ends as the new product is made available to the public.

Product launching KPIs are measured through the accuracy of the project, meaning that it had no errors and it measures timeliness if the project was delivered on time. As for completeness, it checks if all requirements were satisfied during the product launching *(Refer to Appendix H for BPMN of Existing New Product Launch Project Process).*

Promotion Launch

The promotion launch process is somewhat similar to that of the product launch. As mentioned above, the trigger event for promotions launch is the quarterly marketing project timeline. The Marketing Department meets to conceptualize the promotion and its mechanics. After which, tasks are assigned and distributed within the department. Before the promotion is green lit, it must first seek approval from the Board of Directors, if denied, the Marketing Department then revises the promotion and the mechanics and once again seeks the approval of the Board of Directors. However, if the Board of Directors approve the promotion, the Marketing Department informs the concerned departments about the upcoming promotion. After informing concerned departments, the Marketing Department starts designing the promotion materials. Once the materials are designed, they then forward the design to their suppliers for production. After the suppliers hand over the promotion materials, the Marketing Department distributes the materials to the stores. While the designing of promotion materials is happening, the MIS Department starts updating the POS System, by adding the button of the new promotion. Once the materials are distributed, the process ends as the promotion has been launched. Similar to product launch, KPIs are measured through the errors for accuracy, completeness of the requirements and the delivery of promotions *(Refer to Appendix H for BPMN of Existing Promotion Launch Project Process).*

System Development

The system development processes start with either a request for upgrades, modifications or a whole new system from other departments within TEI or the MIS Department, TEI's in-house IT department, initiates a new system to be developed, or to make modifications to existing systems. After receiving the request, the MIS Department collects detailed information about the system to be modified or to be created. After data collection, the MIS Department calls for a meeting with the development team to discuss the system requirements. The project charter and project design are then produced. Once the project charter and project design has been created, the program is developed. The MIS Department

conducts two (2) kinds of testing for the newly developed system. The first kind of testing is the internal testing, wherein testers would be within the department and the second kind of testing is the external training, where they would get users from other departments and the actual user/s to test the system. If the testing fails, the MIS Department identifies the necessary adjustments. MIS Department then performs these adjustments to the system and conducts internal and external testing again. If the testing passes, the user manual is then produced by the MIS Department. Mass training is then done to train users of how to use the new system or the new modifications. After the training is conducted, the project charter is then updated, and the project is closed. The closing of the project produces a final report made by the MIS Department and a report to the requesting entity. Once the project is closed, the MIS Department activates the project and the system development process ends as the updated or new system is deployed. System development KPIs are measured through the evaluation survey after the user acceptance testing (UAT) and feedback, which measure accuracy of the system. As for timeliness, it is measured if they met the target deadline *(Refer to Appendix H for BPMN of Existing System Development Project Process).*

Employee Onboarding

The employee onboarding process begins when the new hire is accepted. The process is guided by a checklist which is kept by the Human Resource (HR) Department *(Refer to Appendix K for Onboarding Checklist).* The HR Department releases the onboarding kit to the new hire for completion *(Refer to Appendix K for Pre-Employment Requirements Checklist).* After receiving the accomplished onboarding kit, the HR Department informs all departments and stores that there is a new hire through Email, so as to make sure stores are aware who to communicate with in future projects. The MIS Department provides the new hire with work tools such as laptops, as well as their user account and corporate email address *(Refer to Appendix K for Onboarding Checklist(MIS)).* The MIS Department then captures the new hire's biometrics. Simultaneously, the Admin Department assigns the new hire with their personal locker *(Refer to Appendix K for Onboarding Checklist(Admin))* and the Finance Department handles the petty cash and encodes the new hire's name into the SAP system *(Refer to Appendix K for Onboarding Checklist(Finance)).* Once the new hire has their work tools, accounts, and locker, the HR Department conducts the orientation as well as the office tour. The HR Department introduces the new hire to their assigned department and closes off the process with the contract signing. Once the employee contract is signed, the process ends as the new hire is onboarded. As for KPIs, HR currently has no KPI that they keep track of with regards to

onboarding *(Refer to Appendix H for BPMN of Existing Onboarding Project Process)*.

Employee Offboarding

As for offboarding, the process starts with a request from the employee's immediate supervisor. The HR Department informs all departments and stores that the employee is resigning through email so stores are aware that their previous contacts are no longer part of the organization and to avoid the ongoing flow of information to the resignee. The HR Department provides the resignee with an acceptance letter stating that they accept the employees letter of resignation. After releasing the acceptance letter, the HR Department then schedules and conducts an exit interview with the resignee. The HR Department then evaluates the resignee's clearance for the back pay they would be receiving, to be computed by the Compensation and Benefits sector under HR. The MIS Department revokes the resignee's user account and corporate email and collects their work tools. After MIS Department receives the work tools, the HR Department then files the employee record to the company archives and the process ends as the employee has officially resigned. Similar to onboarding, HR does not have any KPIs for offboarding *(Refer to Appendix H for BPMN of Existing Offboarding Project Process)*.

4.3 Problem Areas

Almost all movement and operation of Taters Enterprises, Inc. are project-based. Their current tools in executing a project are Microsoft Excel, Microsoft Word, Email, and SMS Messaging. These tools are not enough to properly execute a project with the least amount of delays and issues. TEI constantly experiences project delays which are caused by a number of factors that vary from their current method and machine used in implementing a project. Project delays vary from project to project. With store opening as their largest project, it also has the most frequent occurrence of delays at 100%, hence all store opening projects experience delays which range from two (2) weeks to two (2) months. An estimate of 5% to 35% of departmental projects also experience delays which range from days to weeks, or months in special cases. Departmental projects that are considered to be executed on time are said to be highly compromised in terms of quality and completeness. One of the main concerns is that they do not properly document the whole process. To be more specific, they only document the entire plan of the project at the beginning and do not consistently add the changes done and to be done during the project life. To make matters worse, they

do not document all of their projects, which juggles their documentation from being inadequate or absent. With this setup, the project team members and their respective departments are not actively involved and informed throughout the whole project which then causes a number of misunderstandings and miscommunications which in return also causes bigger problems. Each aspect of the main problem may be further detailed as follows *(Refer to Appendix H for the Ishikawa Diagram):*

Method

As aforementioned, TEI handles multiple projects and it has been an evident problem for the company to handle multiple projects simultaneously. The effects of this can be seen in the efficiency in the process of handling projects, the number of projects executed without compromises, and the quality of project outcomes. With multiple projects needing to be handled all at the same time, TEI has had trouble prioritizing which projects to do first and which employees should handle certain projects. There have been times where projects have been put on hold due to the amount of work needed in one project, and in worst cases, have not been executed all throughout. They have no systematic way of keeping track of which tasks of a project are being done and by who because they do not have a big picture view of all the projects currently in progress. Specifically, HR projects with regards to health and wellness are often parked or entirely not executed due to the multiple projects simultaneously being done. The planning and preparation is not aligned with current projects, and a window period is not determined in order to insert a specific HR project in between, thus putting the project on hold until further notice.

TEI does not currently have a systematized process for assessing the potential project team member's capability and workload in other ongoing and upcoming projects, thus having inequitable workload distribution. The process for choosing team members to be involved in a new project is blindly done by the project department heads according to an employee's position in their respective departments *(Refer to Appendix K for Employee Roster)*. Choosing the right manpower is important in any project since they are the ones who materialize the project plans. The effect of having unqualified and incapable manpower in a project causes delays in which these individuals are preoccupied with other things they deem more important than the project at hand and eventually cannot commit to the responsibilities assigned to them. Spotting incapable manpower in a project also causes forced transferals of team members which simply brings the project back to the planning phase. The MIS department started out with three (3)

simultaneously ongoing projects, each done by one person; the new manager found this practice inefficient and then redirected the focus of all three individuals to accomplish one project at a time, which then paved the way to accomplish more projects in a shorter time period. With proper allocation of manpower, project delays will relatively decrease.

Another problem that TEI is encountering is the lack of project transparency due to the absence of a platform for viewing of certain documents, tasks, and the current project status. This goes hand in hand with the lack of updates from concerned team members as they have no specific protocol for updating. As certain processes have prerequisite tasks that need to be done and a delay has occurred, the succeeding tasks and the people involved are not informed or updated in time to realign their schedules. It has also become a norm that the post-requisites often ask for follow-up updates from their prerequisites because of the lack of regular updating procedures, which then leads to miscommunication. In addition, it has been estimated that only a number of projects, estimated at around 5%, are documented and plotted on a Gantt Chart *(Refer to Appendix K for TEI Gantt Chart),* but instead some use pre-defined checklists in aiding the project team with project tasks to be accomplished. The onboarding project of HR is highly affected by this problem. Without proper communication and activity update exchanges, the project will not execute as planned. There are instances where the new hiree is officially onboarded to the organization, without being properly exposed to all departments, thus deeming the project compromised and will be the cause for future misunderstandings regarding the business process.

One of the critical causes of delays is the lack of monitoring and controlling. This is caused by a combination of transparency issues and inadequate documentation. Projects are not properly monitored due to the fact that they have inadequate documentation to serve as a basis for project progress. It was roughly estimated that only 5% of overall projects have initial documentation, in a form of a Gantt chart or a checklist, and 100% of that are not being updated regularly during the whole duration of the project. In other cases, absolutely no documentation is done, and projects and target deadlines are only done via informal communication. Inadequate documentation sets grounds for a difficulty in monitoring and controlling projects because of the lack of information to guide the project owners in the progress and execution of the project as a whole. Consequently, inadequate documentation also provides no basis and data to accurately evaluate KPIs. Each department has a different method for assessing KPI, but they do have similar indicators *(Refer to Appendix K for Balanced Scorecard (MIS)).* TEI currently assesses performance only by

request of top management or of department heads. KPI evaluation is currently done based on memory and experience from the project team, which makes it an unreliable source as bias and memory conflict may frequently occur. Improper assessment of projects and project delays, may lead to even more delays. In specific, as an initiative of a team member to reduce the delay of a store opening project, he/she made it a point to acquire a POS System immediately, because this is what he/she thought was causing the delay. In reality, this initiative was useless because you will still need to secure a POS permit *(Refer to Appendix K for POS Permit)* afterwards, thus causing a waste in effort while the piece of equipment just sat in the office the whole time being.

TEI also experiences document mismanagement wherein documents are not received or acknowledged properly, and documents needed in the future are not properly stored, which results to miscommunication over the project and matters involved. A specific example of this scenario would be the storage and acknowledgement of capital expenditure, a document used for a store opening project that contains the list of equipment needed which every department is required to submit. With multiple store opening projects in progress, there have been instances where capital expenditures have been mixed up to different stores and were not double checked in time for the grand opening. The mix-up led to incomplete requirements and thus moving the grand opening to a later date once all pieces of equipment have been cross-checked with the capital expenditure. Aside from that, top management notes and comments are not stored properly in association to a project because the project team does not have a central and unified repository of project documents and files that are organized per project.

Machine

Microsoft Excel is the main tool that aids TEI in managing all their projects. In the few projects that are actually documented in the planning phase, the excel file containing the schedule and Gantt Chart is manually passed around to the project team file per file, which also causes inconvenience and version problems as there is no way to ensure that everyone in the team is viewing and basing from the exact same file. This causes the limitation of project viewers being informed.

In relation, Microsoft Excel is not capable of handling project updates systematically whilst also informing all team members of the said update or change. If a team member were to update or place his/her notes in the excel file, it will not reflect with other team members, thus again causing a lack of project transparency. Since most of the processes involved in a project are a prerequisite

of another process, it is important that the documentation is up-to-date, if not, the next process will lead to being delayed unknowingly, and the domino effect will lead to the overall delay of the project execution.

5.0 The Proposed System

This chapter explains the details of the proposed system, including the proposed process, the system objectives, the scope, and the feasibility study of the system.

5.1 System Description

The proposed Project Management System will be able to handle all projects that TEI will implement. It will serve as a unified platform for the whole organization to monitor and control the projects they launch. Through the system, users can create projects by following a series of steps to add the certain details for the project. The system is also capable of monitoring ongoing projects through the use of a generated gantt chart and additional modules such as the Monitor Team and Monitor Project that will aid project owners and department heads to keep track of people assigned to them and the certain tasks that they are supposed to be doing. Changes can only be made through the system by submitting a request either to the immediate supervisor or the project owner. With this approval function of the system, it can save all requests made and it allows TEI to be fully transparent with the people involved in a project. There will be four (4) types of users, namely the Executives, Department Heads, Supervisors and Staff *(Refer to Appendix T for Business Rules)*.

Through the system, users with user types Executives, Department Heads, or Supervisors can create, monitor, and control projects *(Refer to Appendix T for Business Rules)*. These projects can be classified into seven (7) types - store opening, product launch, marketing promotion, system development, onboarding, offboarding, and miscellaneous. The system can accommodate new projects without a specific type to be tagged as miscellaneous. Once a project has been initiated, a kickoff meeting will be done with all the departments involved in the project. Next, the project owner will login to the system and create a new project, he will input all the necessary details such as, name, description, and target start and end date. He will then identify all main activities, sub activities, and tasks and assign them to a department *(Refer to Appendix T for Business Rules)*. The system will process all inputs and generate a gantt chart at the end of project creation process. All departments that were tagged during project creation will be notified through the system and tagged department heads will then identify and assign the responsible, accountable, consulted, and informed for each task. To aid in identifying who can be responsible for a task, a workload assessment that shows the current projects and tasks their team handles can be viewed by the delegator.

After delegating the task, the system will notify the assigned team member that they have been tagged as responsible for a certain task. In order to perform the task, the system will first have to check if the task has any pre-requisite tasks, if there are any, the system will also need to check the status of the task. If the pre-requisite task is completed, it notifies the post-requisite actor. However, if the pre-requisite task is delayed, it constantly notifies the task owner, and also the post-requisite actor that the task pre-requisite to their task is delayed. In addition, it also notifies the immediate executive if the delay has prolonged for a week or five (5) working days. If the delay persists, the president will be notified by the system. After an actor performs their task, the system will check if it is the last task of the project, if not, it goes back to notifying the next task actor. However, if it is the last task of the project, it notifies all people involved that the project has been completed. A project summary report is generated by the system and will also be available for the project owner *(Refer to Appendix N for BPMN of Proposed Project Management Process).*

5.2 System Objectives

The end product of the proposed information system is expected to accomplish certain standards/requirements which will be enumerated in this section. The objectives are inclined to the project's general objective, which is to develop a Project Management System to aid in monitoring and controlling projects.

5.2.1 General Objective

The information system aims to serve as the main tool for monitoring and updating projects in the project management process of the company.

5.2.2 Specific Objectives

The general objective can be broken down into three (3) specific objectives, which are:
- To provide project owners with an overview of the project/s he or she is spearheading to monitor the project team, pinpoint project delays, and to review project changes;
- To notify involved team members regarding project updates and follow-ups to increase interdepartmental transparency by 70%; and
- To store projects, planned, ongoing, and completed projects, to provide an easy-access repository for project documentation.

5.3 System Scope

The proposed project management system is composed of four (4) modules namely, Project Initiation and Planning, Project Monitoring, Project Control, and Project Closing. These four (4) modules follow one whole cycle of a project as it was designed to mirror that of the project management life cycle. Each module will be further discussed in detail later on in this section (*Refer to Appendix O for the Functional Decomposition Diagram*).

Project Initiation and Planning

This module houses the project creation process of the system. The project creation process consists of five (5) steps, Input Project Details, Add Main Activities, Add Sub Activities, Add Tasks, and Identify Dependencies. The project owner is in charge of inputting these details into the system. As the project owner adds the certain activities and tasks, they also schedule when these activities or tasks would be done by inputting the target start date and target end date. These dates will be used for measuring the actual project progress in the next module. As a prerogative from TEI, weekends would be included in the selection of dates as their are instances wherein projects that are rushed or constructions done during weekends to reach the deadline of a certain project. The details within the project creation composes the Project Profile function of this module. Everything done in this module applies to the pre-launching of a project. It is where department heads can delegate certain tasks to their staff while taking into account how much workload they already have. Executives, department heads, supervisors are the only ones allowed to delegate a task which is also restricted to those that they manage. Department heads are restricted to the employees within their department, while supervisors are restricted to the team they handle. Assigning of executives as responsible in the RACI chart are not allowed *(Refer to Appendix T for Business Rules)*.

As task delegation is done, the RACI chart is filled in, otherwise, the RACI chart integrated in the Gantt chart will remain empty. This is all captured in the project gantt chart that would be generated once a project is created and can be visited again in any point in time to see its progress. Projects that are successfully completed with good metrics can also be replicated in an effort to maintain the standard of excellence through the template function in this module.

This also gives the organization a chance to provide the same quality of products and services to maintain their industry-leading standards.

Project Monitoring

This module focuses on the monitoring of projects for project owners and the monitoring of members within a project, or a certain department. Department heads can keep track of their staff members and the tasks they are doing, as well as whoever are accountable, consulted, and informed in their respective tasks. Project progress can be accessed through the project gantt chart. Completed projects are also included until they are automatically or manually archived for the project owner/heads/supervisors to review the tasks and the project as a whole. Included in this module would be the performance metrics of employees, departments, and project teams in terms of completeness and timeliness *(Refer to Appendix T for Business Rules)*. These metrics are also viewable for department heads and supervisors to monitor their team's overall and individual performance for all projects of that given year as these metrics will reset at the end of each fiscal year which, for TEI's case is every December. Departments will also be able to view their team gantt charts that composes of all their tasks for a certain project as to pace themselves if they have other projects to be executed.

The monitoring is not limited to department heads and project owners as staff members can also monitor their own tasks and in turn can decide which tasks to prioritize as they would be given an overview of their pending tasks and which of these would be delayed and their succeeding post-requisites. Tasks that are due two (2) days before the due date to alert the employee responsible of the task of their assignments. A task that is dependent on a delayed task will not automatically adjust once its delayed pre-requisite task is completed in order to pinpoint where delays may build up and occur *(Refer to Appendix T for Business Rules)*. The post-requisite task performer may then file a change request if the time allotted is not enough. This module will also be able to track the movement within projects through the project logs and project documents. Users who are apart of the project may view these logs and all documents uploaded to promote transparency within the organization to avoid miscommunications between departments.

Monitoring will also be aided by the use of system notifications for the movements within the system. Users will be notified if their pre-requisite tasks have been marked complete or if their tasks are delayed. These notifications will

be system wide to ensure that each member of the project team is informed with what happens within a project.

Project Control

This module will mostly deal with requests and the performance of the project team, departments, and individual employees. For the requests, it handles the change in dates or change in performers for certain tasks that employees will request for supervisory approval coming from either their immediate supervisor, department head, or project owner. Change performer requests that are approved are prompted to reassign the RACI chart, wherein the consulted and informed will retain, and the responsible may be reassigned to another employee excluding the requester. As for the accountable, employees can be added or removed for this assignment *(Refer to Appendix T for Business Rules)*. In special and/or emergency cases, a task performer reassignment is allowed which is limited to the department heads and supervisors only.

This module focuses on controlling the things monitored in the previous module, more specifically, the assessment of the project team, departments, or employee's performance. This allows room for improvements that will be beneficial for the organization in their future projects. Performance assessment is highlighted by the metrics of completeness and timeliness of a project team, department, or employee. These metrics are seen in the project gantt, or in a department head and supervisor's monitoring function. Through these assessments, project owners, department heads and supervisors can gauge how well their department is doing and which people are right for the job for the right projects.

Project Closing

The system captures this module through the archiving of projects for reference to enhance their processes and projects. These are supplemented by the reports that are to be generated at the end of a project, mainly the project summary that contains an overview of a project team's performance metrics, all project members, all tasks that were delayed, requests and documents passed. This report captures all important details that the organization would need to better improve their future projects. Included in this module would be the ability to import a .xlsx or .xls file as to archive certain projects into the system based on previous data. This gets the file and plugs it into the database in their respective fields. The

import feature will also encompass that of templates as to avoid doing the whole project creation process even if they already have spreadsheets with the same data. This enables users to upload or import projects that are planned, ongoing or complete into the system. This makes data migration easier.

Modules that would not be included within the system would be that of resource management and budget management. As their project resources are mostly manpower based on how many people they will dispense to do certain tasks. As an organization within the food and beverage industry, this system will be used in the backend of the company as it will be used by the head office. As for budget management, it was not a problem for the organization as their main problem is that of the lack of monitoring of projects which causes the delay of process execution.

5.4 System Feasibility

The initiative for this project was requested by the top management of the organization to the MIS department last year. This then molded the MIS department's objective for 2018 which is to "*Make I.T. Happen*". Wherein I.T. abbreviates to Information Technology. To put it plainly, top management wants TEI to capitalize on the various technologies available at hand to gain competitive advantage in a very competitive industry. Since then, TEI has made it a point that they would be on top of system upgrades, and the use of technological tools that better enhance work and workflow within the organization. At the start of the year, MIS had planned to develop and deploy three (3) information systems, specifically, a task management system, a management information system, and a project management system. Once all three (3) systems are up and running, the MIS department would integrate all three (3) into one portal to create a business intelligence system. The developers had also conducted numerous interviews with staff level employees as well as a survey to gauge how willing they are to adapt to the proposed system in spite of the mandate from top management.

Operational

As mentioned before, the initiative for this system came from top management as they want to seek a better way to monitor projects that the company are currently working on, to be able to check on project progress and receive updates on these projects. Aside from this being mandated by top management, staff level employees were also interviewed for a better comprehension of the operational

feasibility. The developers received a lot of positive feedback with regards to the proposed system as it would help them monitor projects and allow transparency in between departments and the project team. It was emphasized during these interviews that the system would require employees to input within the system which could add to their workload and they feedback was still positive. They were willing to add a few more minutes to their day to do the right thing rather than having to go into a project blind as there is little to no communication between departments and project owners (*Refer to Appendix I for Interview Transcripts*). The developers had also conducted a survey as supplementary evidence of the employee's willingness to adapt to the new system, unfortunately, due to the employee's busy schedules, there were only a total of nine (9) respondents; correspondents were not previously interviewed staff members. Out of the nine (9) respondents, three (3) were from the Store Operations department, two (2) from the Marketing department, two (2) from the Facilities Administration department, and two (2) from the Human Resource department. The aforementioned respondents were coming from departments that have an abundant number of projects. Six (6) respondents answered that they would likely use the proposed project management system while the remaining three (3) respondents were neutral regarding the matter (*Refer to Appendix P for Survey Results)*.

Despite the poor turnout of the conducted survey, the developers had received valuable feedback from the interviews and the willingness to cooperate between the MIS department as they provide the developers with the necessary requirements to develop and launch the proposed system.

Technical

Due to the support from top management, TEI has already acquired the necessary IT infrastructure such as server units in the previous year as being proactive to the initiatives expected to occur this year and to keep up with the technological trends in today's society. These server units are currently being tested and utilized to host a sample website that is currently accessible to the public. Another server unit is dedicated to host their internal systems such as the proposed project management system. Due to the nature of the proposed system being web based, there are no hardware requirements for the users to be able to access the system. The only requirement is the capability of their devices to be connected to the Internet, whether it be wired or not, and any web browser on its latest version. For this requirement, the TEI head office has equipped all of their employees with

desktop PCs and laptops and each device has an updated web browser. All devices have the capability to connect to the Internet. As for employees who have to go on field duty, they are equipped with tablets or laptops that have access to mobile data which allows them to access the system from anywhere they are.

Economic

Intangible costs for this project are the time taken for the software to be developed as this requires hours of interviews for data and requirement gathering. A proper understanding is needed for the developers to properly address the problem. This is time taken to what they could have just used for their work which could eventually disrupt business operations. Another could employee morale as a change in system is not something everyone accepts the same way, this could affect the performance and attitude of the employees towards their work. Given all this, intangible benefits could also be time saved for when the system have already been implemented as this will save operational time for projects. The system will also provide accountability and transparency among the departments and their corresponding employees. The system will also provide improvement on the timeliness of tasks and projects and can minimize delays and eventually remove them. Lastly, this will provide TEI the business development it requires as the employees are equipped with a tool to make their work easier

Schedule

Stated in the Gantt chart prepared by the developers (*Refer to Appendix E for the Gantt Chart*) that the development process will take a year for it to be finished. This is more than ample time to finish the development of the system as well as to conduct testing for the system. This schedule also fits in with the organization's timeline as they have marked the end of this year as the target completion date for the proposed systems mentioned above. The developers have also been able to meet their specified deadlines set on their gantt chart.

6.0 Design

This chapter discusses the design elements of the information system, both inside as to the database design and framework used, and outside as to the user interface and user experience.

6.1 Design Strategies

The system development side of Kernel uses the Model-View-Controller (MVC) framework, specifically CodeIgniter, for the logic and back-end manipulation, and the Bootstrap framework for the front-end and user interface design. The MVC framework has three (3) main parts that work together as a whole. The model is responsible for data manipulation, the view is the main source of the user interface as it displays the information retrieved from the model, and the controller handles user input (Foote, n.d.).

The developers took a minimalistic approach when it came to the design of the system. The main color scheme ensures that it suits TEI's theme colors - red, white, and black. During the designing stage of the system, the developers consulted hand in hand with TEI to seek both their approval and suggestion for the design cues, such as colors, icons, and general layout. The system is designed in such a way that it follows the stoplight colors to represent statuses of projects and tasks. Specifically, green represents ongoing, amber represents planning, and red represents delay. All throughout the system, the preferred way to display information is through tables, in which when clicked displays more details about the information clicked. This enables the user to view all immediate details about a project or a task and also has the option to view more details if he clicks on the specific data row. The current date can also be found on the sidebar, due to the fact that it will not be blocked other elements such as modals, to aid the user during tasks that require date inputs. This could serve as a quick point of reference when making decisions on dates. To serve as a symbol of urgency, the entire row of a delayed task is highlighted in red in the dashboard in order to catch the user's attention.

All of the buttons, both action and navigational, are represented by standard icons, foregoing the common practice of putting words right beside the icon or simply just text. This is done to maintain the minimalistic approach for designing the system. To compensate the absence of button labels, the developers added tooltips for each button when hovered over. The tooltips provide additional information in circumstances wherein the user does not immediately understand the purpose/action of the button. Moreover, navigational buttons or buttons that

redirects the user to a new page are colored blue to differentiate them from the buttons that performs action, which are colored green. Additionally, all text found in the system are in Title case or maintains capitalization on the first letter of every word except articles and conjunctions

As the designing of the system occurred alongside with Taters themselves, the developers made sure that the system flow would not deviate much from their existing workflow.

6.2 Data Specifications

This section discusses the database design of the information systems, from the relationship to the columns of each database table. Each database table is detailed by specifying the field name, description, data type, default value, and accepted value.

6.2.1 Entity-Relationship Diagram

The entity-relationship diagram *(Refer to Appendix Q for Entity-Relationship Diagram)* mainly portrays the movement of the main users/actors to kickstart a project. The blue rectangles represent the actors, the yellow diamonds represent the action being done, the black lines connecting each element represents the relationship, and the type of the relationship is determined by the indicator next to the blue rectangle, whether it is "1" for one entity or "M" for many.

The entities involved are the main users and actors of the system, namely, the project owner, department heads, supervisors, and staff. Each user/actor is also related to each other wherein a department head manages a group of both supervisors and staff, a supervisor manages a group of staff assigned under him, and a project owner may either be a department head or a supervisor. The project owner, although may be either of the two pre-existing actors, is its own element since it has special capabilities and functions that are specific to a project owner, as compared to that of a department head or a supervisor.

The actions are focused on the creation of the project wherein the entirety of the monitoring and controlling would depend. The process begins when a project owner creates a project, a project consisting of tasks, specifically the main activities, sub activities, and tasks. The project

owner then assigns a department to each activity or task. By selecting a department, the system forwards it to a department head, which explains the relationship as portrayed. The department head now has the freedom to further delegate the task given to him/her by a department head to a staff that he/she supervises, or to accept the task and perform it himself/herself. The staff member simply has the ability to accept and perform a task, along with the department heads and supervisors.

6.2.2 Tables/Files Layout

The database being utilized for the information systems consists if fourteen (14) tables, each of which are detailed as follows:

Change Requests

Field Name	Description	Type (Length)	Default Value	Accepted Values
Request Details	Details of the request being made	TEXT	Not Null	Any string value
Request Status	Statuses vary from Pending, Approved, or Denied	VARCHAR(45)	Not Null	Any string value
Remarks	Special remarks or concerns to be addressed	TEXT	Null	Any string value
New End Date	New date for task	VARCHAR(20)	Null	Any string value
Date of Request	Date when request was made	VARCHAR(20)	Not Null	Any string value
Date of Approval	Date when request was approved	VARCHAR(20)	Null	Any string value
Request Type	Type of request that was made	INT	Null	1 or 2

Department Assessment

Field Name	Description	Type (Length)	Default Value	Accepted Values
Completeness	Completeness rate	DOUBLE	Null	Any non-zero decimal value
Timeliness	Timeliness rate	DOUBLE	Null	Any non-zero decimal value

Documents

Field Name	Description	Type (Length)	Default Value	Accepted Values
Document Link	URL of the uploaded document	VARCHAR (2048)	Not Null	Any string value
Document Name	Name of the document	VARCHAR(45)	Not Null	Any string value
Document Status	Statuses vary from Published, Pending, Acknowledge	VARCHAR(45)	Not Null	Any string value
Uploaded By	Uploader of the document	INT (11)	Not Null	Any non-zero integer

Document Acknowledgement

Field Name	Description	Type (Length)	Default Value	Accepted Values
Acknowledged By	Uploader of the document	INT (11)	Not Null	Any non-zero integer
Acknowledged Date	Date of acknowledgement	VARCHAR(20)	Not Null	Any string value

Employee Assessment

Field Name	Description	Type (Length)	Default Value	Accepted Values
Completeness	Completeness rate	DOUBLE	Null	Any non-zero decimal value
Timeliness	Timeliness rate	DOUBLE	Null	Any non-zero decimal value

Logs

Field Name	Description	Type (Length)	Default Value	Accepted Values
Timestamp	Date and time a log was made	VARCHAR (1000)	Not Null	Date and Time format
Log Details	Details of the log	DATETIME	Not Null	Any string value

Notifications

Field Name	Description	Type (Length)	Default Value	Accepted Values
Details	Details of the notification	TEXT	Not Null	Any string value
Status	Statuses vary from Pending, and Read	VARCHAR(45)	Not Null	Any string value
Notification Date	Date when the notification should be sent	VARCHAR(20)	Not Null	Any string value
Type	Types vary from Docu, Pre-req, Post-req, RFC	INT	Not Null	Any non-zero value

Projects

Field Name	Description	Type (Length)	Default Value	Accepted Values
Project Title	Title of the project	VARCHAR (100)	Not Null	Any string value
Project Start Date	Start date of project	VARCHAR(20)	Not Null	Any string value
Project End Date	Target end date of project	VARCHAR(20)	Not Null	Any string value
Project Description	Description of the project	TEXT	Not Null	Any string value
Project Status	Statuses vary from Planning, Ongoing, Delayed, and Archived	VARCHAR(45)	Not Null	Any string value
Project Actual End Date	Date when the project actually closes	VARCHAR(20)	Null	Any string value
Project Adjusted End Date	Adjusted end date based on the delays	VARCHAR(20)	Null	Any string value
Date Created	Date the project was created	VARCHAR(20)	Not Null	Any string value
Project Actual Start Date	Actual start date of project	VARCHAR(20)	Not Null	Any string value
Project Actual End Date	Actual end date of project	VARCHAR(20)	Not Null	Any string value

Project Assessment

Field Name	Description	Type (Length)	Default Value	Accepted Values
Completeness	Completeness rate	DOUBLE	Null	Any non-zero decimal value
Timeliness	Timeliness rate	DOUBLE	Null	Any non-zero decimal value

RACI

Field Name	Description	Type (Length)	Default Value	Accepted Values
User	User	INT	Not Null	Any non-zero decimal value
Role	Role	INT	Not Null	Number 0 to 5
Status	Status of the role, can either be changed or current	VARCHAR(45)	Not Null	Any string value

Tasks

Field Name	Description	Type (Length)	Default Value	Accepted Values
Task Title	Title of the task	VARCHAR(45)	Not Null	Any string value
Task Start Date	Start date of task	VARCHAR(20)	Not Null	Any string value
Task End Date	Target end date of project	VARCHAR(20)	Not Null	Any string value
Task Status	Statuses vary from Pending, Completed, Delayed	VARCHAR(45)	Not Null	Any string value
Task Remarks	Special remarks or concerns to be addressed	VARCHAR(45)	Null	Any string value
Task Actual Start Date	Actual start date of task	VARCHAR(20)	Not Null	Any string value
Task Actual End Date	Actual end date of task	VARCHAR(20)	Not Null	Any string value
Task Adjusted End Date	Adjusted end date based on the delays	VARCHAR(20)	Not Null	Any string value

Templates

Field Name	Description	Type (Length)	Default Value	Accepted Values
Project Title	Title of the project	VARCHAR (100)	Not Null	Any string value
Project Start Date	Start date of project	VARCHAR(20)	Not Null	Any string value
Project End Date	Target end date of project	VARCHAR(20)	Not Null	Any string value
Project Description	Description of the project	TEXT	Not Null	Any string value
Project Status	Statuses vary from Planning, Ongoing, Delayed, and Archived	VARCHAR(45)	Not Null	Any string value

Users

Field Name	Description	Type (Length)	Default Value	Accepted Values
First Name	Given name of the employee	VARCHAR (100)	Not Null	Any string value
Last Name	Surname of the employee	VARCHAR (100)	Not Null	Any string value
Email	Email of the employee	VARCHAR (100)	Not Null	Any string value
Position	Position of the employee	VARCHAR (100)	Not Null	Any string value

6.2.3 Data Coding Standards

The easiest standard to spot is the naming convention for the tables and the columns. For both elements to be easily distinguishable, the table names are in lowercase letters, while the column names are in uppercase letters. CamelCase naming is used for all the methods, both in the

controller and the model. In addition, it is also used for the newly initialized variables in line the views or in JavaScript.

The data coding standards revolve mainly around the database design. The most commonly used format is that of the columns where a foreign key is present. The standard format used is the <table name>_<column name>. For example, the users table has a foreign key with the departments table, therefore the column connecting the two tables from the users table is called "departments_DEPARTMENTID".

The users are classified into five (5) types, which use a numerical character as follows:
- 1 - Admin
- 2 - Executive
- 3 - Department Heads / Managers
- 4 - Supervisors
- 5 - Staff

The departments are also classified by a numerical character wherein:
- 1 - Executive
- 2 - Marketing
- 3 - Finance
- 4 - Procurement
- 5 - Human Resource (HR)
- 6 - Management Information System (MIS)
- 7 - Store Operations
- 8 - Facilities Administration Manager

The responsibility assignment matrix consists of R, A, C, and I, as a type of responsibility and has its own table in the database which is also referred to with a numerical character as follows:
- 1 - Responsible
- 2 - Accountable
- 3 - Consulted
- 4 - Informed

As the system supports multiple delegations, a special numerical character is assigned to the user wherein he/she is tasked to delegate R, A, C, and I of that task:

- 0 - Current Delegation
- 5 - Past Delegation

Change requests are also being stored in the database which has two types, which are also stored using a numerical character as follows:

- 1 - Change performer type
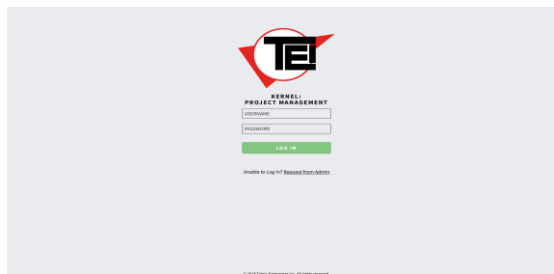- 2 - Change dates type

6.3 Screen Specifications

This section identifies the screen details alongside the corresponding description and use of the web page. The established design strategies can be seen in each screen.

Screen Name: 0.0 Login Screen
File Name: login.php
Description: This screen is for login and it validates the user logging in, as it checks if the user is providing the correct username and password for their account. It also checks the usertype of the person logging in. It redirects to the user's home screen once the login was validated.
Layout:

Screen Name: 1.0 Dashboard Screen
File Name: dashboard.php
Description: This page will show the user's performance, as well as, the performance of the team they belong to. It will also show all projects that the user is currently working on and tasks assigned to them that are already delayed and will end in 2 days. Activities that also needs the user's action such as delegating tasks, approving requests, and acknowledging documents can also be seen in this screen.
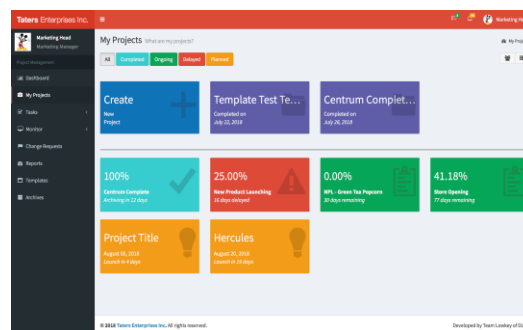Layout:

Screen Name: 2.0 My Projects Screen
File Name: myProjects.php
Description: Only projects wherein the user is involved in can be seen in this screen. Through the different colors, the user can exactly tell the status of a project. From this screen, the user can either click on a project, or a project template to be redirected to the project gantt chart, or to click on create new project to be redirected to the project creation form. A list view and grid view are also provided for the user's ease of viewing.
Layout:

Screen Name: 3.0 Create A New Project Screen
File Name: addProjectDetails.php
Description: Creating a new project can be done through this page. All fields are required to have an input to be able to proceed to the next step, which is adding main activities.
Layout:

Screen Name: 3.1 Adding Main Activities Screen
File Name: addMainActivities.php
Description: In this screen, main activities of the project will be inputted here by the

user. Details such as, main activity name, start date, end date, and the department that will perform the activity should be provided by the user. The user can then proceed to adding sub activities.
Layout:

Screen Name: 3.2 Adding Sub Activities Screen
File Name: addSubActivities.php
Description: This page is similar with the previous screen in terms of user interface, the only difference is that it redirects the user to the adding tasks screen after filling out the required fields.
Layout:

Screen Name: 3.3 Adding Tasks Screen
File Name: addTasks.php
Description: The user can add all the tasks under the sub activities they previously created. Layout wise, it looks the same with the 2 previous forms. This page navigates to adding dependencies on the tasks.
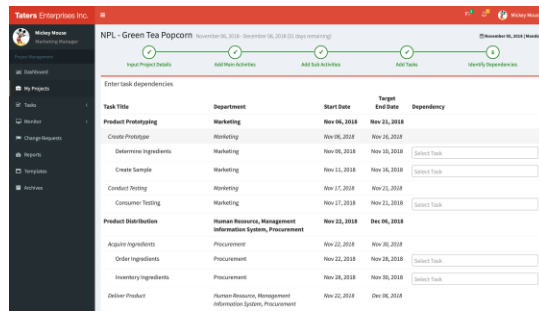Layout:

Screen Name: 3.4 Adding Dependencies Screen
File Name: addDependencies.php
Description: This screen lets the user define the pre-requisites of the tasks that were made prior. After defining the pre-requisites, the last step is to generate the gantt chart.
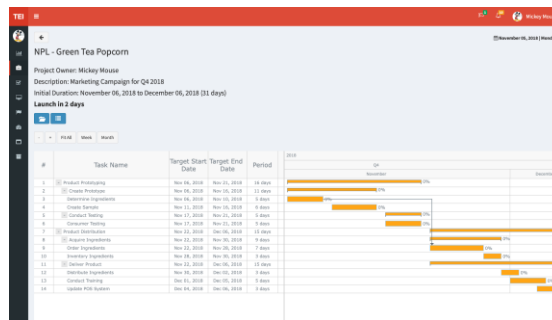Layout:

Screen Name: 4.0 Project Gantt Screen

File Name: projectGantt.php

Description: This page shows the gantt chart, a visual representation of the schedules of tasks in the project. It also shows the performance of the user in that project and all overall performance of the project. From the gantt chart, the user can be navigated to the project documents or project logs.

Layout:

Screen Name: 5.0 Project Documents Screen

File Name: projectDocuments.php

Description: All documents uploaded in that project can be viewed in this page. Some of the documents can only be seen by limited people depending on what the uploader chose. Also in this page the user can acknowledge, download, and upload document.
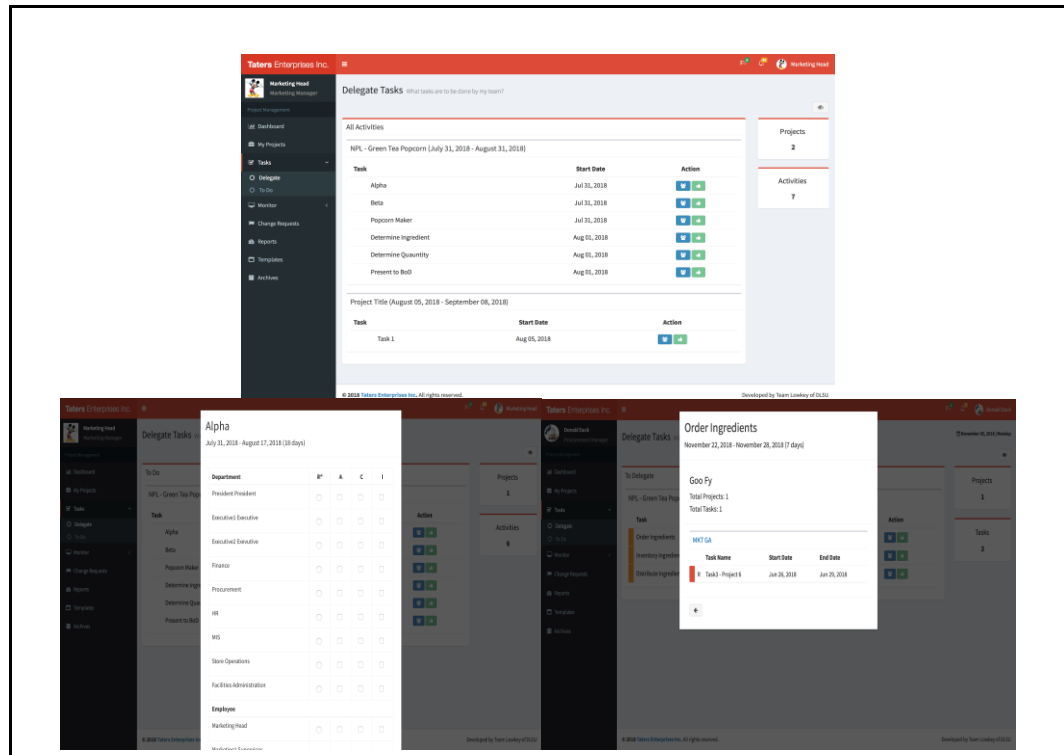
Layout:

Screen Name: 6.0 Project Logs Screen

File Name: projectLogs.php

Description: This is the page where the user can view all the actions that were done in the project.

Layout:

Screen Name: 7.0 Delegate Task Screen

File Name: taskDelegate.php

Description: This screen is where the department heads or the supervisors can delegate a task that was assigned to them by the project owner during project creation. When the delegate button is clicked it will show all the possible people that they can delegate the task to. To see the workload assessment of the a person in their team, the user can simply click on the name of the user and a modal with the workload assessment will appear.

Layout:

Screen Name: 7.1 Delegate Task (View All) Screen

File Name: taskDelegate.php

Description: By default, the delegate task screens shows tasks you need to delegate within 2 days or less. However, there is an option available for the user to view all. When the delegate button is clicked it will show all the possible people that they can delegate the task to. To see the workload assessment of the a person in their team, the user can simply click on the name of the user and a modal with the workload assessment will appear.
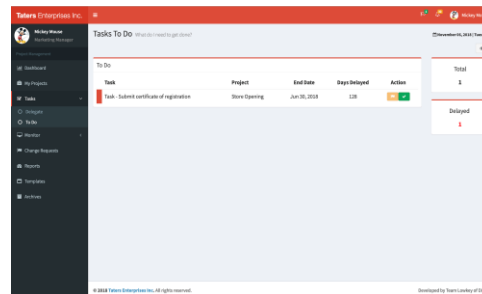
Layout:

Screen Name: 8.0 Tasks To Do Screen
File Name: taskTodo.php
Description: All delayed tasks, and tasks due in 2 days that are assigned to the user can be viewed in this screen. The user can either mark the task as done or submit a request for change in performer or date 2 days before the deadline.
Layout:

Screen Name: 8.1 Tasks To Do (View All) Screen
File Name: taskTodo.php
Description: By default, the task to do screens shows tasks that are delayed and/or tasks due in 2 days. However, the user can choose to view all the tasks by clicking the view all button. The user can either mark the task as done or submit a request for change in performer or date.
Layout:

Screen Name: 9.0 Change Requests Screen
File Name: rfc.php
Description: All change requests that involves the user such as, the request they submitted or an employee seeking for their approval can be seen in this page.
Layout:

Screen Name: 10. Reports Screen
File Name: reports.php
Description: This screen shows all reports that the system can generate for the user.
Layout:

Screen Name: 11. Templates Screen
File Name: templates.php
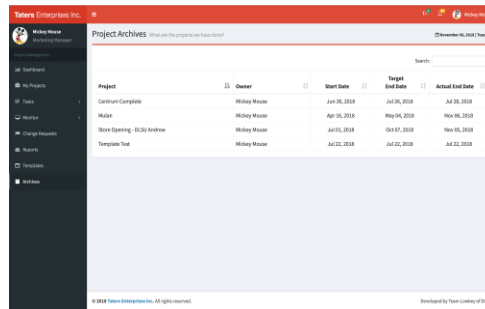Description: All project templates can be seen here and used by a user.
Layout:

Screen Name: 12. Archives Screen
File Name: archives.php
Description: All archived projects can be seen in the archives page.
Layout:

Screen Name: 13. Project Monitor Screen
File Name: monitorProject.php
Description: This page lets the user monitor all projects that he owns. The user can click on any of the projects in the page and they will be redirected to the monitor department screen.
Layout:

Screen Name: 13.1 Monitor Department Screen
File Name: monitorDepartment.php
Description: The monitor department screen shows the overall progress of the project, tasks that are delayed, and the departments involved in the project. From this page, it will navigate the user to the monitor department details screen.
Layout:

Screen Name: 13.2 Monitor Department Details Screen
File Name: monitorDepartmentDetails.php
Description: In this screen the user can see all the tasks assigned to the department he chose in the previous screen. It also shows the number of delayed, ongoing, completed,

and planned tasks. The user can click on any of the tasks shown to be able to see the history of that task, such as the delegate and RFC history.
Layout:

Screen Name: 14.0 Monitor Team Screen
File Name: monitorTeam.php
Description: Monitor team can only be viewed by department head or the supervisors. It shows all employees directly under him. The user can choose an employee and they will be redirected monitor member screen.
Layout:

Screen Name: 14.1 Monitor Members Screen
File Name: monitorMembers.php
Description: This screen shows all tasks wherein the chosen employee is responsible. It also shows the status of those tasks and also the overall performance of that employee. The user can click on any of the tasks shown to be able to see the history of that task, such as the delegate and RFC history.
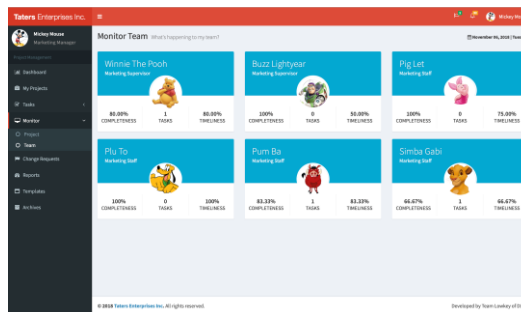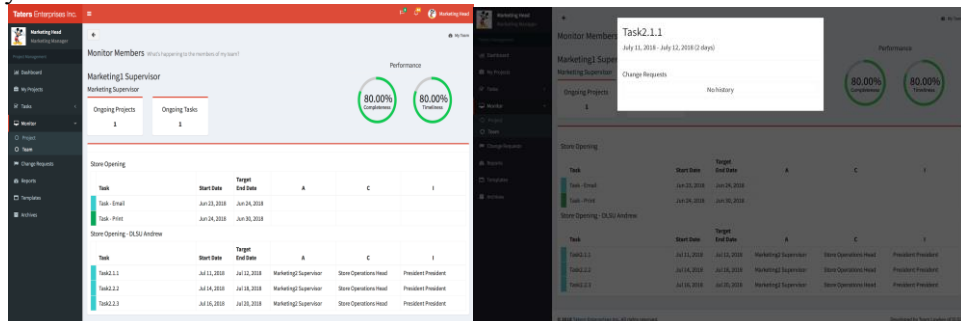Layout:

6.4 Form Specifications

This section focuses on the screens wherein a form is present by detailing the purpose of the form, the data needed to complete a form and a transaction, the users who may encounter the screen, and how often it is submitted through the system.

Form Name: Login
Description: User has to input their registered username and password in order to gain access to the system.
Prepared By: All users
Used By: All users
Volume and Frequency: Once every time a user needs to access their account.
Layout: String username, String (Password) password

Form Name: Create New Project
Description: Creating a new project can be done through this page. All fields are required to have an input to be able to proceed to the next step, which is adding main activities. Adding main activities, sub activities, and tasks are all required fields, the last step is to identify the dependencies of each tasks, if there are any.
Prepared By: Executives, Department Heads, and Supervisors
Used By: Executives, Department Heads, and Supervisors
Volume and Frequency: Once every time a user desires to create a new project for the company, or for their team.
Layout: String project title, String project details, Date start date, Date target end date, String main activity title, String department, Date start date, Date target end date, String sub activity title, String department, Date start date, Date target end date, String tasks title, String department, Date start date, Date target end date, String dependency

Form Name: Request for Change

Description: All users in the company can request for a change either for a performer or for a date.

Prepared By: All users

Used By: All users

Volume and Frequency: Once as needed

Layout: String type, String Reason, Date new target end date (for request in date)

Form Name: Upload Document

Description: Lets the users upload documents in a specific project.

Prepared By: All users

Used By: All users

Volume and Frequency: Once as needed

Layout: String departments, String users, File file, String remarks

Form Name: Delegate Task

Description: This form lets either the department head or the supervisor delegate task to their employees or to another department as Responsible, Accountable, Consulted or Informed.

Prepared By: Department Heads and Supervisors

Used By: Department Heads and Supervisors

Volume and Frequency: Every time a project has been created and they are tagged to

delegate the task
Layout: INT role

6.5 Report Specifications

This section focuses on screens that produce report, specifically the organization of multiple entries of data into a table. Each report has a name, description, specific purpose, the users who may encounter the screen, and how often they may encounter it.

Report Name: Department Performance Report

Description: This report shows the performance assessment of all the departments of TEI. It also includes all the projects that a department is involved and its corresponding timeliness and completeness.

Prepared By: President

Used By: President

Volume and Frequency: Once as needed

Layout: Letter size paper, String data type for all output *(Refer to Appendix R for Actual Printouts)*

Report Name: Project Status Report

Description: The Project Status Report shows all tasks that were planned, tasks that were accomplished either last week or last month depending on the interval that the user chose, problems encountered (tasks that are delayed), risks (pending change requests and tasks that needs to be delegated), and tasks that are upcoming next week or month.

Prepared By: President, and Heads and Supervisors involved in a project

Used By: President, and Heads and Supervisors involved in a project

Volume and Frequency: Once as needed

Layout: Letter size paper, String data type for all output *(Refer to Appendix R for Actual Printouts)*

Report Name: Project Progress Report

Description: Depending on the interval that was chosen, this report will generate a weekly or monthly progress report of a specific project. All the main activities will be

shown as well as its current progress and last week or month's progress. Tasks accomplished within the week or month will also be shown in this report.

> Prepared By: President, and Heads and Supervisors involved in a project
> Used By: President, and Heads and Supervisors involved in a project
> Volume and Frequency: Once as needed

Layout: Letter size paper, String data type for all output *(Refer to Appendix R for Actual Printouts)*

> Report Name: Project Summary Report

Description: This report gives an overview of what happened with the project. It shows the timeliness of the overall project and all the departments included in the project. It also includes the members of the project, their department, the total number of tasks assigned to them and their timeliness.

> Prepared By: President, and Heads and Supervisors involved in a project
> Used By: President, and Heads and Supervisors involved in a project
> Volume and Frequency: Once every project has been completed

Layout: Letter size paper, String data type for all output *(Refer to Appendix R for Actual Printouts)*

> Report Name: Project Performance Report

Description: This reports generates the performance metrics of a project and all the departments involved in a project in terms of its completeness and timeliness. All delayed tasks are also shown in a table format.

> Prepared By: President, and Heads and Supervisors involved in a project
> Used By: President, and Heads and Supervisors involved in a project
> Volume and Frequency: Once as needed

Layout: Letter size paper, String data type for all output *(Refer to Appendix R for Actual Printouts)*

Report Name: Team Performance Report

Description: Team Performance Report shows the performance metrics of all the user's subordinates. It also shows the number of projects and tasks a certain person is currently handling and also the number of delayed task per user.

> Prepared By: Department Heads and Supervisors
> Used By: Department Heads and Supervisors
> Volume and Frequency: Once as needed

Layout: Letter size paper, String data type for all output *(Refer to Appendix R for Actual Printouts)*

Report Name: Employee Performance Report

Description: This report is generated for the user itself for them to be able to see how they are performing in terms of their timeliness and completeness. A project breakdown with all their tasks and specific project performance can also be seen in this report.

Prepared By: Anyone
Used By: Anyone
Volume and Frequency: Once as needed
Layout: Letter size paper, String data type for all output *(Refer to Appendix R for Actual Printouts)*

7.0 System Coding

This section describes the features of the programming languages, and the special purpose language tools used in developing the system. The coding standards and conventions are also discussed here.

7.1 Programming Language

The main programming languages used to develop the system were PHP Hypertext Preprocessor 5 (PHP 5), Hypertext Markup Language (HTML), Cascading Style Sheets (CSS), and JavaScript, which are also considered to be the main technologies used in developing a web application (Loukas, 2018).

PHP 5 is a server-side language which is commonly used in creating dynamic Web pages. It is flexible enough that it can be accessed by majority of operating systems and servers (Oracle, 2018). Specifically, the system is built on PHP 5.6.30. HTML is used to structure the elements in a Web page and to link them together. CSS is used for additional styling of the HTML elements to format/layout how the user would see a specific element. Although CSS was not the main styling language used in the system, though it still offered wider capabilities and options for the developers to personalize the layout of the Web pages as much as possible. JavaScript is used to manipulate the behavior of the data and elements combined in a Web page.

One of the notable features adapted from PHP 5 is the PHPSpreadsheet library which was used in reading an imported/uploaded excel file which would be used in project creation. The library is also equipped with writing to a spreadsheet, but the developers did not see a need for this functionality to be applied to the system. This library was the main tool in completing the "Import Project" function of the system.

There are numerous JavaScript features used throughout the system. To name a few, the system uses this language specifically for basic user input validation that does not require database query comparison, date inputs, form submissions, and implementation of other plugins used in the system. A JavaScript plugin called chart.js was used for added data visualization for reports.

The aforementioned languages work together smoothly to enable dynamic actions and data displays, which is highly encouraged in system development.

7.2 Special Purpose Language Tools

Accompanying the programming languages used to develop the system, special purpose language tools were used for a more coherent system structure and effective use of existing tools and technology. In terms of system structure, MySQL, CodeIgniter, and Bootstrap interconnects the main aspects of the system with regards to data storage, data processing, and user interface, respectively.

MySQL is open-sourced, a database management system, and uses a Structured Query Language (SQL) (MySQL, n.d.). The developers also used MySQL Workbench as the visual tool to assist in designing, developing, and administering, the system's database (MySQL Workbench, n.d.). The database is a structured collection of data that can be read from and written to by the system.

CodeIgniter is the PHP framework used in developing the system with its Model-View-Controller structure. The model is responsible for all database manipulation which includes, retrieving, inserting, and updating of data tables and/or rows. The view handles the manner of displaying the data for each web page. It also has the ability to handle fragments of a page. Lastly, the controller is the bridge that combines the data from the model to be displayed in the view in order to fulfill a request. The system also makes use of CodeIgniter's built-in methods such as upload, email, and form validation.

An important tool that contributed to the system's data visualization on one of the most important aspects of the project management system is the generation of a RACI Gantt Chart with the help of AnyChart. "AnyChart is a flexible JavaScript (HTML5) based solution that allows developers to embed interactive and great looking charts and dashboards into any web, standalone or mobile project." (AnyChart, n.d.).

7.3 Programming Standards

Coding techniques are used not so to improve the functionality of the system, but for the readability and maintainability of the system. There are three important sections in coding techniques that should be decided upon a group of system developers - Names, Comments, and Format. Aside from these, there are also additional programming techniques and standards that the developers have adapted towards the system.

The naming convention used within the backend of the system is Camel Case for easier readability, when it comes to methods and variables. Camel Case

is the formation of multiple words that capitalizes the first letter of a new word (Example: camelCase). This is used in naming variables, tables, methods, and MySQL variables. The verb-noun routine is also applied in naming methods, following the same convention. Title Case is another naming convention wherein the first letter of each word in a phrase is capitalized (Example: Title Case). This is used mostly for the user end, specifically in page headers, table headers, widget/box headers, and report titles. The naming conventions for the database tables are set to be in all lowercase letters, while the table columns are set to be in all uppercase letters. The columns wherein they have a foreign key with a different table are indicated in the column name divided by an underscore for easier reference (Example: tablename_COLUMNNAME). The abbreviations used in the system are only of "RFC" which stands for "Request For Change". This term is assumed to be understood by all the employees of the company since the system will be used internally.

Comments in a system may act as internal documentation if written properly. The system's comments are placed before the first line of a certain method. Method comments simply describe the purpose of the method as the code itself should be readable on its own without detailed explanation. There are also some cases wherein the developers place comments on loops and variables for better comprehension.

There is a wide variety of formatting styles for system development. As for the programming languages used, strict formatting is not required and no matter how the codes are placed, it will still run as if they were formatted. There are specific standards that the developers have set among themselves to sustain readability and maintainability, namely:
- an HTML page's title should be the same or similar to the corresponding file name,
- PHP chunks of code embedded in the HTML are always wrapped with the full PHP start and end tags,
- control statements are separated with a space before the condition and its opening parenthesis,
- long control statements are separated by its operator into the next line,
- indentation is applied with respect to the code block a line of code is a part of,
- brackets of methods and control structures that wrap the code begin on the next line from the method name/control statement and end on the next line of the last line of code,
- a line of code can have more or less ninety (90) characters,

- each value assignment for an array is separated into one assignment per line, and
- all functions must return a value, whether it may be a single element/value, an array, an object array, a query result, or a boolean.

8.0 System Testing

This section will discuss the four (4) types of testing done, namely, Unit Testing, Integration Testing, System Testing, and Acceptance Testing. These types will also be discussed in detail as to how they were conducted for the developed project management system.

8.1 Unit Testing

This is where developers test individual modules and functions. They are expected to see if they are running as intended. The developers were tasked to individually develop specific modules and functions. During the development period, they had also conducted unit testing for each of the modules and functions they have developed. The developers had implemented white box testing, which is a testing method that has testers know the actual program or function of the code and how it works. This was chosen above black box because it is a quicker way of testing and an easier way for the programmers to spot the error, investigate, and remediate the problem. Another implementation of user testing that the developers used was having other programmers in the team to test the module or function to verify that the program is indeed working as intended. They also evaluate the module or function and give their comments and suggestions to better improve the functionality, user experience, and design.

8.2 Integration Testing

Integration testing is the combination of the fully tested units of the system. This is where you integrate two (2) or more functioning modules to see if they work while coexisting with each other. Through this, the developers can check if the newly developed modules do not disrupt the continuity of the system and more importantly, the process. This type of testing also allows the developers to spot any interface defects between the modules such as redundant elements or differences in the user design and user experience. This also helps the developers gauge the capability of the system to handle more than one (1) module. This was implemented to the developed project management system as the developers had integrated their individual modules. Through this they not only saw that the modules work as intended individually, but that modules that were connected had the intended functionality. Functions such as Task Delegation and Task Completion were cohesive in the business process of the TEI.

8.3 System Testing

This type of testing is where the developers combine all modules and functions together to form the entirety of the system. Here, they check if the system runs all modules and functions as intended without any bugs or crashes. This is where the efforts of the programmers on the individual parts of the system come together to see the totality of its effect on the whole of the company's processes. Through this, the developers can see if all modules and functions are full working and can coexist in the system environment. As regards to the project management system that was developed, the development team had done this by dedicating a sit-down session to run the entire system. The developers used test cases that they had created which involves the modules and functions as well as their expected results. These test cases were then executed to see if the system gave the result they were expecting. System testing also included the flow in between processes, such as creating a project, delegating tasks, and accomplishing the tasks. The flow of the process was then compared to the actual business process if the results were as intended or better improved. The development team also tested the ease of use or user experience, if the system was easy to use and easy to understand for their intended users. Lastly, they ran a real business scenario through the system to see how it works in a business setting and if it would properly function.

8.4 Acceptance Testing

Acceptance Testing is the last type of testing that has actual users of the system test the system to see if they are satisfied with how it operates and if it coincides with their business processes. This testing is perhaps the most crucial, as this is where the efforts of the development team are truly evaluated on whether the system developed was indeed inline with their requirements and specifications. This type of testing is oftenly called User Acceptance Testing (UAT).

This was applied to the project management system by having the users test the system themselves. They were then given a form to fill up that had functions relating to their role as a user, may it be an Executive, a Department Head, a Supervisor, or a Staff employee *(Refer to Appendix V)*. These functions were the rated from one (1) to five (5), with five (5) being the highest rating. The users also had a section wherein they were free to give their feedback regarding the system. The developers had nine (9) users to test the system, 3 Departement Heads, 3 Supervisors, and 3 Staff employees. The developers were not able to

have an Executive test the system as they were not available at the time they were conducting the UAT.

The UAT form was divided into five (5) sections, namely Data Security, System Functionality, which was different for each other user types, Reports, User Interface Design, and General Project Considerations. For Data Security, across the nine (9), they had an average of 4.97 for the four (4) factors under it. For System Functionality, Department Head's had a total average of 4.63 for 29 factors *(Refer to Table 8-2)*. As for Supervisors, the total average for 29 factors is 4.70 *(Refer to Table 8-3)*. For the Staff, they had 19 factors with a total average of 4.77 *(Refer to Table 8-4)*. The Reports section had an average of 4.51, the User Interface Design had an average of 4.53, and lastly, General Project Considerations had a total average of 4.74 *(Refer to Table 8-1)*.

As seen in the results above, Kernel was successful in fulfilling user requirements as the averages per section were above average. The users found that the system was able to capture the essence of monitoring and controlling of projects, as well as project members of each department. One department head in particular was very enthusiastic about the system saying that it would help handle his projects and said if it were possible to make the system accessible through mobile phones, which the developers had taken into account in their recommendations to better improve the system. This department head is of the Procurement department who spearheads the biggest project that TEI has which is the store opening. He had stated that the Employee Performance report would help in employee appraisals to evaluate their performance.

8.5 Test Cases

Test cases are made to serve as a guide for not only developers but testers as well as this outlines how the system should be tested to ensure that each module is run through. These cases also include the expected result for certain actions as well as error checking and validation for the system

The developers had created test cases to run through during system testing. These cases helped the developers test the system as thorough as possible, making sure these cases went through all major functions and modules the project management system in question has. The developers have created fourteen (14) sections, covering every module and function, for the test cases for the developed system *(Refer to Appendix U)*.

9.0 System Implementation Plan

This chapter describes the overall system implementation plan with regards to training the users, converting from the legacy system, and converting old data to the new database.

9.1 Personnel Training

The objective of conducting personnel training is to familiarize and instruct the main users of the system with the features and capabilities that the system can do to maximize the new method in conducting business operations. In addition, the trainers should teach them well enough that the main users are able to instruct the futre employees of the company to utilize the system at its finest. This method is called as "Training-the-trainee".

There are three (3) different user categories that will be using the system. These categories are as follows: (1) Staff, (2) Heads, and (3) Management Information System (MIS) department, which serves as the maintenance personnel for the system. Different functions are present depending on the user category, thus, three (3) different training sessions will be conducted. During the training process, it is important to get feedback from the users on their concerns and suggestions to further improve the system.

The plan of action for providing training will start with the trainers discussing the overall system, its main purpose and role in the company, and how users can navigate through the system features. The training sessions include the flow of the operations/features, explaining the special codes used, what actually happens in each function and how the information is handled by the system, where you can find and place information, and the acceptable inputs that will not cause the system to perform poorly. A technical manual will also be provided for them which includes the system architecture, system installation, information and error handling, backend operations per function, and how to provide help for user support.

The MIS staff will then help in training the rest of the users. Training sessions will be conducted by batch as the developers want to provide learning by hearing, seeing, and doing (Shelly & Rosenblatt, 2010). A more hands on training wherein the users can fully experience the system themselves will be able to help them familiarize themselves with the system. With limited number of trainees per session, the developers can provide easy help when a problem arises. In addition

to the training, a user manual will also be handed out in the hopes of it being useful to the users on how to perform the system's basic functions.

The trainers will include the procedures and the handling of information from the above features. In addition to the user manual for the general users and technical manual for the maintenance personnel, a video demonstration of the system will also be provided. The duration of the whole training process is estimated to be roughly a week, while aiming for at least 10 - 15 users to be taught per day.

9.2 System Conversion

The process of retiring the old system to a new one is known as system conversion or changeover. There are four (4) changeover methods, namely, direct cutover, parallel operation, pilot operation, and phased operation. Each changeover method has its own advantages and disadvantages, and risk and cost factors involved. For this project, the group decided that the best, if not, the most appropriate changeover method will be the parallel operation.

A Direct Cutover approach is when the legacy system is immediately replaced with the new system. This method is the least expensive among all the other approaches, however, it also involves high risk as users cannot compare outputs from the working legacy system with the new system's current output. It also includes the risk of the new system having critical errors that might cause the system to terminate. Unlike in direct cutover, the Parallel Operation allows both the legacy and the current system to run simultaneously in order to verify the output is as expected. In most cases, Parallel is the most expensive operation changeover method, however, for this case, no cost is involved in running both the legacy and the new system. Pilot and Phased Operation were not considered by the developers as a conversion method because all modules of the system are connected, this also applies for the users of the system.

The new system will be accessible through the Internet, with any web browser, the reason for this is because, not all tasks can be done in the office, such as construction, on-site training, and submitting government requirements. The deployment of the system is expected to be smooth due to the fact that they already have the necessary technologies in place. Once the system has been deployed to the company's server, the staff and heads can start using the system simultaneously with the legacy system. If there are no problems encountered while using the new system, the legacy system can then retire.

9.3 Data Conversion

Existing data is inserted into the database of the new system during data conversion. However, before that a data conversion plan is to be made, here conversion mapping will be done. The plan is made with the joined efforts of the developers and the MIS department.

   To aid with the actual data conversion process, the group has developed an import function through the system to have all existing projects be easily inserted in the new database. A template in excel format is also available for download whenever a user needs it. The template includes instruction and sample data for the user to be able to fill the template with ease. All necessary details when creating a project, such as project details, task details, and role assignment should be filled up by the user *(Refer to Appendix W)*. The system also provides error checking to ensure that all data that will be inserted in the database are validated. This also limits human-error inputs. The import function also reduces risk of having incorrect, inaccurate, and redundant data entries. Data cleansing should be done before importing the template into the system.

10.0 Cost Benefit Analysis

This section discusses the cost benefit analysis. Every information system consumes resources while it is being developed. This helps justify the need for the system in terms of the organization's tangible and intangible benefits against its corresponding costs to develop and deploy the system.

10.1 Intangible Costs

Adapting to a new system consumes time and may require training and learning the new system. With that, there is a cost of time due to adapting and transitioning to the new system. Another could be the decline in employee morale as employees are required to adapt the new system which may require more work, albeit the right kind of work. Some employees might not be open to this change as they are used to doing tasks in the method that they have been doing so.

10.2 Tangible Costs

The development costs for the system resulted into Php 0.00 because no hardware or software was required to be purchased in order to develop the system. The developers used personal computers and open-source development tools such as HTML5, CSS3, PHP, CodeIgniter framework, Bootstrap, Github, and MySQL. The developers also did not request to be paid as they saw this opportunity as a way to gain experience rather than profit.

The estimated installation cost is Php 7,245.00 which was utilized to provide all necessary documents for the system such as software development documents, manuals, and references. There was no need to acquire any hardware and software for installation as TEI is already equipped with the infrastructure in preparation for the system. The developers will also provide demo and training free of charge during the system handover with TEI.

The existing annual operation cost of Php 28,626,000.00 was an estimate that TEI has provided which covers the salaries of TEI employees including all three (3) executives, seven (7) managers, 25 supervisors and 37 staff members as well as monthly billings to keep their daily operations functional.

The proposed annual operation cost of Php 26,608,000.00 was an estimate given by the developers which still covers the same entities but exactly Php 18,000.00 less than the existing annual cost. This is due to a minimal decrease

with consumption of printed documents as well as lesser communication bills since the system would provide the users with project updates and information with regards to the tasks they need to do.

The new system is estimated to last for an approximate five (5) years at least as technology quickly evolves, the capabilities of systems will also improve. These developments could quickly make Kernel outdated and would fall behind the current technological trends.

10.3 Intangible Benefits

Employee satisfaction, especially that of the executives, is one of the main benefits as it would provide updates on all projects as well as a basis for improvement to prevent the same delays from occuring. Workload for employees will increase at first but as the system accumulates data, TEI employees can easily model their projects based on what is already existing in the system, hence workload will eventually lessen. Kernel will also be able to increase productivity as it reduces the repetition of work by the use of templates, and the reduction of recurring mistakes and problems. Kernel also minimizes human intervention which in return could increases employee satisfaction and morale in the long run.

10.4 Tangible Benefits

According to TEI, Kernel would greatly benefit them for the upcoming year as they plan to be more aggressive in opening stores. Kernel will be able to aid them with tracking the progress of each project as well as maintaining their quality. Given that they will increase the number of projects to be executed in the next year, they would still have to be able to continue managing all their other projects such as the time-triggered marketing projects, and event-triggered HR projects. With Kernel in place, TEI will have the capability to handle more projects which could later result in profit as they would avoid, if not eradicate, the delays they experience in their projects.

10.5 Analysis

It will take about five (5) years, 4.83 years to be exact, to payback the expenses incurred with developing Kernel. It is exactly the same as the expected lifespan of the system which makes it reasonable to be deployed. Return on investment is 148%. Not only will it return intangible benefits but as well as 1.5 times the investment to develop the system. Although the net present value is at around 114

million, the system was not designed to return quantifiable benefits which would lower TEI's existing operational cost. This should not contribute to the factor of the system's economic feasibility as the focus of the system is to minimize, or even completely eliminate delays for projects *(Please refer to Appendix X for the CBA Computation).*

11.0 Conclusion and Recommendations

This section will discuss the conclusion of the project, how it solved the problems identified, how it fulfilled the system objectives, and the development team's insights on how to better improve the system that was not part of the scope that they have set.

11.1 Conclusion

The project management system that was developed satisfied all the user requirements that were gathered, while simultaneously providing a solution to all the identified causes for the main problem of having delays in project execution. Each function within the four (4) modules of Kernel has its own significant purpose and contributes to the solution for a certain problem. The lack of monitoring and controlling, and difficulty in handling multiple projects were both solved by project documentation, by providing a project repository for all types of projects, and by providing reports that can be generated to aid the project owners in knowing the progress and status of a project, or even the performance of the project or team. The lack of project transparency, limited number of project viewers, and incapability of handling project updates were all solved by providing a unified view or access point to each project along with all the information, documents, and logs associated with it; in addition, system updates are also provided to each project member for all tasks they are involved in. Document mismanagement was solved by providing a document repository and each document is tagged to a department or to a project team member that would require their acknowledgement which then would be recorded for accountability purposes. Lastly, inequitable workload distribution was solved by providing a snapshot of the projects and project tasks assigned to an employee, along with his/her job description.

Although the road to that conclusion was not as immaculate as the developers would like, they had experienced problems in designing the system in a way that would fit the given specifications of the organization. With the use of the Joint Application Development (JAD), both the developers and the organization were active in helping each other make the system development as smooth as possible without being scope creeps. The chosen development method required repetitive consulting and feedback with the client, which evidently paid off and the output resulted into a system that fulfills the needs of the company.

Kernel, the project management system, was successful in achieving the overall objective of the entire project which is, to serve as the main tool for monitoring and updating projects in the project management process of the company. The system was able to provide a user friendly way to monitor and control the projects that TEI handles. This was seen in the way the project owners were capable of overseeing multiple projects and having an access to all planned and ongoing projects; how the project team can continuously stay transparent with project updates, progress, and status; and how staff members were able to not only do their work, but to do it the right way the first time.

11.2 Recommendations

Though the system that was developed was successful in meeting its objectives, the developers believe that there is still room for improvement. The development team suggests the implementation of a real-time collaborative project creation process something akin to Google Apps where users can see real-time changes made to a certain project. Another recommendation is the creation of a mobile application that users can access on the go as not all tasks can be done in the office or in a place that has Internet connection. Together with a collaborative environment, the application of a messaging board or chat room would also be useful. Lastly, the implementation of emailing through the system where they can compose and send emails would also add value.

The successful integration plan of Kernel to the organization's vision, *One Data,* would also add great significance to the system alongside the Task Management System currently in the pipeline.