ESCUELA TÉCNICA SUPERIOR DE INGENIERÍA (ICAI)
MASTER EN INGENIERÍA INDUSTRIAL

Estudio de viabilidad de una nueva Herramienta de Gestión de Proyectos para Group IPS

Autor:

Álvaro Pérez Bello

Director:

Ivaila Petrova

Madrid

Junio 2016

AUTORIZACIÓN PARA LA DIGITALIZACIÓN, DEPÓSITO Y DIVULGACIÓN EN RED DE PROYECTOS FIN DE GRADO, FIN DE MÁSTER, TESINAS O MEMORIAS DE BACHILLERATO

1º. Declaración de la autoría y acreditación de la misma.

El autor D. Álvaro Pérez Bello DECLARA ser el titular de los derechos de propiedad intelectual de la obra: *Estudio de viabilidad de una nueva Herramienta de Gestión de Proyectos para Group IPS*, que ésta es una obra original, y que ostenta la condición de autor en el sentido que otorga la Ley de Propiedad Intelectual.

2º. Objeto y fines de la cesión.

Con el fin de dar la máxima difusión a la obra citada a través del Repositorio institucional de la Universidad, el autor **CEDE** a la Universidad Pontificia Comillas, de forma gratuita y no exclusiva, por el máximo plazo legal y con ámbito universal, los derechos de digitalización, de archivo, de reproducción, de distribución y de comunicación pública, incluido el derecho de puesta a disposición electrónica, tal y como se describen en la Ley de Propiedad Intelectual. El derecho de transformación se cede a los únicos efectos de lo dispuesto en la letra a) del apartado siguiente.

3º. Condiciones de la cesión y acceso

Sin perjuicio de la titularidad de la obra, que sigue correspondiendo a su autor, la cesión de derechos contemplada en esta licencia habilita para:

a) Transformarla con el fin de adaptarla a cualquier tecnología que permita incorporarla a internet y hacerla accesible; incorporar metadatos para realizar el registro de la obra e incorporar "marcas de agua" o cualquier otro sistema de seguridad o de protección.
b) Reproducirla en un soporte digital para su incorporación a una base de datos electrónica, incluyendo el derecho de reproducir y almacenar la obra en servidores, a los efectos de garantizar su seguridad, conservación y preservar el formato.
c) Comunicarla, por defecto, a través de un archivo institucional abierto, accesible de modo libre y gratuito a través de internet.
d) Cualquier otra forma de acceso (restringido, embargado, cerrado) deberá solicitarse expresamente y obedecer a causas justificadas.
e) Asignar por defecto a estos trabajos una licencia Creative Commons.
f) Asignar por defecto a estos trabajos un HANDLE (URL *persistente)*.

4º. Derechos del autor.

El autor, en tanto que titular de una obra tiene derecho a:

a) Que la Universidad identifique claramente su nombre como autor de la misma
b) Comunicar y dar publicidad a la obra en la versión que ceda y en otras posteriores a través de cualquier medio.
c) Solicitar la retirada de la obra del repositorio por causa justificada.
d) Recibir notificación fehaciente de cualquier reclamación que puedan formular terceras personas en relación con la obra y, en particular, de reclamaciones relativas a los derechos de propiedad intelectual sobre ella.

5º. Deberes del autor.

El autor se compromete a:

a) Garantizar que el compromiso que adquiere mediante el presente escrito no infringe ningún derecho de terceros, ya sean de propiedad industrial, intelectual o cualquier otro.
b) Garantizar que el contenido de las obras no atenta contra los derechos al honor, a la intimidad y a la imagen de terceros.
c) Asumir toda reclamación o responsabilidad, incluyendo las indemnizaciones por daños, que pudieran ejercitarse contra la Universidad por terceros que vieran infringidos sus derechos e intereses a causa de la cesión.

d) Asumir la responsabilidad en el caso de que las instituciones fueran condenadas por infracción de derechos derivada de las obras objeto de la cesión.

6º. Fines y funcionamiento del Repositorio Institucional.

La obra se pondrá a disposición de los usuarios para que hagan de ella un uso justo y respetuoso con los derechos del autor, según lo permitido por la legislación aplicable, y con fines de estudio, investigación, o cualquier otro fin lícito. Con dicha finalidad, la Universidad asume los siguientes deberes y se reserva las siguientes facultades:

- La Universidad informará a los usuarios del archivo sobre los usos permitidos, y no garantiza ni asume responsabilidad alguna por otras formas en que los usuarios hagan un uso posterior de las obras no conforme con la legislación vigente. El uso posterior, más allá de la copia privada, requerirá que se cite la fuente y se reconozca la autoría, que no se obtenga beneficio comercial, y que no se realicen obras derivadas.
- La Universidad no revisará el contenido de las obras, que en todo caso permanecerá bajo la responsabilidad exclusive del autor y no estará obligada a ejercitar acciones legales en nombre del autor en el supuesto de infracciones a derechos de propiedad intelectual derivados del depósito y archivo de las obras. El autor renuncia a cualquier reclamación frente a la Universidad por las formas no ajustadas a la legislación vigente en que los usuarios hagan uso de las obras.
- La Universidad adoptará las medidas necesarias para la preservación de la obra en un futuro.
- La Universidad se reserva la facultad de retirar la obra, previa notificación al autor, en supuestos suficientemente justificados, o en caso de reclamaciones de terceros.

Madrid, a 14 de Junio de 2016

ACEPTA

Fdo……

Motivos para solicitar el acceso restringido, cerrado o embargado del trabajo en el Repositorio Institucional:

Declaro, bajo mi responsabilidad, que el Proyecto presentado con el título

Estudio de viabilidad de una nueva Herramienta de Gestión de Proyectos para Group IPS

en la ETS de Ingeniería - ICAI de la Universidad Pontificia Comillas en el curso académico 2015 - 2016 es de mi autoría, original e inédito y no ha sido presentado con anterioridad a otros efectos. El Proyecto no es plagio de otro, ni total ni parcialmente y la información que ha sido tomada de otros documentos está debidamente referenciada.

Fdo.: **Álvaro Pérez Bello** Fecha: 14/ 06/ 2016

Autorizada la entrega del proyecto

EL DIRECTOR DEL PROYECTO

Fdo.: **Ivaila Petrova** Fecha: 14/ 06/ 2016

Vº Bº del Coordinador de Proyectos

Fdo.: **Jaime de Rábago** Fecha: 14/ 06/ 2016

ESCUELA TÉCNICA SUPERIOR DE INGENIERÍA (ICAI)
MASTER EN INGENIERÍA INDUSTRIAL

LED CLIMBING WALL

Autor:

Álvaro Pérez Bello

Director:

Ivaila Petrova

Madrid

Junio 2016

RESUMEN

Group IPS es una empresa belga dedicada a la gestión de proyectos en el sector industrial. Group IPS cuenta con una robusta metodología de gestión de proyectos. Durante los últimos 20 años, esta metodología ha sido refinada para conseguir la magnitud y la madurez de la actualidad. A lo largo de esta etapa se han creado diversas plantillas e incluso se han ido incorporando potentes programas de planificación. Aun con todo ello la estructura de los documentos sigue siendo descentralizada. Esto obliga a tener que migrar datos de unos documentos a otros. Las copias de estos datos se realizan de manera manual siendo fuente de ineficiencia a y errores. Por ello nace la iniciativa de desarrollar una programa para la gestión de proyectos con cuatro objetivos:

- Integrar todas las herramientas en un mismo entorno
- Automatizar la actualización de información entre documentos
- Simplificar la relación entre los entregables de Gestión de Proyectos y los documentos de cada uno de los programas utilizados actualmente
- Agilizar la planificación de las tareas y recursos en el proyecto

El objeto de este documento es realizar una definición funcional de la plataforma para poder realizar un posterior estudio de la viabilidad del proyecto y determinar el éxito de su implantación.

Este proceso se llevará a cabo mediante los siguientes estudios:

- Análisis del funcionamiento de la metodología de Group IPS e identificación de las claves a tener en cuenta en el desarrollo de la aplicación
- Estudio de distintas metodologías de gestión de proyectos para mejorar la existente
- Análisis de programas de gestión de proyectos que cumplan los requisitos de la plataforma
- Descripción funcional de la herramienta
- Estudio de viabilidad
- Próximos pasos

Análisis de la metodología de Group IPS

El análisis metodológico se ha basado en todos los documentos formativos de la empresa complementando con el curso intensivo de formación de la empresa en Alemania. IPS cuenta con una estructura de documentos con la función de garantizar la definición del alcance de los trabajos del proyecto junto con el control de los costes, plazos y la documentación necesaria para su descripción y ejecución.

Los documentos más característicos de la empresa son el PDS, PDF, OTS y DTS. En ellos se definen las principales características del proyecto de la siguiente manera:

- PDS: Process Description File, define el proceso de la fábrica que se pretende realizar con los datos productivos y funcionales de la misma (áreas, requisitos de calidad, rotación del producto, volúmenes,...)
- PDF: Project Definition File, listado de todas las tareas necesarias para la ejecución del proyecto (también conocido como WBS). Es el documento central para el control del proyecto. El PDF es el documento base para la elaboración del presupuesto, la planificación y la licitación de los distintos paquetes.
- OTS y DTS: Overall Time Schedule y Detailed Time Schedule, son los documentos que definen los plazos de ejecución de las tareas. Él OTS contiene el plazo de la ejecución de las distintas fases así como los hitos más relevantes del proyecto. DTS por otro lado consiste en una planificación más detallada de las distintas tareas a realizar.

Una vez realizado en análisis e identificados los puntos de interacción más fuertes se obtiene un mapa de la estructura de los documento en la que se pueden destacar las dependencias más fuertes entre los documentos. Durante el proceso de definición de la herramienta estas interacciones se tendrán en cuenta para el desarrollo de la base de datos que albergue la herramienta.

Actualización de la metodología

El proyecto de mejora de las herramientas de la empresa incluye la actualización de algunas de las prácticas de la empresa para mejorar la eficiencia de la empresa en la gestión de proyectos.

Se han analizado principalmente cuatro corrientes de gestión de proyectos: PMBOK, Scrum, Six Sigma y AACE.

El Project Management Body of Knowledge es el libro en el que el PMI recoge todos los conceptos básicos sobre gestión de proyectos. La metodología de IPS está certificada por la ISO 9001 por lo que todas estas prácticas están recogidas por la metodología de la empresa.

Six Sigma es una metodología nacida en Japón en la empresa Toyota. Se centra en conceptos como la eficiencia, la cadena de valor y eliminar aquellas tareas que no generen el mismo. Esta metodología es aplicable a cualquier escala: equipo , departamento, oficina o empresa. Dado que el objetivo es reducir la carga de trabajo por medio de la implantación de una nueva herramienta de trabajo y no mediante la formación de los empleados, esta metodología no aporta valor al proyecto.

Scrum es un subconjunto de la metodología Agile. Esta metodología es comúnmente usada en el entorno de la programación. Esto se debe a la volatilidad del alcance de los proyectos en este ámbito. A pesar que la naturaleza de los proyectos es distinta, se puede aplicar la filosofía de definición del producto a la elaboración de los proyectos de IPS. La buena definición de los proyectos es una fase importante de los proyectos. Por ello el concepto de *sprints* aplicado en la metodología Scrum encaja bien con la forma de plantear la definición de los proyectos en IPS.

Por último la AACE es una asociación de control de costes americana. Group IPS posee unas herramientas para el control de costes que se adaptan de forma correcta a las necesidades de los proyectos por lo que no parece necesario implantar mejoras de esta corriente de gestión de proyectos en la metodología de IPS.

Actualización tecnológica

El estudio de mercado de aplicaciones de gestión de proyectos se ha realizado mediante la búsqueda de aplicaciones, tanto nativas como plataformas web, las cuales puedan adaptarse a la forma de trabajo actual y aportar valor en el ámbito de la gestión.

En cuanto a programas de ordenador no se ha encontrado ningún programa que presente alguna mejora respecto a la herramienta usada en la empresa hasta

ahora. Actualmente se utiliza MS Project para la creación de diagramas de Gantt. Se ha visto necesario explotarlo más para el control costes, seguimiento del progreso y definición del alcance.

En cuanto a soluciones web hay dos plataformas con características similares que resultaría interesante integrarlas con la plataforma actual de IPS (MyTracker).

Wrike es una plataforma online diseñada para la gestión de tareas. Esta herramienta permite visualizar las tareas de distintas formas así como generar informes del estado de las tareas con sus propiedades. Wrike posee una API que permitiría la integración con el sistema actual. El problema que presenta esta herramienta es el elevado coste y el bajo grado de personalización que ofrece.

TeamGantt ofrece un abanico de funcionalidades muy similares a las de Wrike con un precio más asequible. TeamGantt por otro lado presenta problemas para conectar el servicio con la herramienta actual.

Después del estudio de mercado no se ha encontrado una herramienta que satisfaga las necesidades de IPS por completo por lo que se recurrirá al desarrollo de una plataforma específica para la empresa.

Descripción funcional de la herramienta

La descripción de la herramienta se ha centrado en las funciones básicas de la misma así como las interacciones que debería haber entre módulos de la misma. Esta descripción funcional ha sido usada para solicitar presupuesto a distintas empresas de programación para el desarrollo de la plataforma. Se pretende que la herramienta final que se implemente en IPS sea lo más completa posible. Por este motivo la descripción de la plataforma se encuentra en un estado básico de mínimos los cuales se podrían ampliar en el desarrollo particular de cada uno de los módulos.

Estudió de viabilidad del proyecto

El estudio de viabilidad del proyecto se ha dividido en tres partes:

- Estudio de los ahorros ocasionados por la implementación de la plataforma
- Estudio de los costes de desarrollo de la plataforma

- Desarrollo del modelo económico del retorno de la plataforma y su Estudio de viabilidad en función del tiempo de retorno de la inversión

Los ahorros se han estimado partiendo de un análisis realizado junto con la responsable de Calidad de España en el que se ha valorado el impacto que tendría cada uno de los módulos de la herramienta. El impacto se ha asociado con la eficiencia de los recursos usando ofertas de proyectos grandes en los que hay partidas variadas para cada una de las funciones de los módulos. El estudio se ha realizado teniendo en cuenta man-months y euros en la oferta. El ratio de eficiencia media que se ha estimado finalmente es del 15%.

El coste se ha estimado mediante la combinación de las ofertas recibidas por las empresas interesadas en participar en el proceso de licitación. El precio objetivo ha consistido en la media de las ofertas más un 30% destinado a solventar contingencias durante el desarrollo del proyecto más 20.000 € destinados al mantenimiento extra que requerirá la plataforma durante el primer año de uso para afinar la aplicación. Contando con todas estas premisas el precio de la herramienta asciende a 100.000 €.

Para realizar el cálculo de los años de retorno de la inversión se ha realizado un modelo con la cifra de facturación en función de los empleados, los ratios de facturación de cada uno de los rangos de la empresa y la proporción de estos en la empresa. En base a estos parámetros se obtiene una cifra de ahorro que permite estimar en función de la cantidad asumible de reinversión. Este modelo permite, además de evaluar la viabilidad del proyecto para la empresa, evaluar la viabilidad del proyecto para otras empresas que estuvieran en búsqueda de una herramienta de estas características. Esta herramienta tiene un tiempo estimado de retorno de 4 años para empresas de una envergadura de 20 empleados. Por ello a Group IPS el cual cuenta con 200 empleados esta herramienta le resulta muy rentable.

Próximos pasos

El estudio de viabilidad realizado ha permitido plasmar de manera objetiva los beneficios de implementar esta herramienta en Group IPS así como la viabilidad de la misma. Por ello desde la oficina central en Bélgica se ha comenzado a realizar una serie de trabajos previos para el desarrollo de esta aplicación. Cabe destacar que antes del estudio de viabilidad había en marcha varios proyectos de mejora en esta línea para actualizar las herramientas de Group IPS. En

concreto la implementación de un ERP común a todo el grupo (MyERP), un directorio de contactos de clientes y proveedores centralizado (Suppliers List + CRM), un sistema de almacenamiento documental en la Nube (OneDrive) y un gestor del progreso de los proyectos (MyTracker).

Se está realizando una adaptación de la herramienta de control del progreso de los proyecto para que se adecue al nuevo formato propuesto. Estas actualizaciones permitirán agregar tareas más específicas para poder asignar de forma más precisa el trabajo a los distintos recursos. Por otro lado se realizarán una serie de modificaciones destinadas a la mejora de la interfaz de usuario para que resulte más sencillo su manejo.

Por otro lado se ha comenzado a realizar una definición más detallada del gestor de tareas incluyendo propiedades de los distintos campos, relación de los mismos en distintos módulos de la plataforma y un primer planteamiento de la interfaz de usuario.

Una vez concluida esta definición de la parte central de la herramienta se procederá a definir el resto de los módulos e integrarlos a la plataforma de forma progresiva.

Conclusión

El desarrollo de esta nueva plataforma de gestión de proyectos es un proyecto ambicioso y de gran escala especialmente por qué no se encuentra en el ámbito típico de los proyectos de IPS. No obstante presenta una serie de ventajas a corto y largo plazo que hacen del mismo una parte vital del desarrollo de la empresa en los próximos 5 años. Una vez concluido el estudio de viabilidad el cual avala el éxito del mismo parece correcto apostar por el desarrollo de la herramienta. Actualmente el proyecto se encuentra en las primeras fases de desarrollo adaptando módulos existentes para ser vinculados con la herramienta y a su vez desarrollando el módulo central del proyecto para ver los requisitos del resto de los módulos antes de comenzar su desarrollo.

SUMMARY

Group IPS is a Belgic company dedicated to Project Management in the industrial field. Group IPS has a robust methodology of Project Management. Over the last 20 years, this methodology has been tuned to get the size and current maturity. Over these years many templates and trainings have been created as well as the implementation of different programs to obtain better results in planning and design. Nevertheless, the structure of the different documents remains decentralized. This structure forces IPS employees to update information across documents. The update of this data, is performed manually and this becomes a source of inefficiencies and errors. This creates the need to develop a tool to manage projects. The four main goals from for the tool are:

- Combine all tools into one unique platform
- Automatize the update of the information across documents
- Simplify the relationship between the PM deliverables and the documents of each program
- Simplify the planning of resources and task allocation

The purpose of this document is to elaborate a functional definition of the platform to perform a feasibility study of the project and determine the plausible success of its implementation.

For this study the following analysis will be taking into consideration:

- Analysis about Group IPS's methodology and the keys to take into account in the development of the application
- Research on different methodologies of project management to improve the existing one
- Benchmark of different programs available in the market that fulfil the specifications of the platform
- Functional definition of the Overall Project Tool
- Feasibility study
- Next steps

IPS Methodology Analysis

The methodology analysis has been made out of the training documents of the company and with the knowledge obtained in the internal training from the company in the German headquarters. IPS has a document structure with the objective of ensuring the right definition of the scope, cost control, time control and all the description files needed for the erection of the site.

The main documents of the project of project management are the PDS, PDF, OTS and DTS. Inside all of them the main properties of the project are defined:

- PDS: Process Description File, defines the process of the factory. All the production rates and properties (areas, quality specifications, product rotation, production volume, …).
- PDF: Project Definition File, list with all the tasks needed to complete the project (also known as WBS in project management argot). This is the central document for the control of the project. The PDF is the starting point for the elaboration of a budget, planning and even the definition of the procurement packages.
- OTS and DTS: Overall Time Schedule and Detailed Time Schedule, they are the documents that define the timeframes for the execution of the different phases of the project. The OTS focuses on a general overview whereas the DTS consists on a more detailed planning of each of the different tasks to perform.

Once the analysis was done and the main key points of interaction where identified and the strong dependencies among documents could be taken into account. During the process of definition of the tool these considerations will be very important in order to build a coherent database for the platform.

Methodology Update

The upgrade of the company tools includes the update of some of the practices of the company to improve the overall efficiency of the company in project management.

The analysis covered four main methodologies of project management: PMBOK, Scrum, Six Sigma and AACE.

El Project Management Body of Knowledge is the PMI's main book with the basic concepts of project management that need to be known. IPS methodology is certified with ISO 9001 and therefore all this practices are already in use in the company.

Six Sigma is a methodology born in the heart of Japan at Toyota. Efficiency, value chain and erase task that don't provide it are some of the key concepts that are pursue by this methodology. This methodology can be applied at any scale of a business: team, department, office or even the whole company. Since the objective of the tool is to reduce the work by implementing a tool, not by the training of the employees in new practices, it seems like this methodology is more suitable for other project.

Scrum is one of the variants of Agile methodology. This methodology is commonly used in programing environments. This is due to the changing nature of the projects. Although IPS projects are not related with programing, the same philosophy of changing scopes can be applied to project definition phases with the client. That is why the concept of *sprints* applied in Scrum methodology suits well in the definition phases.

The last methodology that has been analyzed has been the AACE methodology for cost control. Group IPS has tools to control the budget of the different project and therefore there is no real need to implement new methods for cost control in this context.

Technology Update

A benchmark has been made out of a big set of project management tools both online and desktop oriented. The tools had to be suited for IPSs needs as well as add value in the project management procedures.

Out of all the programs that where examined, none provided a clear improvement to the tool used in the company. Currently MS Project is being used to create Gantt diagrams. MS Project provides more functionalities and all of them should be explored and used to exploit its potential. MS Project could be used for cost control, progress tracking and scope definition.

There have been to online solution that outstood the rest of tools. Both of them could be interesting to implement the tool with MyTracker, the current tracking system of IPS.

Wrike is an online platform designed for task management. This tool allows the user to easily display all tasks in different arrangements. Wrike also lets the user generate different types of reports to check the status of different tasks. Wrike has an API that would make it suitable for the integration with MyTracker. The main problem with this tool is the high price and the low level of customization it offers.

TeamGantt offers a similar range of functionalities for a smaller budget. TeamGantt on the other hand presents worst connectivity facilities to integrate the service with MyTracker.

After the benchmark none of the applications examined fulfil the range of functionalities required by IPSs tool.

Functional Definition

The functional definition of the platform has center its attention in its basic functions as well as the interactions that all modules should have among themselves. This functional definition has been used to obtain different quotations of some programing companies. The final version of the platform is intended to have a broad spectrum of functionalities. Therefore the current functional definition covers the basic features and will be extended in each of the with the implementation of each module.

Feasibility Study

The feasibility study has been separated in three different parts:

- Savings due to the implementation of the platform
- Costs originated by the platform
- Economic model to study the payback time of the project

The savings have been estimated analyzing each of the modules with the person responsible for Quality Control in the company and studding the impact that each of them would have on the performance on the company. The impact has been calculated using different quotations of the company and applying the efficiency rates to estimate the savings. The study has been made using man-months and and euros. The resulting efficiency ratio is 15%.

The cost has been estimated combining the different quotations received by the companies in the procurement process performed in March. The final estimated price has been done combining the three most relevant offers, adding a 30% reserved to contingencies and finally including 20.000 € for the maintenance of the first year. The final budget has been estimated to be 100.000 €.

The payback time has been calculated using a simple model with the net income of the company as a function of the number of employees. By taking in consideration the efficiency ratio of the platform the expected savings of the platform can be calculated. The parameters of the model are the invoicing ratios, the employees rank structure and efficiency of the platform. Based on these parameters and the rate of reinvestment for the project, the amount of money saved can be estimated and used to calculate the success of the investment.

This model allows also to calculate the payback time for other companies making it suitable for selling purposes for the company.

The tool has a payback time of 4 years for a 20 people office. Group IPS has almost 200 and therefore the tool is very profitable.

Next Steps

The feasibility study has allowed to reflect in a neutral way the benefits of the platform for the company as well as its profitability. For this reason, Group IPSs headquarters have decided to start performing preparatory works to adapt the current structure of the technological infrastructure of the company to host the new platform. Before the project started there where some projects of smaller magnitude to boost IPS through technology. The implementation of an ERP system (MyERP), a general directory for contacts (Suppliers List + CRM), a unified storage system (OneDrive) and a project tracker (MyTracker).

The tool for project tracking is being upgrade to host the new platform. This upgrades will allow to add individual subtasks to the main blocks to have a more precise control of the workload. On the other hand, there will be several modifications to improve the user interface and to help the user on their tasks.

On the other hand, a deeper functional description for the task manager has been started including properties such as properties of the fields, relationships among them and a rough layout.

Once this definition of the central part of the platform is concluded, the rest of the block will be defined and implemented.

Conclusion

The development of this new platform for project management is of great magnitude because is not within IPSs comfort zone. Nevertheless, it provides several advantages both in the short term and long term which make it essential for the development of the company in the next 5 years. Once the feasibility has been completed and taking in consideration the positive result it seems that the project should be pursued. Currently the project is in the first stages of the development updating some previous modules and defining the following ones.

CONTENT

FIGURE INDEX

TABLE INDEX

UI ANEX FIGURES

INTRODUCTION

Introduction

Group IPS (Industrial Project Services) is an engineering company that performs industrial projects from a feasibility phase to definition, erection and closing. In its 23 years of history IPS has done over 500 projects worldwide. The company has over 200 engineers. IPS has experience in many fields such as metallurgy, automation, chemistry, pharmaceutical, food, construction and many others. The work of IPS is backed by a robust methodology of Project Management that's able to adapt to the necessities of any project to guarantee an effective control of the project's resources. Over the last years and with the rise of new technologies IPS has been exploring new tools to improve efficiency and control over the projects.

The next step in this chain of improvements is to design a new platform that will host all the important data of the project and will help IPSs employees on their daily work.

The tool will take advantage of a database structure to combine information in different views. This implementation will minimize the amount of work spent on updating information and will be dedicated to the project itself.

I. IPS METHODOLOGY ANALYSIS

IPS methodology Introduction

The purpose of this chapter is to analyze the main procedures and documents of IPS methodology to take them in to account in the development of the Overall Project Tool. This chapter will take in consideration all the duplicated data across documents and will propose new handling procedures to optimize the platform outcome.

Process Description (PD)

Group IPS focusses on Industrial Projects, from conceptual design to erection. The most important part when developing a project for a client is understanding the client's needs. The function of the Process Description is defining in a document all the specifications and requirements of the project and reaching an agreement with the client in what are these specifications.

In Group IPS there isn't a main specialty regarding industries. That's why the PD also helps the Project Managers at IPS understand how the process works and what are the different areas that will be built in order to successfully plan and execute the whole project.

The main goal of the PD is to describe the basic data and goals of the project. The PD is the document that puts in common the vision of the project owner, the project team and the customer. This document enables customer to evaluate how the product will be at the end of the project. The PD must be explicit in order to record decisions made. The PD refers to graphic documents such as the P&Ids or the Layouts.

The PD should include information such as:

- The product mix
- The incoming products
- The processes
    - Process layout
    - Process description (parameters)
    - Production time table

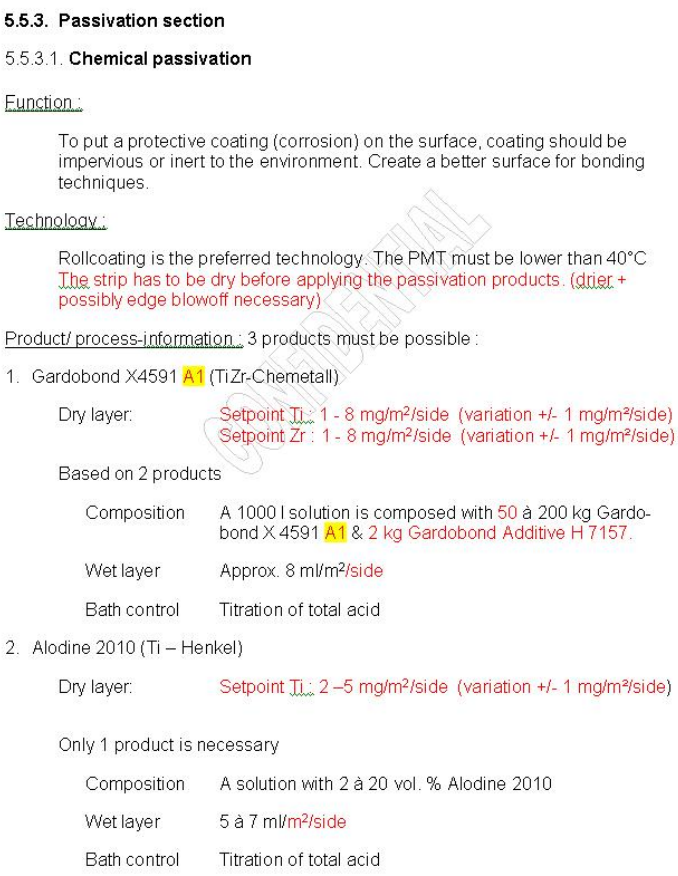
- The utilities (fluids, power, …)
- The co-products
- The waste products
- The basic environmental criteria (water, air, noise)
- The capacity
- The production requirements (sequences in big plants, production cycles, stops, preventive maintenance)

Characteristics of the PD

The PD is currently a Microsoft Word document written (or revised) by the Project Manager (PM). The PD should have different Chapters defining the following aspects of the project:

- The product mix
- Incoming products
- The definition of the process
- The capacity
- Production time table
- Production requirements
- The scope
- Electrical scope
- Utilities Scope
- Scope of services

On the document there must be a record of all the versions of the document. Figure 1 PD example shows an example of the looks of the PD.



5.5.3. Passivation section

5.5.3.1. **Chemical passivation**

Function :

To put a protective coating (corrosion) on the surface, coating should be impervious or inert to the environment. Create a better surface for bonding techniques.

Technology :

Rollcoating is the preferred technology. The PMT must be lower than 40°C
The strip has to be dry before applying the passivation products. (drier + possibly edge blowoff necessary)

Product/ process-information : 3 products must be possible :

1. Gardobond X4591 A1 (TiZr-Chemetall)

   Dry layer: Setpoint Ti : 1 - 8 mg/m²/side (variation +/- 1 mg/m²/side)
   Setpoint Zr : 1 - 8 mg/m²/side (variation +/- 1 mg/m²/side)

   Based on 2 products

Composition	A 1000 l solution is composed with 50 à 200 kg Gardobond X 4591 A1 & 2 kg Gardobond Additive H 7157.
Wet layer	Approx. 8 ml/m²/side
Bath control	Titration of total acid

2. Alodine 2010 (Ti – Henkel)

   Dry layer: Setpoint Ti : 2 –5 mg/m²/side (variation +/- 1 mg/m²/side)

   Only 1 product is necessary

Composition	A solution with 2 à 20 vol. % Alodine 2010
Wet layer	5 à 7 ml/m²/side
Bath control	Titration of total acid

Figure 1 PD example

PD flaws

The PD is a document that has to be revised several times by the PM and the client. The content in the PD is mainly text and images. There is a significant amount of time used by the PM in taking care of the format of the document and updating information that can be automated such as title, date modified, last revision... The structure and the format should be the same across projects.

PD integration with the OPT

The integration of this document with the OPT must be performed in a way that all the efforts of the PM must be oriented towards creating content, leaving formatting,

exporting and version tracking to the OPT. The OPT could have a Latex oriented software that would generate the output document automatically with format and labels.

Part of the process description could include some of the main block of the PDF, therefore there should be some way of indicating which chapters in the PD must be included and updated in the PDF. This will have to be revised during the development of the PD tool.

Project Definition File (PDF)

The PDF is known in Project Management as the Work Breakdown Structure (WBS). The purpose of this document is to list all tasks that have to be performed in order to finish the project. The document's main goals are:

- Identify the scope in detail
- Define responsibilities
- Help in decision making
- Single source of information
- Is the key document for:
  - Budget
  - Planning
  - Communication

The PDF can also be used to have a control in the different packages that will be performed in the procurement phase, the contractor that perform each task and many other attributes that can be used according to the project.

Characteristics of the PDF

The PDF is a spreadsheet document with all tasks written in a column and different attributes of the task in the rest of the columns. Although each project has its own adaption of the PDF, some general rules can be applied. Figure 2 PDF general structure shows a valid example for the general structure needed in a PDF.

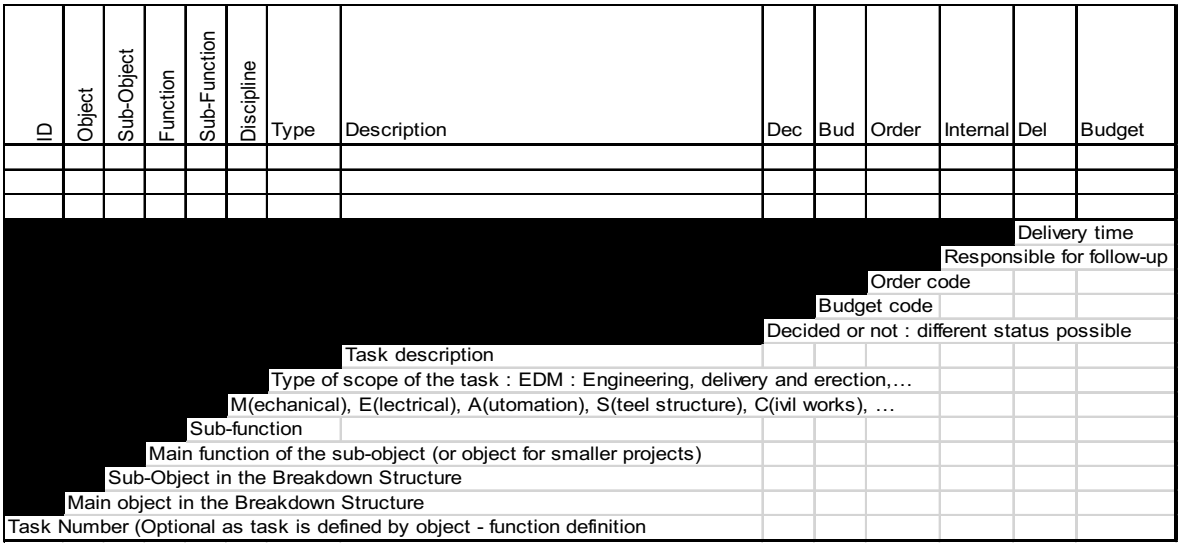


Figure 2 PDF general structure

Asides from this structure, every project might have its particular features. The PDF is the document in IPS Methodology with the highest rate of change in the life of the project.

PDF flaws

The development of a PDF has two main phases: defining all tasks and their attributes and linking all the properties of the individual tasks (like time or cost) with the parent task.

This recurrent activity takes a lot of time from the PM whenever the scope of the project changes. The implications of a change in scope can affect in a cost changing or in the update of the whole PDF because the references of the formulas from a specific cell might not exist anymore.

PDF integration with the OPT

The approach of the OPT is going to be database based. The structure of a PDF calls for a database structure. There should be a predefined template of the PDF like the one that already exists in IPS with different options to adapt it to the project. The relationship between the tasks and the parent tasks should be direct, the cost of the

parent task should be the sum of the sub-tasks and the duration should follow the same thought process.

The PDF should include the option of assigning scheduling properties to each of the tasks of the database and synchronize it with the time schedule of the project.

Some projects might require a subdivision of projects within them. For that reason, there should be an option to divide the project in to subprojects, allowing them to have their own documents, all linked with the main project.

Layout

The main goal of the layout is to identify the location of the different elements in the plant as well as to solve space and execution problems and between different disciplines. The layout helps the PM to identify the different aspects of the plant:

- Flows of the plant
- The distribution
- Future possibilities for extension

Some key concepts when defining the layout are:

- Accessibility for operation and maintenance
- Safety concepts
- Keep it simple (normally the cheapest solution)
- Concept for all interfaces (utilities & power)

Characteristics of the Layout

The layout is a graphic document that enables the representation of the final result. There are many different options for developing the layout. The final document is usually a .pdf exported from a CAD software.

Layout flaws

When developing the layout for the project there are many versions, options and revisions that requires specific document management. There are solutions already available by CAD software companies.

Layout integration with the OPT

The main feature of the layout interface should be a document manager that would help track the development of the different versions and revisions.

A secondary feature that could be implemented is a tagging system in the CAD editor that would help the PM associate areas to fields in the PDF obtaining quantities associated with the layout or additional features like enabling the tracking of the tasks from the punch list.

P&ID

The P&ID is the schematic drawing of the project. The P&ID is a detailed graphical representation of the process including the hardware and the software (e.g., piping, equipment, instrumentation). It is necessary to design, construct and operate the facility. It represents the design, the philosophy used, the assumptions, the constraints, etc.… It defines the connections of the different equipment, the inputs and outputs of the process, ratios and consumption rates.

Characteristics of P&ID

The P&ID involves the creation of different steps such as:

- User Requirement Specification
- Summarizing the goal and collecting of the required data.
- Preparation of a flow chart
- Validation of the flow chart
- Preparation of the P&ID
- Validation of P&ID

- Preparation of several lists

All this concludes with different drawings containing the flow charts, P&IDs and the list of all components of the project.

P&ID flaws

The P&ID has a lot of documents interrelated. Also the list of components is complex to generate.

P&ID integration with the OPT

The P&ID has two approaches (same as the layout). It can be seen as a document manager to keep track of all the versions.

There could be a CAD solution with an IPS library of instrumentation objects with properties that will allow the draftsman to keep track of the equipment used in the P&ID and their properties. This CAD application would generate the list with all equipment and could have specific functions to calculate recurrent properties such as pressure drop or power consumption. The block will have PDF tags to include the equipment in the PDF if necessary.

Overall Time Schedule (OTS)

The OTS is the general planning of the project. The main milestones and durations of the project are shown in the OTS. With a quick glance the PM can tell the client when are due the different deliverables of the project, by when the procurement must be finished and when do the orders have to be placed to finish the project on time.

Characteristics of the OTS

The OTS is a bar diagram that shows the information of the main blocks of the project such as main orders, civil works, utilities, commissioning... The OTS can be

performed in many software's but is mainly done in MS Project or Primavera using the OTS template from IPS.

The blocks from the OTS are related to the main chapters in the PDF.

OTS flaws

IPS's OTS template is difficult to modify. Changes need to be done line by line.

OTS integration with the OPT

When designing the OTS part of the OPT there should be an implicit link between the information in the PDF and the information required by the OPT. By adding specific attributes for the OPT such as category or milestone the OTS could be instantly generated without the need for any additional work by the PM.

Evolutive Reporting

The main target of the Minutes of Meeting is to record the decisions and tasks from the meetings and assign responsibilities. This bounds both parties in the decisions made in the meeting for future decisions.

The meeting reports should include the following:

- Topic of the meeting
- Place and time
- Participants and non-present invited persons
- Moderator and secretary
- Agenda
- Last reports and results according the action plan
- Discussion according the agenda
- Action plan (incl. Task-description, person in charge, deadline, owner, …)
- Next meeting
- Mailing list

The Evolutive Report allows the PM to take track of the minutes in a dynamic way. The tasks are maintained until they are completed and afterwards the no longer valid information is removed.

Characteristics of the Evolutive Reporting

The Evolutive Report consists in a spreadsheet with all the minutes of the meetings. By adding tags like Archive or Done, the PM can hide irrelevant entries leaving the useful content in the report.

Evolutive Reporting flaws

The formatting of the spreadsheet is time consuming. Some of the filtering options are not fully functional.

Evolutive Reporting integration with the OPT

There should be a Reporting Tool integrated with the OPT to allow the PM do the Reports of the project.

There should be an option to link the tasks assigned in the report to a task manager in the OPT to simplify the organization of the PM.

Detailed Time Schedule (DTS)

The DTS is the detailed planning of the project. All the tasks defined in the PDF should be included in the DTS allowing the PM to obtain a reliable estimation of the finishing date of the project. By using the DTS the PM can locate which tasks are being late, which ones are in the critical path and the ones that can be relocated without affecting the duration of the project.

Characteristics of the DTS

The DTS is a Gant diagram that shows the relationship between the individual tasks of the project and how they affect the evolution of the project. The DTS can be performed in many software's but is mainly done in MS Project.

The blocks from the DTS are related to the tasks in the PDF, after all the tasks from the PDF are situated in time and therefore must be reflected in the DTS.

Actually in IPS methodology there are two DTSs in IPS, DTS1, associated with the time schedule of the team members of the project and DTS2, which defines the schedule of the different contractors, once they are contracted.

DTS flaws

The main problem with the DTS is the duplicated information with the PDF. Once the tasks are defined in the PDF, the DTS should be generated automatically without any extra work from the PM.

DTS integration with the OPT

When designing the DTS, there should be an implicit link between the information in the PDF and the information required by the DTS. By adding specific attributes in the PDF such as due date or milestone the DTS could be instantly generated without the need for any additional work by the PM.

The DTS1 will also be associated with the personal schedule of each team member allowing them to track their hours and progress directly with the OPT.

Once the Offer by a contractor is approved, a DTS2 will be automatically integrated into the project. Modifications can be submitted after this and will have to be approved by the PM to be updated.

Procurement

Procurement is one of the best practices performed in IPS. For that reason the Procurement part of the OPT should be adapted to the needs of IPS to maximize the performance of the company.

Characteristics of Procurement

Procurement is the procedure by which IPS evaluates different contractors for specific packages and gives a final recommendation to the customer. The procurement tasks involve the submission of different documents for information and for the bidding process. This documents are:

- Offer
- Contract
- Layouts
- Quality Manual
- Technical specifications

Procurement flaws

The procurement phase has two main activities that are very time consuming: document submission tracking and the bidding process. This makes the PM to pass through different stages that require constant updating of the documents.

Procurement integration with the OPT

The procurement tool will allow the PM and the contractors to have an easy way of keeping track of all documents, drawings, bidding through the application.

It will be necessary to consider online access for the contractors to simplify the job of the PM of submitting documents and receiving them and also the comparing part of the offers.

The OPT procurement tool should permit contractors to submit and fulfil all required documentation online with the minimum exchange of files.

There will be an extensive research on the different tools available on the market and the integration of one of this tools with the main application.

Contact List

Group IPS is involved in projects with different clients. This creates the necessity of using a contact list in each of the projects. The contact list allows everyone involved in the project to have the contact information of the people that work on the project.

Characteristics of the Contact List

The Contact List has many fields to identify each of the contacts. This fields are typically:

- Name
- Company
- Job description
- Phone number
- E-mail
- Comments

The Contact List also includes the different contractors in the project.

Contact List flaws

The Contact List is a very simple document. It doesn't have any major flaws.

Contact List integration with the OPT

The Contact List in the OPT should be included in a way that from the interface the user can send an email to a contact or to a list. The OPT will feed from this document to send updates of the documents or to notify contractors of the new procurement deadline.

In order to make the tool cooperative, contractors from all projects will be updated into a common database of contractors with different fields to allow an easy access for future references. Figure 3 Contact List example shows an example of the looks of the contact list.

IPS SPAIN
Group - IPS

No	Empresa	Nombre	Puesto	Telefono	Email	Estado	Comentarios
1	Euroquimica	Antonio Picado	CEO	925 545 000			
2	Euroquimica	Juan Antonio Gutierrez	Responsible de Producción	696 799 792	juanantonio.gutierrez@euroquimica.es		
3	Euroquimica	Teodoro Toledo	Responsible de Compras	925 545 000	teodoro.toledo@euroquimica.es		
4	Euroquimica	Maria Flores	Comprador	925 545 000			
5	Euroquimica	Marcos Pascual	Ingenieria EQ		marcos.pascual@euroquimica.es		
6	Euroquimica	Jose Juan Hernandez	Responsable de Calidad		jjhernandez@euroquimica.es		
7	Euroquimica	Vicente	Encargado de Mantenimiento		[illegible]@hotmail.com		
8	IPS Spain	Juan Sanchez Chaver	Account Manager	637 599 560	juan.sanchez@group-ips.com		
9	IPS Spain	Begoña Soto	Piloto de proyecto	627 920 939	begona.soto@group-ips.com		
9	IPS Spain	Juan Juarez	Project Manager	674 254 061	juan.juarez@group-ips.com		
10	IPS Spain	Alvaro Perez Bello	Ingeniero	91 525 52 33	alvaro.perez@group-ips.com		
11	Stanley	José Paniagua Pedro		696 940 279	jose.paniagua@niscayah.es		Control de accesos
12	Securitas Seguridad España, S.A	Raúl Vázquez Robledo		699 501 411	raul.vazquez@securitas.es		Control de accesos
13	Gunnebo	Jaime Rico		619 796 179	jaime.rico@gunnebo.com		Control de accesos
14	Estopcar	Juan Luis Calvo		619 266 791	juanluis@estopcar.com		Topografo
15	Carlos Tavira	Carlos Tavira		619 410 142	carlos.tavira@hotmail.com		Topografo
16	Prefire	Marc Pérez		695 405 204	marcperez@prefire.es		PCI
17	Securitas Seguridad España, S.A	Daniel Herrera Alvarado		696 01 69 36	daniel.herrera@securitas.es		PCI_Enviado por SCI ya que solo trabaja en Barcelona y alrededores
18	OCA ICP	Jose Herrera García		917.994.600	jose.herrera@ocaicp.com		Solo aprueban proyectos, no te hacen la ingeniería.
	OCA ICP	Joaquin Bernardino			joaquin.bernardino@ocaicp.com		
19	Energética Manchega	Pedro Pablo Sanz Gea		915.520.642	info@energeticamanchega.com		Ellos hicieron el proyecto de API de Illescas
20	Orbita	Carlos Marco Martínez		674.505.946	cmarco@orbitaingenieria.es		Mandan el presupuesto hoy
21	Ileber	Jesus			jesus@ileber.com		No estan interesados
22	Quimel	Alberto Culebras de Diego		606.566.120	a.culebras@quimel.es		No estan interesados
23	Mecalux	Isaac Hernandez Agüera	Dpto Operaciones	690.604.604	ihernandez@mecalux.com		c/ Julio Palacios 14 - Pol Ind Leganes
24	Mecalux	Eduardo Lozano de la Fuente	Jefe de Equipo	690.995.919	elozano@mecalux.com		
25	Cosain Fire	Juan Antonio Tejero	Dpto. Comercial - Zona Centro	620 944799	jatejero@cosain.com		
	SABADELL	OLIVIA ARANTZAZU	Directora Seguros de Empresa/ Dirección Territorial	902 030 255 (Ext 57541)	fernandezarantza@bancsabadell.com		

Figure 3 Contact List example

Quality Plan

The Quality Plan contains all procedures needed to ensure Quality within the project. It is essential for the correct execution of the project. The Quality Plan has two main goals:

- Ensure that the project is being managed, developed, and deployed in a sound and reasonable way.
- Ensure that the project deliverables meet the quality levels that are expected from them.

Characteristics of the Quality Plan

The Quality Plan has many chapters explaining the organization and the procedures of the project. The Quality Plan should be developed by the PM. The Quality Plan contains the following contents:

- Safety
- Organization of the team
- Standards, laws, payments and specifications
- Management of Documentation
- Quality
- Coordination
- Reporting and follow-up of advance

Quality Plan flaws

The Quality Plan tends to have the same structure in all Projects. The process is repetitive and should be standardized with a template.

Quality Plan integration with the OPT

There should be a Quality Plan template in each language to help the PM to easily elaborate a Quality Plan for the project based on IPS's standards.

White File

The White file is the main deliverable in a project definition. It contains the latest revision of the different documents of the project. The White file should be available to the client.

White File Structure

Process Description

The latest version of the PD should be included to allow the PM check with the client the current status of the design

PDF

The latest version of the PDF should be included in the White File to check with client if the tasks stated in the PDF are correct.

OTS

The OTS serves as a time guideline through the project. It should be included in the White File to serve as a reference.

Layout

The layout is the visual representation of the project. It is necessary to included it in the White File to help understand different parts of the project.

P&ID

The latest version of the P&ID should be included in the White File to allow the client and the PM discuss the latest modifications.

DTS

An updated version of the DTS must be in the White File to show the progress done since the last meeting and to provide visual information about the current situation of the project.

Quality plan

The Quality plan contains the guidelines with the communication protocols and the use of the documents for the client or the contractors.

Last weekly report

The report from the previous weekly meeting should be included in the White File to provide a summary of the content from the previous meeting.

Last steering report

The report from the previous steering meeting should be included in the White File to provide a summary of the content from the previous meeting.

Characteristics of the White File

The White File is a printed version of all the documents of the project.

White File flaws

The White File is time consuming. Updating it involves a lot of time of printing and substituting documents.

White File integration with the OPT

The action of printing all documents for the White File should be automated in one action button. There should be an ecofriendly option of printing only the pages with different information that the previous version. An option for creating an executive summary out of the documentation should be implemented to give a quick overview of the state of the project.

Overall Document Management

Group IPS has a folder structure that remains constant among projects. This structure helps to facilitate the collaboration among team members.

Characteristics of the Document Structure

The document structure follows the following order:

0. Whitefile
1. Organization
2. Quotations
3. Orders
4. Internal Communication
5. External Communication
6. Documents
7. Reference Documents
8. Subprojects
9. As Built

Document Structure flaws

The main flaw identified with the Document Structure is the fact that is editable by anyone. This allows inconsistencies between projects and can end in different structures on future projects.

Document Structure in the OPT

The structure of the project will be based on the same document structure that lays within IPS methodology. The tool will create a structure similar to the one that is currently in use and will generate the documents from the database. This centralized standard structure will help the collaboration among team members. Since the tool will be integrated with the mailing system this will allow to keep track of the Document Transfer to contractors and other recipients.

Quotations & Project Tracking

The Quotations are the first milestone in all projects. After the Quotation is approved the project officially begins. When a Quotation y approved by the client, a project

tracker is created with all deliverables and tasks of the project. With this project tracker each of the different resources of the project obtain tasks assigned to them and can start working and reporting progress.

Characteristics of Quotations & Project Tracking

Quotations are made either in a spreadsheet or directly in MyTracker. MyTracker is a custom developed tool, which permits the control of the internal resources, their availability and the quality of the project. The tool was created in 2013 and is still being improved. After the Quotation is approved, MyTracker creates a Project Tracker with an automatically assigned project number.

Quotations & Project Tracking flaws

The automated process of the creation of the Project Tracker makes difficult the inclusion of the thoughts of the PM in the creation of the offer. There should be a review option by the PM to check with the offer strategy.

Quotations & Project Tracking integration with the OPT

The Quotations and the Project Tracking tool are the core of the management part of the tool. The OPT will allow to keep track of the tasks of the offer and the subtasks with different administration options. Each employee will be able to make adjustments in the tasks assigned to them to have a better control over the resources of the company.

The project tracker will be linked with MyTracker integrating the main milestones and tasks into the project.

II. METHODOLOGY UPDATE

Methodology update Introduction

Project Management has been around for many years. The beginning of Project Management can be dated back to 1700 with Christopher Wren although it has been applied systematically since the 50's. Since then new ways of Project Management have aroused.

This chapter analyzes different methodology alternatives to boost IPS methodology in the OPT implementation. The analysis is going to focus on Six Sigma Methodology, PMBOK, Scrum and AACE.

Six Sigma

In order to understand Six Sigma methodology applied to Project Management some research on the internet and some books has been performed.

Introduction to Six Sigma

Six Sigma is a systematic approach that helps companies obtain, maintain and maximize success. Six Sigma is a customer oriented discipline that uses data and statistic analysis to understand what the needs of the customer are and improve business processes.

By using Six Sigma the company can benefit in the following areas:

- Cost reduction
- Productivity improvement
- Market-share growth
- Customer retention
- Cycle-time reduction
- Defect reduction
- Culture change
- Product/service development

Six Sigma gathers different methodologies such as TQM, CQI, BPR and many others. From that point of view people tend to be reactant as to whether Six Sigma add any substantial value. This are some of the aspects that make Six Sigma different from other PM methodologies.

- Six Sigma is a set of best practices and skills that can be adopted by any business activity to maximize the impact of the company's efforts
- Six Sigma methodology can be applied to a project, a department or the entire company
- It focuses on non-manufacturing activities where there is a lot of margin to improve the company's efficiency (normally 70%)
- Six Sigma motivates and inspires employees making them feel a part of the company

Six Sigma provides a consistent way to track and compare performance to customer requirements. Six Sigma is a data-driven methodology that provides the PM with tools and techniques tools to help a manager be successful in all aspects of the project.

Six Sigma is complementary to other methodologies.

Six Sigma application to IPS methodology

Six Sigma is focused on improving the efficiency of the company. Group IPS has some clear inefficiencies in its methodology tools that are being revised. Appling Six Sigma to IPS Methodology should be done when IPS efficiency ratios are higher in order to maximize the outcome of Six Sigma. Six Sigma is also oriented towards employee practices therefore if IPS decides to implement Six Sigma methodology it wouldn't be only tool-oriented but also training-oriented.

Six Sigma could benefit IPS in:

- Improving back-office efficiency
- All employees will have a set of best practices independently of the department

Six Sigma should not be implemented now for the following reasons:

- Group IPS main problem lays within redundancies in documents and procedures
- The implementation of Six Sigma requires many hours of training among the whole company. The benefits provided by Six Sigma methodology do not back this effort
- Group IPS is going to experiment a big change in work procedures. If this change is combined with Six Sigma it will be difficult to evaluate if the improvements in the company are because of Six Sigma or due to the implementation of the OPT

After evaluating all this reasons Six Sigma should not be implemented now in Group IPS.

PMI – PMBOK

The Project Management Body of Knowledge is a collection of knowledge regarding project management done by the Project Management Institute. In the PMBOK there are references to many PM disciplines such as planning, cost control or risk management. In order to update IPS methodology standards first it is necessary to check in what particular areas IPS is using adequate tools and where is IPS lacking resources for managing projects. Table 1 Comparison PMI/IPS shows a comparison between PMI standards and Group IPS's tools.

Table 1 Comparison PMI/IPS

PMI	Group IPS
Project Integration Management	Masterplan and Project Preparation
Project Scope Management	PDF
Project Time Management	DTS, OTS & Project tracker
Project Cost Management	PDF
Project Quality Management	Quality Plan
Project Human Resource Management	Project tracker & Timesheets
Project Communications Management	Evolutive Reporting & Quality Plan
Project Risk Management	***To be developed***
Project Procurement Management	Procurement Methodology

Risk assessment and risk management have been implemented in many IPS projects following customers methodology however there isn't any specific risk plan procedure inside IPS methodology.

The development of this Risk Management procedure should be first done and then implemented with the OPT.

Agile methodology - SCRUM

In the 80's the goals for project management where established to define the objectives of a successfully finished project:

- The project is executed in the planned time
- The project is within budget limits
- The project meets the scope defined by the client
- The project meets the quality criteria defined by the client

Throughout the 90's, with the increment of software development project, some questions about the definition of success within a project where raised. That's how Scrum methodology or Agile methodology was born. Agile methodology focuses on redefining methods to improve software development. Agile methodology extremely values the following aspects in the development of a project:

- The interaction among individuals above processes and methods
- A working product over extensive documentation
- The collaboration between client and the team beyond the contractual agreement.
- A quick response against change over a strict follow of the planning

IPS should focus on the last two taking in consideration the nature of IPS's projects.

Collaboration between client and team

Agile practices are client oriented due to the undefined nature of the products. They work well in an environment where defining characteristics of the project to soon might add less value than having an open mind about them and been open to change

them. The added value of this methodology is the ability implement directly the comments of the client on the project itself.

Agile methodology also focuses in the integration of the employee in the client's team and the client into the project team. In order to apply this aspect, agile methodology suggests that both the client and the project team should work together in the project instead of the project team directly working for the client.

Prioritize the quick response over following a specific planning

This model works well on unstable environments and with the factor of continuous change and fast evolution. The key procedure in Scrum methodology is to act fast and check with the client. If the client asks for a big ball instead of working for three months on a huge ball build a small ball on one week and check. That way the client can comment not only on the size but also on color and weight. This methodology should be applied during the project preparation phase.

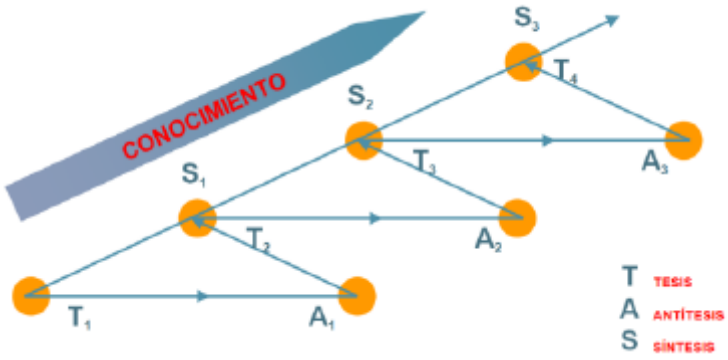


Figure 4 Learning process in SCRUM (Palacio & Ruata, 2011)

Scrum

SRUM methodology is mainly used in software development but it can be synthesize and reused for other project management purposes. The main feature of SCURM methodology are what it's called a "sprint". Sprints are short time intervals in which the team sets goals to achieve and at the end of the sprint the team meets and evaluates the outcomes of this goals. This functional activity applied to Industrial

Projects Preparation will help understand the needs of the client in small intervals. In Figure 5 Scrum process the sprint working cycle is shown.

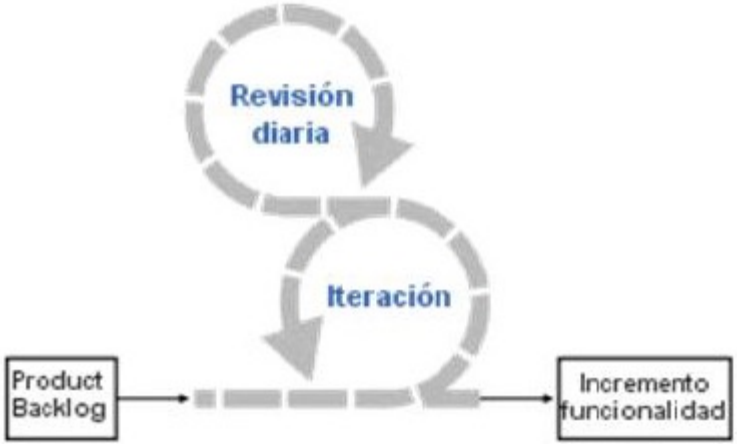


Figure 5 Scrum process (Palacio & Ruata, 2011)

The other aspect of SCRUM that is appealing for project management is the task management tool that is used. The tool is called Kanban (shown in Figure 6 Kanban example). It has been used in other disciplines such as manufacturing by companies like Toyota. It provides all team members a clear view of the project tasks that are still pending, the responsible person for this task and other aspects that are suitable for multidisciplinary projects.

Figure 6 Kanban example

The task tracking is already used in IPS methodology. Scrum methodology can be used to improve the visual interface of the OPT.

Association for the Advancement of Cost Engineering and TCM

The AACE was founded in 1956 by 59 cost estimators and cost engineers. The association provides various guidelines to walk through cost control in engineering. The guidelines help the project manager to have a systematic approach of cost control during the lifetime of the project (Hollmann, AACE International - About Us, 2015).

These guidelines are oriented towards:

- Business and program planning
- Cost estimating
- Economic and financial analysis
- Cost control
- Program and project management
- Planning and scheduling
- Cost and schedule performance measurement
- Change control

All these guidelines are explained in the Total Cost Management Framework. This manual takes an effective approach into planning and controlling resources, costs, profitability and risk (Hollmann, Total Cost Management Framework an Integrated Aproach to Portfolio, Program and Project Management, 2006).

Taking in consideration the expertise of IPS in this field it doesn't seem appealing to study and adapt these guidelines into IPS's methodology.

Conclusion

Although there are many different forms of PM all pursue the same goal, keep control over the project. IPS's methodology can be optimized in many ways but by comparing it with different methodologies it can be seen that the basics are covered. Some features from Scrum can be implemented in the platform to maximize its

performance. The rest of methodologies don't provide a clear improvement to the techniques used currently.

III. TECHNOLOGY UPDATE

Technology update introduction

One of the main goals of the thesis is to implement a project tool for IPS. One of the solutions could be to buy one of the many software that currently exist.

This chapter will analyze different alternatives to boost IPS methodology from a software perspective.

The research will be on both online and offline software solutions.

Conventional Software

Rational Plan

Rational Plan is a project management tool that helps project managers manage different projects at the same time. It seems suitable since it can be installed in IPS's server and provides many project management features that could make it an excellent tool for IPS.

Some of the features included in this product are:

- A common repository for all the projects (instead of sharing files, common in the standalone versions, the users will work on the same projects which will be stored on the server)
- Real concurrent access (users will be able to concurrently make changes into the same projects, even tasks, etc.)
- A versioning system for tracking changes into the projects
- A way for the resources to see their assignments in the web browser, update tasks completion (on tasks where they are involved, etc.)
- Detailed access rights for the users (which user/customer can see/change what, etc.)

- No need to install software on users' machines (it can be used locally).
- Option to see the Gantt and manipulate tasks directly from the browser window.

Budget

There are two options to buy RationalPlan:

- Server license: the cost to install RaionalPlan on IPS's server would be 350$, it comes with a Project Manager, one Stakeholder and 5 resource type users. Apart from that it is required to buy one Multi License (98$) per Project Manager. Aside from this fees RationalPlan has the option of buying separate StakeHolder licenses (32$) and a limited license (24$) only to see tasks and update the status.
- Cloud Server: This has the same functionalities but it runs on a RationalPlan web server. It costs 94$ per month and it includes as many users as needed.

Buy implementing the fixed cost option with the same corporate structure as in the rest of the offers (200 employees) the costs would rise up to 19.852 $ in one payment.

On the other hand, by acquiring the online server the related ROI would be 211 months or 17 and a half years.

Summary

Rational Plan would be an excellent substitute for MS Project regarding cost and functionality. The only problem it presents is that the licenses work on an online server, therefore it requires internet connection.

Asta Powerproject (Proposal from IPS Bulgaria)

Asta Powerproject is a management software for construction and engineering professionals. It is a project, portfolio and resource management solution suitable for all sizes and all industry sectors and it is a useful organization tool for anyone involved in the delivery of a project.

Range of functionalities

- Like any other management software, it can be used for preparation of accurate schedules and budgets, the key advantage is that it can be connected interactively with the BIM (Building Information Model) project of the building. The changes of any of the planning process components is reflected automatically in all others components and thus minimizing the risk of mistakes. It can easily visualize every step of the process as well as all possible scenarios if the time/cost parameters variations.
- The software has online platform component and the project database can be used by multiple users in different locations around the world simultaneously – planners, contractors, clients, etc. for project coordination, exchange of information, control of the construction process. All team members have access to view reports, update projects, report progress and record expenses wherever located, 24 hours a day.
- The software is suitable for companies with multiple simultaneously running projects – it is a useful tool to track the company involvement at any given time and redirect forces wherever needed. It can optimize the project resources to maximize profitability. Therefore, it is possible to plan activities in any time unit – from minutes to years and create calendars for individual team members, departments or the whole company.
- It is compatible with any other project management software (Primavera, MS Project) and other applications such as accounting, HR and BIM.
- The users' level of access is easily organized in a way that everyone involved is fully informed according to their needs.
- The programs have the possibility to set up project templates to speed-up the planning process and ensure that organizational methodologies are met.

For additional information here the product's website:

http://www.astapowerproject.com/software/asta-powerproject/

And a short video presentation:

https://www.youtube.com/watch?v=kV0KPedxgD4

Product types

Asta Powerproject Client

Asta Powerproject is a project management software tool which is used to manage Architecture, Engineering and Construction projects of all types and sizes. It is used to manage all aspects of construction and engineering projects such as producing tender plans, managing the contract program reporting progress to clients and management, controlling costs and resources, reducing the risk of delay and disruption, and scheduling that reflects exactly what happens on site within the plan.

Asta Powerproject Enterprise

Asta Powerproject Enterprise is the core Asta Powerproject project management system on central server. It combines multiple users of Asta Powerproject who want to work on the same project or program of projects, in real time, at the same time. It is designed for larger construction projects. It combines Asta Powerproject, professional project management software for construction, with a central database that holds all project information and allows multiple users access to a single project plan. Asta Powerproject Enterprise also provides quick and easy progress reporting from site, together with customized reports on any aspect of the project.

Asta Powerproject BIM

Asta Powerproject BIM extends the functionality of Asta Powerproject providing the possibility to create a flexible, 4D-enabled planning platform to share information.

Licenses type

There are two available license types, with the option to share licenses between team members for increased cost-effectiveness:

Named License – that is the simplest license where the software can be accessed on a specific machine only. However, the license can periodically be transferred to another machine if required. The project data is stored as a single file which can be saved on a local memory disk or a shared location.

Concurrent License - The software can be installed on any number of machines which all point to a central machine on the internal company network where the Asta license server is installed. The license server counts how many people are using the software and ensures that this number does not exceed the licensed quantity at any

one time. A concurrent license allows multiple people to work on the same project file if that file was saved into a shared location (such as a network drive or cloud storage) but only one person would be able to edit it at any one time. Concurrent licenses can also be temporarily loaned for a predetermined time to a designated machine, allowing Asta Powerproject to be used when offline from the company network.

Budget

Standalone Software				
License Name	**Unit**	**Unit Price**	**Yearly Maintenance**	**Total Price**
Asta Powerproject Client - Named License	1	€ 1,395	€ 279	€ 1,674
Asta Powerproject Client - Concurrent Licence	1	€ 2,075	€ 415	€ 2,490

Enterprise Software				
License Name	**Unit**	**Unit Price**	**Yearly Maintenance**	**Total Price**
Asta Powerproject Enterprise Client - Named License	1	€ 2,100	€ 420	€ 2,520
Asta Powerproject Enterprise Client - Concurrent Licence	1	€ 2,750	€ 550	€ 3,300

Standalone Software				
License Name	**Unit**	**Unit Price**	**Yearly Maintenance**	**Total Price**
Asta Powerproject Client BIM - Named License	1	€ 2,150	€ 430	€ 2,580
Asta Powerproject Client BIM - Concurrent Licence	1	€ 3,330	€ 666	€ 3,996

Enterprise Software				
License Name	**Unit**	**Unit Price**	**Yearly Maintenance**	**Total Price**
Asta Powerproject Enterprise Client BIM - Named License	1	€ 2,900	€ 580	€ 3,480
Asta Powerproject Enterprise Client BIM - Concurrent Licence	1	€ 3,950	€ 790	€ 4,740

The total price to be shared: € 4,740 taxes are excluded

Summary

The proposal would be acquiring one client Asta Powerproject Enterprise BIM (shared among the different offices from the group).

It provides an overall view of the whole project including planning, budget and reports.

One of the features that might slow the implementation of Asta Powerproject is the training of all users in BIM and the additional costs related to the implementation of BIM software in the company.

MS Project

MS Project is a Project Management Software made by Microsoft that is used currently in IPS to keep track of planning. MS Project can be used to estimate the budget of the project, resource allocation and other project management disciplines.

MS Project offers many options. The two that respond best to IPS's needs are Project Pro and Project Standard Desktop. Both of them offer the following features:

- Plan and organize Projects
- Manage efficiently resources
- Deliver projects according requirements

Project Pro works with Office 365 offering the following extra features regarding communication among team members and simplifying sharing.

In order to maximize the benefits of using a Project Management solution there will be an analysis comparing MS Project and another software solution, Primavera P6.

Budget

Microsoft offers two different licenses to buy MS Project.

Table 2 MS Project price

Plan	Price / User & Year	Total Cost / Year
Project Standard	769€ (only payment)	153.800€*
Project Pro	253€	50.640€

** This cost is the estimate value of the whole structure for Group IPS, not an actual investment cost.*

Summary

MS Project is a very powerful tool for Project Management but is currently been used for planning.

Among the two paying options is unclear which option is the one that suits better to Group IPS. Project Pro offers a flexible approach whereas Project Standard is less expensive.

The use of MS Project in IPS should take over more functionalities such as cost control and resource management.

Primavera

Primavera is a Project Management Software that allows Project Managers and companies to have a better control meeting deadlines, budgets and resources.

Some of the most interesting features include:

- Task Calendar view to plan work
- Resource availability across projects
- Project overview to track project progress
- Flexible cost structure adapted to the needs of the company
- Basic interface to help employees start using Primavera
- Web based graphical options

The blog TenSix Consulting makes an extensive review (TheP6Pro, 2013) of the differences between Primavera P6 and MS Project. The author does not recommend any of the two leaving the reader open to make a choice based on the needs of the company instead of the features of the software.

Here are the main features that are important for the development of the OPT.

- Multiple User Access: MS Project does not allow collaboration in projects whereas Primavera does.

- Issues & Risk: MS Project lacks features for issues tracking o risk management. Primavera has this features.
- Web Support: Primavera allows the user to convert information into HTML code to easily share information.
- Custom Fields: MS Project allows to enter formulas in the field. Primavera only allows to enter values.
- External Relationships: Primavera allows to stablish relationships between projects whereas MS Project only allows to use this feature through a feature called *Links Between Projects.*
- Project Website: Primavera allows the user to create a Website will all project details such as tasks, costs, WBS, planning.
- Multiple Project Creation and Tracking: Primavera P6 features to analyze and compare between projects are broader than MS Project. This capabilities extend to multiple project tracking, multiple project or WBS comparisons, costs and units calculations.
- Discussions: Primavera allows for team members to communicate in threaded conversations in each of the tasks inside the tool.

Budget

Primavera P& Professional costs around 3050€ including the license and Oracles support (Primavera Scheduling, 2016).

Table 3 Primavera Prices

Plan	Price / User & Year	Total Cost / Year
Primavera P6 (offline)	3050 €	610.000 € *
Primavera P6 Server	Pending offer	Pending offer

** This cost is the estimate value of the whole structure for Group IPS.*

Conventional Software Summary

There are many software's available to handle project management. All of them are expensive and therefore all must be used properly and as extensive as possible. Although they excel in many features none of them provide the whole range of functionalities that are being seek by IPS. Currently MS Project is being used mainly

to create Gantt Diagrams. This process should be revised to reduce structure costs in the company.

Online Software

Procore

Procore has many features which could help IPS in the daily routine. Here are some of the most useful features.

Features

Procurement platform

Procore allows users to solicit bids from the bidding documents and contracts prepared in the detailed design phase. Procore allows contractors to download the documents, submit their bids to the application.

Procore permits filtering by location, track the status of a contractor, send documents such as plans or contracts as bid packages and set due dates.

Procore has a system for smart bidding evaluation which helps to identify the best bid based on key factors for a specific contract. Procore also allows to create a bid history of vendors by place, speed of the vendor which can support a decision on a bidding process.

Procore generates bid packages supporting many files such as .pdf, .dwg, and .xls. All this documents can be used for a bidding process once they are uploaded to the Procore Document Management Tool.

The last feature in bidding is the tracking functionality. The application allows to keep track of all emails sent and received, the changes made in the documents and record every action made by every contractor. All this is performed in the background automatically.

Budgeting

Procore comes with a budgeting tool with the main features that are expected from a Project Management software. The budgeting tool also allows the PM to link budget lines to orders to keep up to date the budget without any additional actions.

Contract & Change Management

Procore provides the PM the tools to track and distribute contract documents and change orders. The tool also lets the PM generates standard bills and keep track of the payments. Procore updates contracts based on approved changes and keeps everything up to date.

Daily Log

The Daily Log keeps track of all events on site. The daily log automatically shows the weather conditions for the day, lets the PM to customize the Daily Log, improve labor productivity and archive all the data for future references. The Daily Log displays pre-schedule tasks for the day leaving for the PM to comment on them the details of the day and the percentage achieved each day.

Dashboard

The Dashboard shows updated information about the project. The PM can see open RFIs, change orders, punch list items and approaching tasks or overdue tasks.

Directory

The Directory Tool helps organizing all the contacts of the project with different profiles to administrate who can see what contacts.

Document Management

Procore provides a powerful Document Management Tool that allows to manage and control each of the documents of the project. Some of the main features include:

- Unlimited storage space
- Own and archive all of the data
- Protect documents with permission levels
- Sophisticated check-in / check-out functionality
- View DWG files inside of the application with the built-in viewer

Drawing Management

The Drawing Management Tool from Procore provides the project manager with:

- Real time As-Built
- OCR technology
- Drop punch items and link RFIs, submittals, documents and related drawings
- Manage drawings by area
- Sync markups and changes with the team automatically
- Work offline

Email Tracking

Procore makes easy to track and manage all project related emails. It can easily search email records, it work with the current Outlook account, it has special tracking functions such as marking messages as private or the tracking function using the "cc" function.

Integrations

Procore has built-in integrations with many programs such as MS Project or Oracles Primavera P6.

Meeting Minutes

The Meeting Minutes Tool from Procore allows to manage the project meetings including:

- Distribution of agendas via email
- Meeting minutes
- Post-meeting distribution of meeting minutes for approval
- Organize meetings by topic
- Track every meeting detail an assign action items
- Create a digital record of project meetings

Photos

Procores Photos Tool allows the PM to use keep all the pictures uploaded and control which user can view them. The tool lets employees mark photos and comment on details with everyone involved in the project.

Punch List

One of the main characteristics of Procores Punch List is the ability to create items on site. Punch list items can be assigned directly from the drawings to contractors by email. Procore can be set to send automatic overdue emails to the person assigned to each item.

Reporting

The Reporting tool makes it easy to track, archive and export all project data. Some of the features include:

- Project Monitoring progress across various tasks
- Create export-ready reports
- Build action-based logs

Scheduling Integration

Procore provides a scheduling solution to create, edit and share schedules. The scheduling tool features:

- Keep the team on the current schedule
- Integrate with Primavera and MS Project
- See the schedule by day, week, month, or traditional Gantt view
- Filter tasks by person or company
- Sort tasks by status: completed, in progress, and critical

API

Procore aims to be the best platform for Project Management in the world. In order to simplify the implementations in different companies, Procore offers an open API to allow companies integrate their own software with Procore.

- Accounting Software
- Estimating Software
- CRM Systems
- BIM Solutions
- Payroll
- Time Tracking Software
- Business Intelligence Software
- Data Warehousing Systems
- Custom Add-on Applications or Features

Cost

Procore has given an approximate quotation of 100.000 $ annually. This covers unlimited users, unlimited projects, unlimited data storage, unlimited support and full training and implementation.

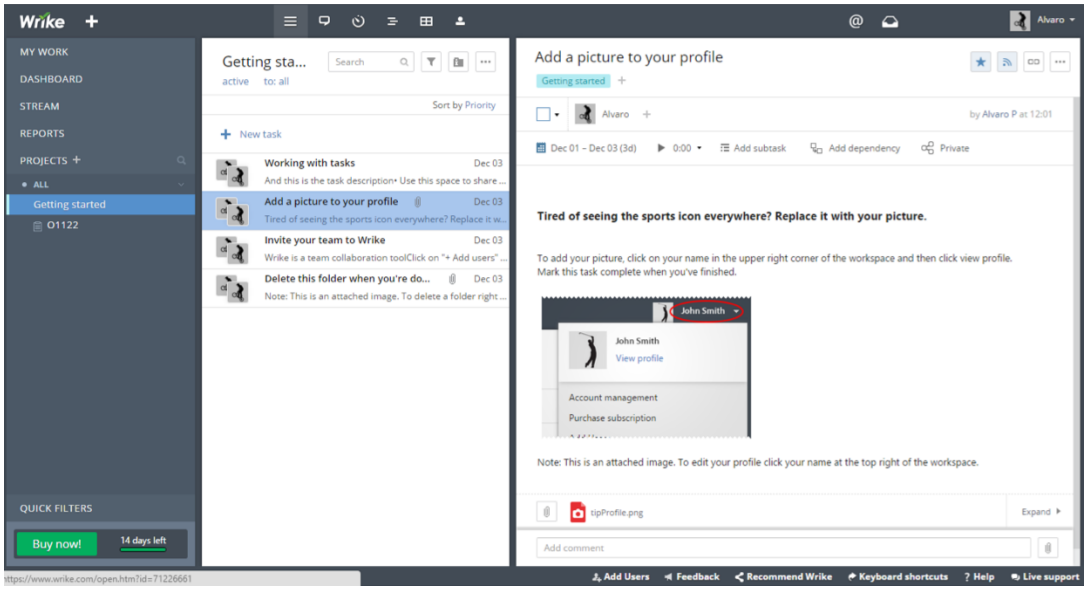
Summary

Procore combines all project documents into the same place simplifying the interactions between team members, the client, contractors and anyone related with the project. Although Procore is a powerful platform it lacks some of the features needed by IPS. Due to its cost and missing tools Procore should not be used as the Overall Project Tool.

Wrike

Introduction

Wrike is an online platform for project management and resource management. The main objects in Wrike are tasks. Tasks have similar properties as to MS Project tasks. The user can assign the duration of the task, start date, due date, various resources to perform the task and even attachments to work on. Each task has its own discussion board to allow team members talk about the specific task. Wrike allows to control and visualize the progress in each of the different progress and the availability of each person in their team. Wrike also provides multiple tools to generate automated reports to track in a broader way the progress of the project as well as different interfaces to display the data gathered by the web-application.



Aspects to consider in OPT implementation

Tracking progress

Wrike allows users to keep track on how much time they have worked by using a record button on each task. Figure 7 Tasks (Wrike) shows the main dialog to interact with tasks. Among the options the record button shows. Tracking the progress in hours by the OPT will have a big impact on staff planning as well as in future quotations.

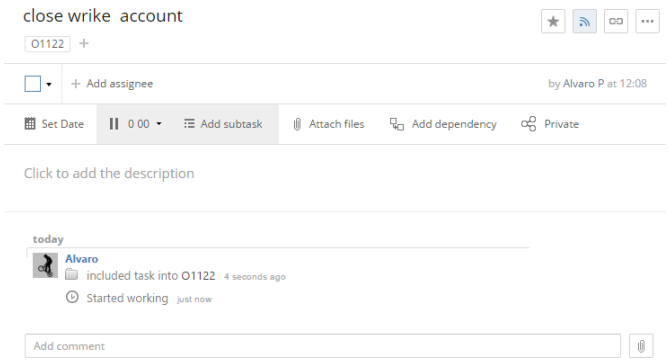


Figure 7 Tasks (Wrike)

Overview of all projects

Wrike allows each employee to have an overview of all the tasks pending of each of the projects to witch he is assigned. This function is essential in a task tracking tool and therefore essential in the OPT. Figure 8 Task Overview shows an example of the task overview with two projects and different tasks.

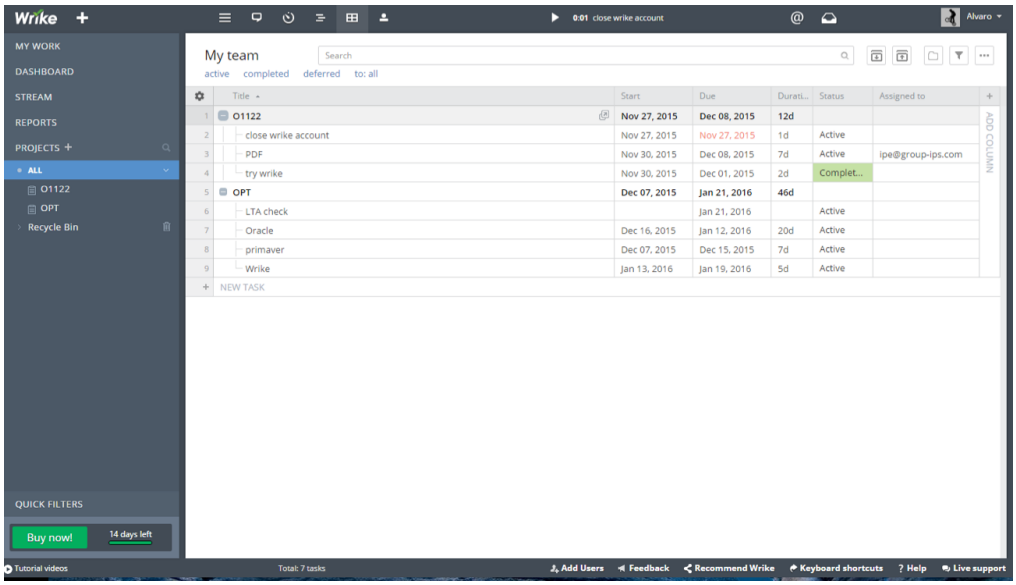


Figure 8 Task Overview

Share Gant to customers

Wrike allows the project manager to share the status of the project with the client by sharing a Gant diagram view of all the tasks. This feature allows the project manager to instantly communicate with the client showing transparency. It can also be used to in meeting to quickly view the current state of the project. Figure 9 Shared Gant Diagram shows the view of the current state of the project with overdue tasks, completed tasks and scheduled tasks.

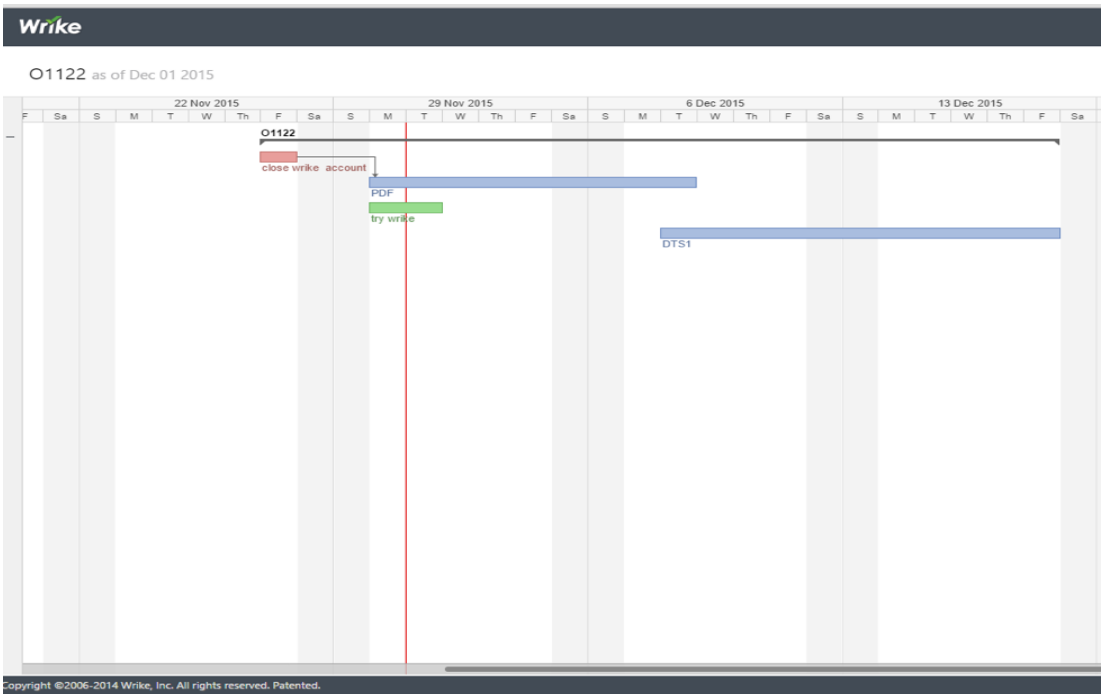


Figure 9 Shared Gant Diagram

Resource management

Wrike allows the Project Manager to easily assign tasks to resources by a drag and drop editor which shows the current amount of work of each employee.

Figure 10 Staff planning view shows Wrikes interface for task allocation. When the tasks assigned to an employee exceed the 100% of availability, Wrike alerts the PM with conflicts to avoid having people overloaded.

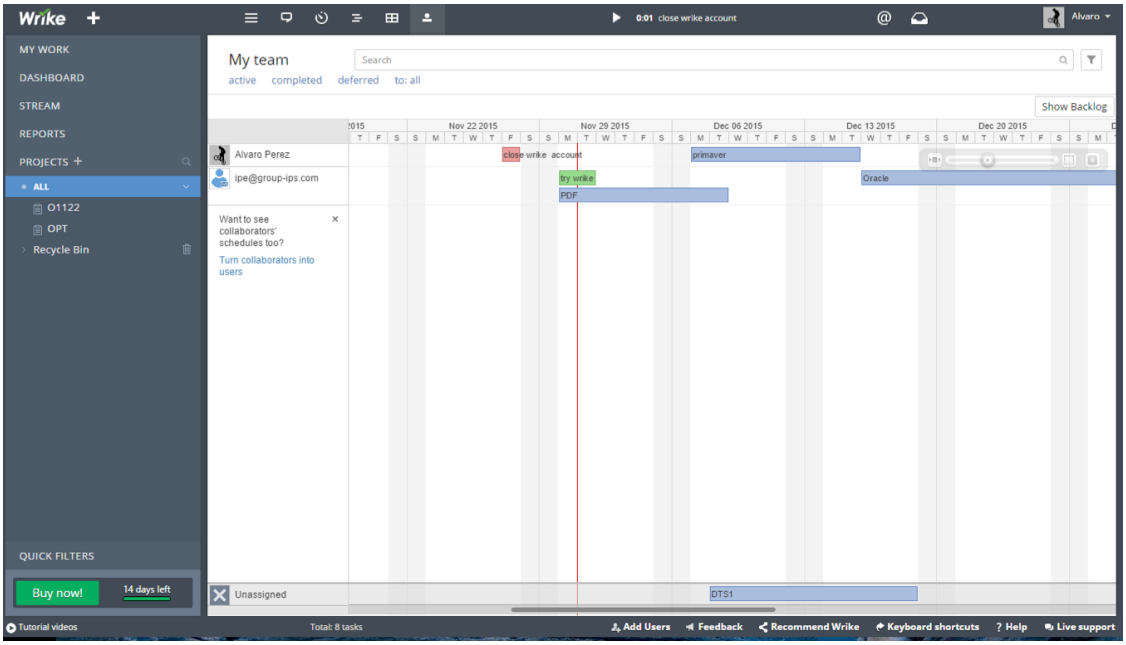


Figure 10 Staff planning view

API

Wrike has its own API that allows the program to connect to other systems such as ERP, CRM and enterprise software, to share information between them. It also has many integrations with systems that are already on the market such as Outlook, Dropbox, Gmail, Drive and many others.

Cost

Wrike has different Pricing alternatives. The Professional Plan is meant for teams of up to 15 members therefore the only solution is Enterprise. The Enterprise plan has almost an unlimited number of users and it allows for customization according with the needs of the company. Some of the features that can be implemented into the solution are:

- Personalized fields in the WBS
- Workflows: this will allow to create project templates with the different documents that must be created in each stage of the project
- Dashboards
- Sync tasks with Office

There has been a first contact with a Wrike representative to clarify all the functionalities of the platform and to request an offer to study the financial viability of the solution.

The offer has been estimated for 200 employees. The offer can be seen in Table 4.

Table 4 Wrike's prices

Plan	Price / User Month	Monthly cost	Total Cost / Year
Wrike Enterprise for 200 users	25.00 $	5,000.00$	60,000.00$

Summary

Wrike offers a solution for task management and staff planning. It provides a flexible solution that can be adapted to any project and that will help organize procedures in all Operating Units.

Jira Software

Jira is an online software product used for software development management. It has many interesting features that should be considered when implementing the tool. Some of the features that can be implemented into the OPT are:

- Workflows: to stablish dependencies among tasks
- Scrum boards: as seen in the Methodology Analysis, Scrum boards help divide the work into different categories (To Do, In Progress, Review and done). This maximizes work performance by showing the PM a good overview of the project's situation.
- Kanban boards: they allow team members to have full visibility of the project allowing them to deliver maximum output in minimum cycle time.
- Agile reporting: Jira provides many report templates to have useful real time information about the project
- Portfolio planning: the portfolio planning view lets the PM have an overview across projects and team resources

Cost

Jira offers two solutions to implement the software. Using their online servers or installing it on a local server.

Table 5 Jira Prices

Plan	Price / Month	Total Cost / Year
Online Server	750 $	9.000 $
Host on Server for Enterprises	-	12.000 $

Summary

Jira is not a software that should be acquired by IPS to do project management. In the case of implementing a custom made solution for project management some of the features provided by Jira could be implemented in the OPT.

TeamGantt

TeamGantt is a task management tool hosted on an online platform. It has many features that are suitable for the company such as:

- Gant view of the schedule
- Task contains properties such as hours of duration, resource used in the task, documents related with the task…
- Powerful staff planning interface

Although TeamGantt lacks some features that would be very useful for managing project such as budget control, it can be considered as a solid proposal to be used. TeamGantt is used by many companies such as Oracle, Twitter or Sony to improve the quality of their projects.

Budget

TeamGantt offers different plans according with the size of the company and the features. Table 6 Team Gantt Price shows a summary with the different plans and their features.

Table 6 Team Gantt Price

Basic	Team	Pro	Unlimited
5 users	20 users	Unlimited	Unlimited
10 current projects	20 current projects	75 current projects	Unlimited
5 Gb Storage	15 Gb Storage	30 Gb Storage	100 Gb Storage
278 $/year	470 $/year	950 $/year	2390 $/year

Analyzing the necessities of IPS the suitable plans would be either the Pro version or the Unlimited. The key factor would be the number of current projects using TeamGantt. There could be a trial period with a smaller number of projects being used.

Summary

TeamGantt offers a fairly good amount of features for a reasonable budget. Integrated with MyTracker could give IPS a new approach for resource management and workload control. It covers all functionalities related with task management and resource allocation. Due to the lack of capacity of integration with the current platform it doesn't look like it will be compatible with the whole system.

ProjectCenter

ProjectCenter is an online scheduling tool which allows project managers to increase productivity.

Important features about Project Center:

- Workflows: they can be created to increase productivity
- Schedule: ProjectCenter has scheduling functionalities to improve task management
- Cross-Project Reporting
- Project Schedule and Planning, Plan and detail the main project activities.
- Integration with MS Project
- Tender and bid Management for procurement
- Meeting tracker
- Project Calendar
- Project Directory

Summary

Basic tool for project management. It has good scheduling functionalities. Doesn't stand out from other tools reviewed.

Online Software Summary

There is a huge offer of these products in the market. Mainly there are two solution approaches: task management and project management.

Task management

This segment of products includes Wrike, ProjectCenter, TeamGantt and Jira. All this software's allows the user to schedule tasks and assign different properties to each of the tasks. This online tools also provide very efficient platforms to do staff planning.

Comparing all of the tools two of them stand out: Wrike and TeamGantt.

Wrike is a very powerful platform that allows to set any type of property to each of the tasks as well as documents and contextualized discussion boards.

TeamGantt offers a similar tool set than Wrike with a couple of missing features such as cost control and MS Project integration.

The high costs of both Procore and Wrike make them not suitable for the implementation.

TeamGantt seems like a good choice for a task management tool due to its costs and functionalities. The implementation in the OPT will be studied in the next phases of the project.

Project Management

Procore stands out from all the options revised and offers a great toolset for project management at IPS. It simplifies cost control, planning and procurement. Task management, internal communication and layout management is also included in the main features of this product. It can be compared with the Conventional Software's such as MS Project or Primavera but adding features to interact with contractors and the client.

Other software

Ariba

Ariba is an online software based on SAP that enables Suppliers and Customers in procurement activities. It provides a robust platform to do procurement with different contractors.

Ariba is mostly focused on buying supplies and therefore offers many features that would not be used by IPS.

Ariba is not a software suitable for IPS implementation since it doesn't cover most of the features required for a solution to IPS's problem

Summary

There are many tools in the market that would benefit significantly IPS. Depending on the solution approach the two main options are TeamGantt for task management and Procore for project management.

IV. OVERALL PROJECT TOOL

Functional Definition Introduction

The Overall Project Tool (OPT) is a software based tool that will integrate the work performed by IPS staff in all projects.

Currently there are three main phases in the development of a project: feasibility analysis, project preparation and project realisation. The two phases that cause most of the problems are feasibility and project preparation because of the preconception that there is enough time left to change aspects of the project. This idea is dangerous, the key to a good project execution comes with good preparation and good planning.

The OPT will consist on a platform that will guide the PM through the whole project providing different tools to implement all deliverables and reduce the workload in repetitive tasks related with update of redundant information across documents. The platform will plan and organize all task that must be performed by all team members (from IPS and outside) in order to meet the specifications in time for the project to be executed correctly. For that reason, the database structure will associate the preparation tasks to durations and time allocations developing a DTS with the working schedule of the preparation of the project.

The elaboration of all deliverables will be guided by the tool. Once a document is schedule, the team member will have the option to open a "document editor". This editor will provide different templates or views for the employee to create and edit the deliverable. This editor will give you the chance of watching the training related with that document or a quick link to documentation on the topic to help the responsible of the document in the making process.

One of the main goals of the project management tool is to minimize the redundancies in document elaboration by creating a project database that will link all the properties of each task across documents. The project management tool will have the natural sequence of the documents predefined so that the deadlines that have to be met to develop all documents are known by all staff involved with the project. This will create an implicit workflow among documents that will facilitate the generation of this documents.

Functional Definition

Quotations, Project Tracking & Task Manager

In order to do so, the OPT will start by drafting a rough schedule from the Quotation. This Quotation will transform into a Tracker and will generate several main standard tasks. The tasks will be revised by the PM and all team members to ensure that the times workloads associated with the tasks are adequate. All these tasks will be subdivided into specific subtasks that will be allocated in the schedule of each of the team members. The sum of the subtasks of one task should conform the task itself. If it doesn't add up, the PM will receive a conflict alert to indicate a potential problem. To be able of defining standard tasks, there is a need to define a set of standard deliverables to make the quotations as standard as possible. This will allow the PM to present to the client a well-defined Quotation with examples to show him what to expect from each deliverable. Having the deliverables clarified in the offer will help to define the scope of the works needed to be done by the team members. As a consequence, all team members will find easy to self-assign subtasks to ensure the realization of the works needed to be done.

Since the tasks of the project will be linked with project definition deliverables, all tasks will have previous requirements that need to be met in order to start with said document. As well as the requirements of each document, every document will have different stages using different resources to complete them such as: drafting (ENG), revision (SENG) and approval (PM). The different stages of each document will be defined in the tool and will allow the PM or the person in charged to assign the subtasks of the document to different people according with the needs of itself. This will create some paths and priorities among tasks that will define a sequential working schedule.

Once all the tasks are defined a DTS, of all the work needed to be done, can be generated with the schedule resources of the project. Every employee will have control over the tasks that are assigned to them and will be able to schedule them in their weekly planning. From a staff planning point of view this will allow resources to be allocated according with their availability (in hours, not in percentages). In case the team runs out of resources it will help to identify how many extra people for how many hours will be needed to accomplish the due dates assigned.

There will be two levels of control, the management level and the detailed level. The management level will have full ownership of the project and it will allow the PM to check the overall process of the project including the progress of all tasks on the different areas involved. The detailed level is focused on allowing each team member to control their own work. It will centralize the particular subtasks needed to be done in order to finish the task on time and will allow the team member to manage his own workload.

The OPT will suggest employees when to schedule their tasks based on the progress of the task and the remaining time. The tool will alert employees when they are behind schedule on any of the specific tasks that are assign to them. The tool will also alert the PM and the Project Coordinator of the project in case the project has run out of resources and will leave to their choice to make arrangements for the project to succeed. This changes might include postponing the task, if it is not on a critical path, or even demanding more resources punctually to the engineering department to finish the task on time.

Essentially the work performed by the Project Pilot (PP), involving team control and task control, can be implemented in the tool. The implementation of this activities will save time of the PP associated with these activities and will leave him more time to make decisions related with the management of the project.

On an individual level the tool will allow each employee to schedule their work from different projects over the week. If there are conflicts with the required task time and the available time of the employee, the PM of the projects involved will receive an alert to inquire him to take action on that matter and resolve the conflict.

Process Description (PD)

The Process Description Tool will be a Text editor with the ability to define Headings for future formatting, adding images and tables. MS Word fulfils this description. Therefore the main focus of this part of the integration is to analyze how to make IPS's PDs more robust (difficult to change format) and more accessible to everyone (the latest version in all languages).

Figure 11 PD Layout shows a rough example of how the PD editor should look like. In addition to the main features that come with MS Word, there are a few implementations that should be made to improve the overall performance.

1. New rev: this action button will allow the PM to submit this revision for approval and start working on the next revision. The PD manager will keep track of old versions and the approval process.
2. Old rev: this action button will display older versions of the document with comments and the approval of the people involved in the revision.
3. Share version: this action button will send a draft version of the PD without submitting it as a done revision. It will launch a mail window with the attachment.
4. Generate: In the case that the template is applied using LaTex the generate action button will launch the script and apply format to the document. This will guarantee the same format in all Group IPS documents. Figure 12 Generate view shows how the formatting process will leave the PD.
5. Text editor: the editor must be as functional as possible. For this reason headers and footers will be hidden and be left for the formatting process.

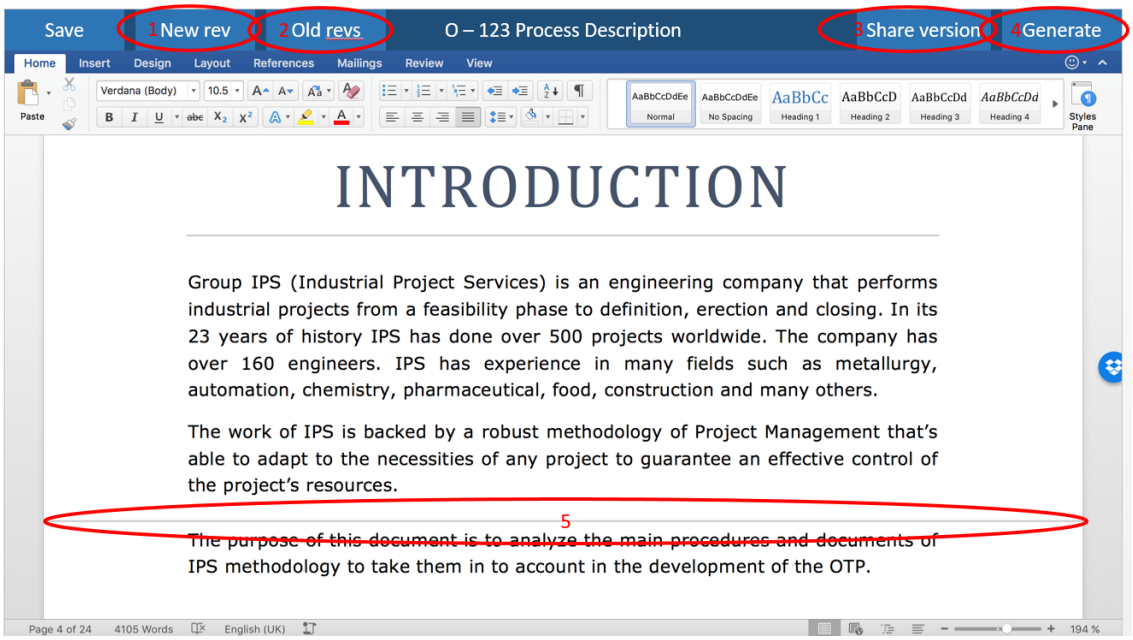


Figure 11 PD Layout

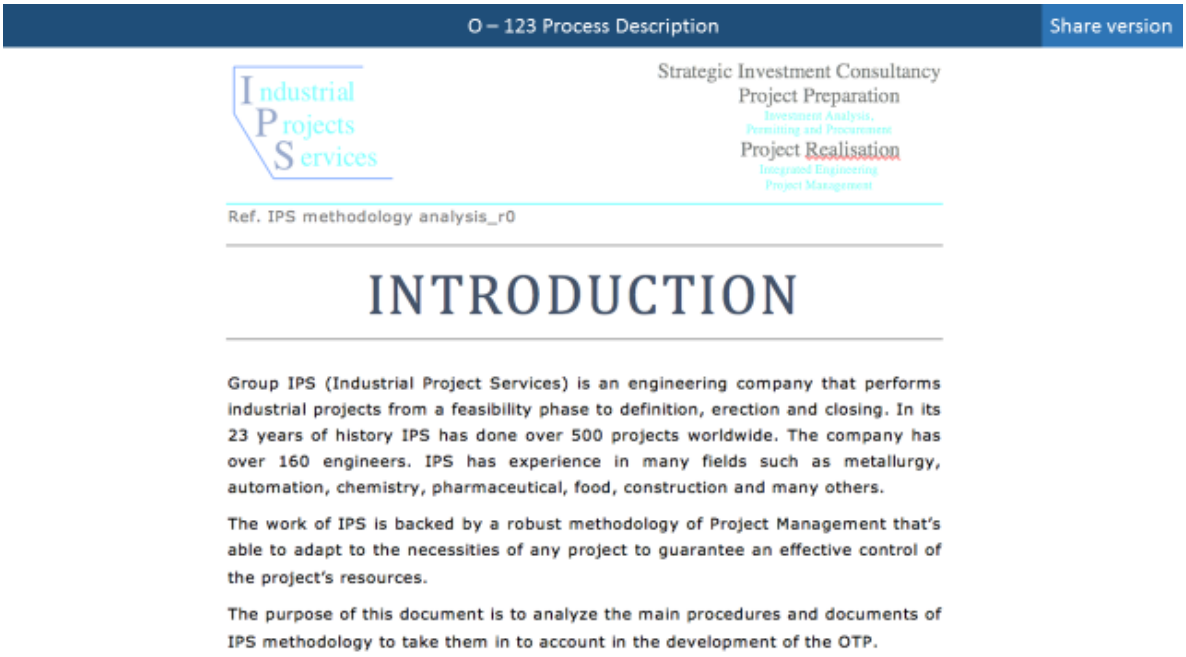


Figure 12 Generate view

Project Definition File (PDF)

The Project Definition File Tool editor will be a database engine capable of managing tasks with different properties and allowing the PM to establish relations among them. The two most important features that must be available in the PDF tool are:

- The PDF Tool must be flexible to allow adding new properties to suit any project
- The properties of the parent tasks must be linked with the subtasks to avoid mistakes and extra work

Figure 13 PDF Layout displays a conceptual look of the PDF tool editor. Some features like adding new tasks or assigning the hierarchy level of each of the tasks must be implemented in the tool. Some of the features that must also be included in the PDF tool are listed below.

1. New rev: Same as PD Tool editor
2. Old rev: Same as PD Tool editor
3. Share version: Same as PD Tool editor

4. Generate: Same as PD Tool editor
5. Add: Depending on the project some properties must be included to control different aspects of it. The tool should let PM implement simple logic functions between parent tasks and tasks (SUM(), MEAN(), MIN(), MAX(), …)
6. Parent/Sub-Parent: The PDF tool editor must link automatically correlated properties between Parent and Sub-Parent tasks.

Figure 13 PDF Layout

By using part of the infrastructure of IPS it can be currently developed based on the code of the Quotations tool. By modifying some of the fields the same structure can be exported.

Layout

The Layout tool will mainly be a document manager. It will take care of all the standard numeration processes keeping track each of the versions of the layout. The features that must be included in the Layout tool can be seen in Figure 14 Layout tool layout and are the following:

1. Show old: the layout manager will provide with the older versions of the different layouts. Figure 15 Show all ex. shows how the interface would look like.
2. + Upload New: the layout manager has to make intuitive and easy to add new documents. The tracking process will be taken care of by the tool.
3. Revision and revision format: The application will automatically give format to the names of all documents to increase the uniformity across all team members. It will include project number, revision number and version number. For the Document *"Layout General"* the application will return *"O123_Layout_General_rev03_v3"*.

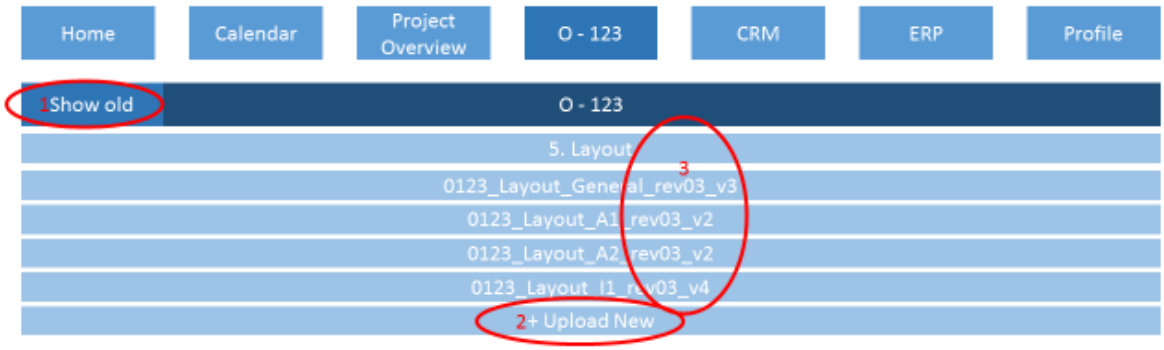


Figure 14 Layout tool layout

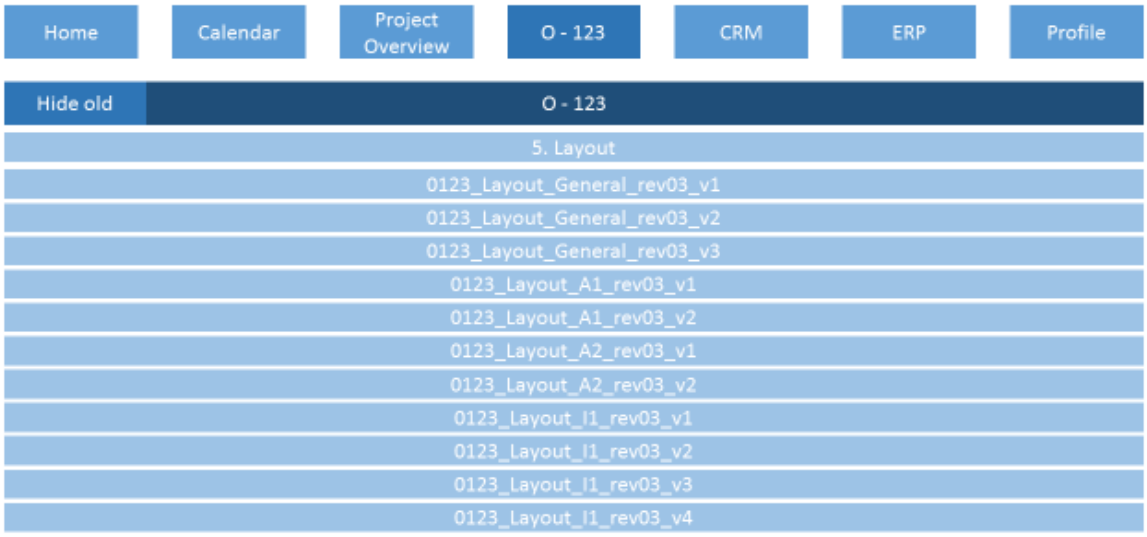


Figure 15 Show all ex.

For an ambitious approach of the layout tool, the interface can have a punch list editor to mark key points on site. Some of the features that should be included in the Punch List (Figure 16 Punch list editor) editor must include:

- Sharing a PDF to contractors to communicate with them without exporting, attaching and sending.
- Edit from a mobile device without internet connection.
- Support PDF documents in the application.

Figure 16 Punch list editor

P&ID

The P&ID tool, as well as the Layout tool, has two definition approaches: document manager and graphic editor.

The document manager is the same as the document manager of for the Layouts (ref - Layout) therefore it won't be described in this section. On the other hand the CAD editor would have a big effect on the company, especially in the engineering department.

The P&ID editor can be implemented with blocks with valves, pumps, pipes, tanks… This block could have in-built functions to determine different properties such as pressure drop or utilities consumption. The whole P&ID should be able to be exported into a spreadsheet to easily submit RFQ or include all components into de PDF.

The development of this tool is a big project in itself and there should be an independent feasibility study to determine whether this tool should be implemented or bought. Figure 17 P&ID doc manager shows the Layout proposal adapted to the P&ID document manager tool.

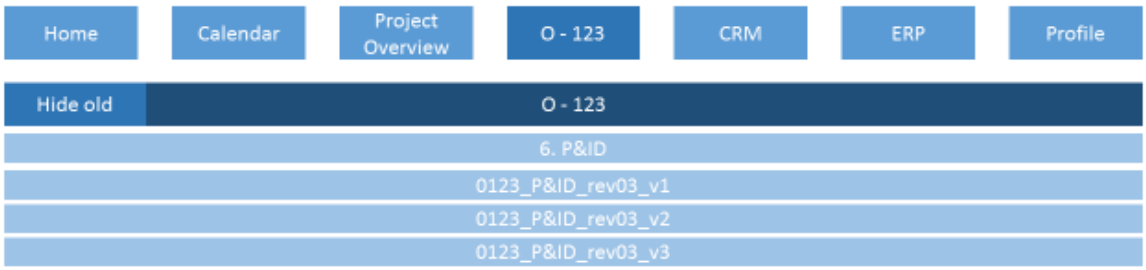


Figure 17 P&ID doc manager

Overall Time Schedule (OTS)

The OTS tool of will have a graphic interface to define at the beginning of the project the main milestones of the project and the estimated durations of each of the phases of the project. The looks of the interface will look like the DTS editor but with different type of blocks to identify orders, engineering, civil works, commissioning… Figure 18 OTS layout shows a preview including the format of the OTS adapted to the tool template. The functionality will be to identify the different phases of the project giving the PM and the client an overview of all the project.

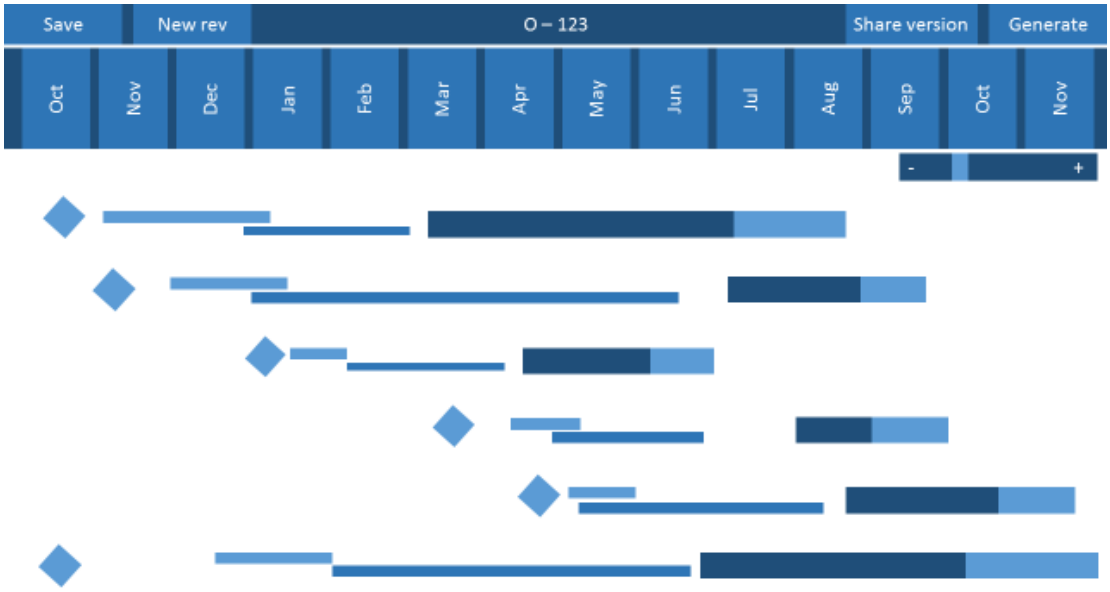


Figure 18 OTS layout

Evolutive Reporting

The main target of the Minutes of Meeting is to record the decisions and tasks from the meetings and assign responsibilities. Therefore the Reporting tool will be able to add different actions to be taken. The action list will be linked with the schedule of all participants to create actions with due dates for the participants in the meeting.

The meeting reports should include the following:

- Topic of the meeting
- Place and time
- Participants and non-present invited persons
- Moderator and secretary
- Agenda
- Last reports and results according the action plan
- Discussion according the agenda
- Action plan (incl. Task-description, person in charge, deadline, controlled by, …)
- Next meeting

- Mailing list

The Evolutive Report allows the PM to take track of the minutes in a dynamic way. The tasks are maintained until they are completed and afterwards the no longer valid information is removed. The Evolutive report can add actions to be taken linked with specific tasks in the PDF. This will allow the PM to identify tasks with unresolved issues by looking at the PDF.

Procurement

Procurement is the procedure by which IPS evaluates different contractors for specific packages and gives a final recommendation to the customer. The procurement tasks involve the submission of different documents for information and for the bidding process. This documents are:

- Economic Offer
- Contract
- Layouts
- Quality Manual
- Technical specifications

The procurement platform will help the PM organize and distribute de documentation of the tender package among different contractors. The documents required can be accessed from the main document manager and be linked so that the latest version of the documents are shared with the contractors (after the PM's approval).

The platform should also allow contractor to submit their offers in a standard format to help the PM in the comparison of the offers.

Contact List

Group IPS is involved in projects with different clients. This creates the necessity of using a contact list in each of the projects. The contact list allows everyone involved in the project to have the contact information of the people that work on the project.

The Contact List has many fields to identify each of the contacts. This fields are typically:

IV. Overall Project Tool

- Name
- Company
- Job description

Overall Project Tool Feasibility

- Phone number
- E-mail
- Comments

The Contact List also includes the different contractors in the project. The Contact List should be linked with the current ERP system to have all contacts from the company updated and linked. Therefore, the contact list will be links to IPS's contact list.

White File

The White file is the main deliverable in a project definition. It contains the latest revision of the different documents of the project. The White file should be available to the client.

White File Structure

Process Description

The latest version, approved by the PM, of the PD should be included in the White File.

PDF

The latest version, approved by the PM, of the PDF should be included in the White File.

OTS

The OTS serves as a time guideline through the project. It should be included in the White File to serve as a reference.

Layout

The latest version, approved by the PM, of all layouts will be included in the White file.

P&ID

The latest version, approved by the PM, of the P&ID should be included in the White File.

DTS

An updated version of the DTS must be in the White File to show the progress done since the last meeting and to provide visual information about the current situation of the project.

Quality plan

There should be a copy of the Quality plan to have a printed version of all communication protocols and previous agreements.

Last weekly report

The report from the previous weekly meeting should be included in the White File to provide a summary of the content from the previous meeting.

Last steering report

The report from the previous steering meeting should be included in the White File to provide a summary of the content from the previous meeting.

The action of printing all documents for the White File should be automated in one action button. There should be an ecofriendly option of printing only the documents that have changed since the last meeting.

An option for creating an executive summary out of the documentation should be implemented to give a quick overview of the state of the project. This executive summary should include:

- Current status of the schedule
- Next actions to be taken
- Spent budget
- Late tasks

Overall Document Management

Group IPS has a folder structure that remains constant among projects. This structure helps to facilitate the collaboration among team members.

The document structure follows the following order:

0. Whitefile

1. Organization
2. Quotations
3. Orders
4. Internal Communication
5. External Communication
6. Documents
7. Reference Documents
8. Subprojects
9. As Built

Figure 19 Document Manager Layout shows a preview of how the interface should look like. It would substitute Windows folder system.

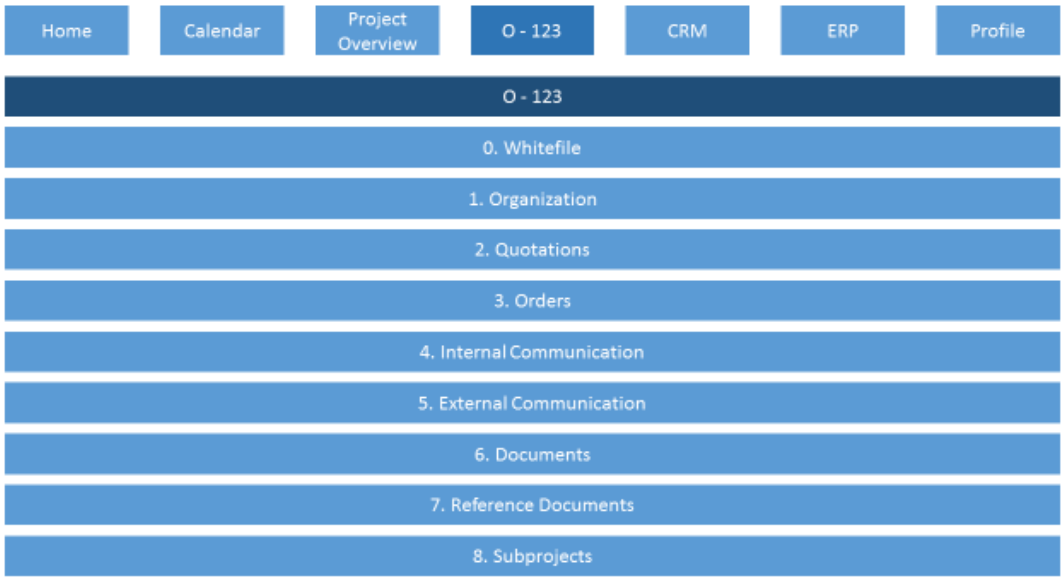


Figure 19 Document Manager Layout

V. INVESTMENT ANALYSIS

Investment Analysis Introduction

Aside from the technical aspects of the project an investment analysis must be performed to ensure the viability of the project.

Data set

In order to perform the analysis, the price assigned to different offers was examined. The analysis has been made using only a fraction of Group IPS turnover. The data set was drawn from six big projects from IPS Spain. IPS SPAIN represents a 10% of Group IPSs turnover. Due to confidential issues nor the clients or the quantities of each of the projects can be presented in this analysis.

All deliverables where categorized in the following categories for the analysis:

- DTS: elaboration of the detailed planning of the project
- Engineering: all activities regarding basic and detailed design of engineering deliverables.
- Document Management: document management labors
- OTS: Elaborating an overall planning for the project
- PDF: breaking down the list of tasks of the project
- PDS: defining and elaborating a document with all the characteristics of the project
- Piloting: mentoring
- Procurement: preparing and managing all phases of the procurement process
- Project Closing: preparing all As Built

The analysis was made with two objectives: predict the savings in employees for the company and the cost savings regarding projects.

The data for the analysis has been distorted linearly to preserve confidentiality but the percentages remain useful.

Staff analysis

The summary of all staff assigned for this projects is presented in Table 7 Staff dataset. The column MM represents the man-months dedicated on average to a specific task. Based on this working distribution and the features of the OPT, different efficiency rates where applied to understand how much staff could be redirected to other projects if the tool was implanted in the company. All the efficiency ratios have been contrasted with the Senior Project Engineer in charge of Quality control and Staff Planning to ensure that they were accurate.

Table 7 Staff dataset

Deliverable	MM
DTS	5.36
Engineering	29.76
Document Management	2.27
OTS	0.91
PDF	15.18
PDS	15.94
Piloting	7.10
Procurement	16.69
Project Closing	6.80
Total	**100.00**

Efficiency Ratios

- DTS: by implementing a database structure the time spent in developing the DTS will be reduced. The new format for developing the planning will also simplify the procedure. Since all redundancies will be deleted that will have a big impact on this document. The efficiency rate assigned to this document has been a 60%.
- Engineering: all engineering practices will have the same procedure. The OPT will help in version tracking and sharing with customers. Since the impact has been estimated to be low the efficiency rate will be a 5%.
- Document Management: the new platform integrates the same document structure as currently. The main difference is the platform format; the document manager will become an online server linked with the OPT instead

of a folder based document manager. This will have great improvements on security. The efficiency rate has been assigned to 10%.

- OTS: the overall planning will have an easier format for introducing dates and developing the whole planning. The efficiency rate has been assigned to 30%.
- PDF: the PDF is going to have the highest impact in changing the format and advantages. The problem is that most of the work regarding the PDF is content generation and for that reason the efficiency rate will not be the highest. The efficiency rate has been assigned to 30%.
- PDS: the PDS generation consist on text editing and the platform is going to be document oriented. Therefore, the efficiency improvement will be the same as in Engineering. The efficiency rate has been assigned to 5%.
- Piloting: Piloting consist on mentoring younger employees on the different projects. The OPT will allow the Pilot of the project to have a good overview of the project allowing the Pilot to waste less time understanding the current situation of the project. The efficiency rate has been assigned to 5%.
- Procurement: by syncing all documents with the procurement platform the time spent in the procurement phase will be reduced. Also it will help to reduce human errors in comparisons and formatting. The efficiency rate has been assigned to 30%.
- Project Closing: at the end of the project all deliverables must be sent to the client with the final version. The OPT is oriented towards document tracking and version tracking. Therefor the final generation of the last revision will be simplified. The efficiency rate has been assigned to 30%.

After this analysis all efficiencies have been summarized in Table 8 Efficiency ratios.

Table 8 Efficiency ratios

Deliverable	Efficiency
DTS	60%
Engineering	5%
Document Management	10%
OTS	30%
PDF	30%
PDS	5%
Piloting	5%
Procurement	30%
Project Closing	30%

By applying all the ratios to the current MM designated to this deliverables, the savings can be estimated. Table 9 Analysis results shows how much man-months can be saved per deliverable. The total savings rise to a 15.9% in staff.

After performing this analysis, it seems necessary to study how much this can be translated to income. The problem in using the percentage in MM is that the rate for all MM is not the same (i.e. a Senior Project Engineer has a higher rate Piloting than a Junior performing a DTS).

Table 9 Analysis results

Deliverable	Efficiency	MM	Saved
DTS	60%	5.36	3.22
Engineering	5%	29.76	1.49
Document Management	10%	2.27	0.23
OTS	30%	0.91	0.27
PDF	30%	15.18	4.55
PDS	5%	15.94	0.80
Piloting	5%	7.10	0.35
Procurement	30%	16.69	5.01
Project Closing	30%	6.80	2.04
Total		**100**	**15.9**

Revenue analysis

This analysis will provide a more accurate estimation of the cost savings implementing the OPT. The solution has two approaches. Decomposing the workload of all documents into different profiles and then assigning different efficiencies to each of the resources or apply this efficiency to the actual cost of each deliverable.

The second approach is more realistic since it will be based on real quotations and the actual rates.

Table 10 Invoicing analysis show the results of the analysis. Since the efficiency rates have been established on the same bases as the resources analysis.

Table 10 Invoicing analysis

Deliverable	Efficiency	Quotation	Saved
DTS	60%	520.569,30 €	312.341,58 €
Engineering	5%	2.887.969,72 €	144.398,49 €
Document Management	10%	223.101,13 €	22.310,11 €
OTS	30%	83.662,59 €	25.098,78 €
PDF	30%	1.539.471,81 €	461.841,54 €
PDS	5%	1.552.411,68 €	77.620,58 €
Piloting	5%	883.718,44 €	44.185,92 €
Procurement	30%	1.639.791,96 €	491.937,59 €
Project Closing	30%	669.303,38 €	200.791,01 €
Total		**10.000.000,00 €**	**1.579.734,59 €**

The savings in invoicing would be approximately 15.8%, 0.1% less than in the resources analysis. Therefore, it can be concluded that from a conservative point of view the savings would be of approximately 15%.

Other improvements analysis

One last analysis will be performed to ensure that the tool is the optimal solution for the company. Instead of investing in the tool the solution to maximize IPS's performance to invest in training. By educating all employees in the best practices the efficiency ratios could be applied too. IPS has its own training facility in Eisenhüttenstadt (Germany). The Technical Center serves as the Project Management School for all IPS employees as well as customers.

Efficiency Ratios

- DTS: training has been estimated to have a positive influence in both resource and invoicing of 5%.
- Engineering: the methodology has not a significant impact on engineering practices and therefor the estimated efficiency ratio has been set to a 1%.
- Document Management: training in document management practices have different effect. It is true that by having more qualified employees in document management the staff can be reduced. The problem is that the

invoicing for this qualified personnel will be higher and therefore the reduction will not be as noticeable. The efficiency rate for staff has been set to 2% whereas the rate for the invoicing has been set to 1%.

- OTS: The overall time schedule, as the document management, has problems with staff and invoicing. Employees that generate OTS with ease will be at a higher price and therefore thee invoice rate will decrease less. Staff rate has been set to 5% and invoice rate to 2%.
- PDF: same as OTS. Rates of 5% (staff) and 2% (invoicing).
- PDS: same as OTS. Rates of 5% (staff) and 2% (invoicing).
- Piloting: training does not save any resources or invoicing. Piloting expertise is learned by been exposed to different situations.
- Procurement: same as than OTS. Rates of 5% (staff) and 2% (invoicing).
- Project Closing: Project closing invoicing can be reduced with training. By educating employees into updating the las version in specific folders, costs can be saved.

After this analysis all efficiencies have been summarized in Table 11 Efficiency ratios (training).

Table 11 Efficiency ratios (training)

Deliverable	Staff	Invoicing
DTS	5%	5%
Engineering	1%	1%
Document Management	2%	1%
OTS	5%	2%
PDF	5%	2%
PDS	5%	2%
Piloting	0%	0%
Procurement	5%	2%
Project Closing	0%	3%

After studying the potential benefits of training in the company the same calculations where performed to see the potential benefits. In tables Table 12 Staff analysis (training) and Table 13 Invoicing analysis (training) the results from the analysis can be seen.

Table 12 Staff analysis (training)

Deliverable	Efficiency	Staff	Saved
DTS	5%	5,36	0,27
Engineering	1%	29,76	0,30
Document Management	1%	2,27	0,02
OTS	2%	0,91	0,02
PDF	2%	15,18	0,30
PDS	2%	15,94	0,32
Piloting	0%	7,10	0,00
Procurement	2%	16,69	0,33
Project Closing	3%	6,80	0,20
Total		100,00	1,56

The estimated percentage of savings related to staff is approximately 3% whereas the invoicing savings are only 1,56%. The estimated savings of giving specific training to all IPS employees is estimated to be around 2%.

Table 13 Invoicing analysis (training)

Deliverable	Efficiency	Quotation	Saved
DTS	5%	520.569,30 €	26.028,46 €
Engineering	1%	2.887.969,72 €	28.879,70 €
Document Management	2%	223.101,13 €	4.462,02 €
OTS	5%	83.662,59 €	4.183,13 €
PDF	5%	1.539.471,81 €	76.973,59 €
PDS	5%	1.552.411,68 €	77.620,58 €
Piloting	0%	883.718,44 €	- €
	5%	1.639.791,96 €	81.989,60 €
Project Closing	0%	669.303,38 €	- €
Total		**10.000.000,00 €**	**300.137,09 €**

Overall Project Tool Cost

For the estimation of the OPT a small procurement procedure was performed to estimate the actual cost of a platform custom developed for IPS.

The procurement consisted on five different companies. Table 14 Price Offers shows all the offers submitted by the companies. Company C and Company E where removed from the process due to the poor documentation provided with the offer and that the estimation was very low (showing that they did not understand the scope of the project).

Table 14 Price Offers

Company	Offer
Company A	27.000 €
Company B	75.362 €
Company C	*4.470 €*
Company D	84.700 €
Company E	*4.500 €*

For the purpose of this analysis the objective price of the project has been set to be 30% more of the average to ensure that the analysis takes into account contingencies during the programing phase. There has been an extra 20.000 € reserved for intensive maintenance during the first 6 months of installation. The total cost is estimated to be around 100.000 €.

Payback time

Both scenarios will be analyzed from all perspectives: staff and invoicing. This analysis although it will be done with real data from the company, it will be showed only qualitatively to preserve confidentiality with the company.

For this analysis a model of the company's invoicing has been made according to the distribution among workers (Junior, Project Engineers, Seniors and Managers). This model has as inputs the Invoicing rate of each profile, the percentage of the profile among the company and the reinvestment rate of the project.

With all this information the model calculates the amount of money that can be destined to the development of the application. Figure 20 Investment model shows the model with Group IPS's structure. The investment model assumes one year of the investment. To have some reference numbers the number of employees in some of IPS's offices are:

- **Spain**: 20
- **Germany**: 25
- **France**: 9
- **Belgium**: 110

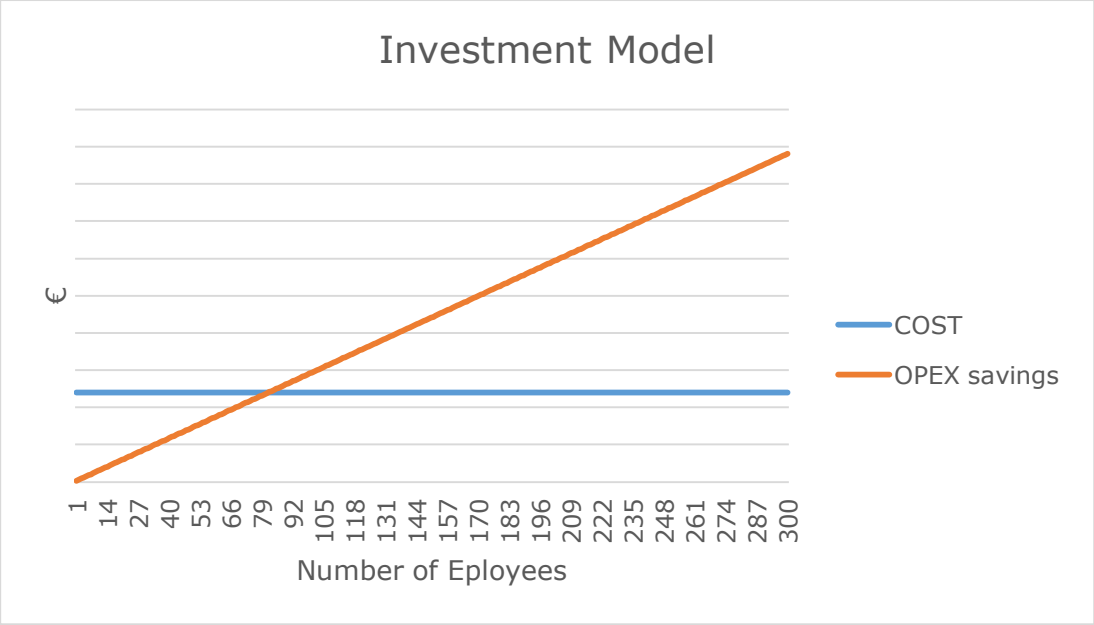


Figure 20 Investment model

With the size of the different offices of IPS it can be seen that this project is very profitable for a large office like Belgium's but by implementing this project worldwide all offices will benefit from this investment.

By assuming one-year Payback one problem arises, is it feasible for a smaller project to pursue this line of work? The payback for different projects is normally between 3 and 10 years. Very profitable projects will have a lower payback time. In this case since the profit of the implementation depends on the number of people that currently work in the company, the larger the company, the smaller payback time there will be. Figure 21 Payback (employees) shows at the expected payback time as a function of the number of employees.

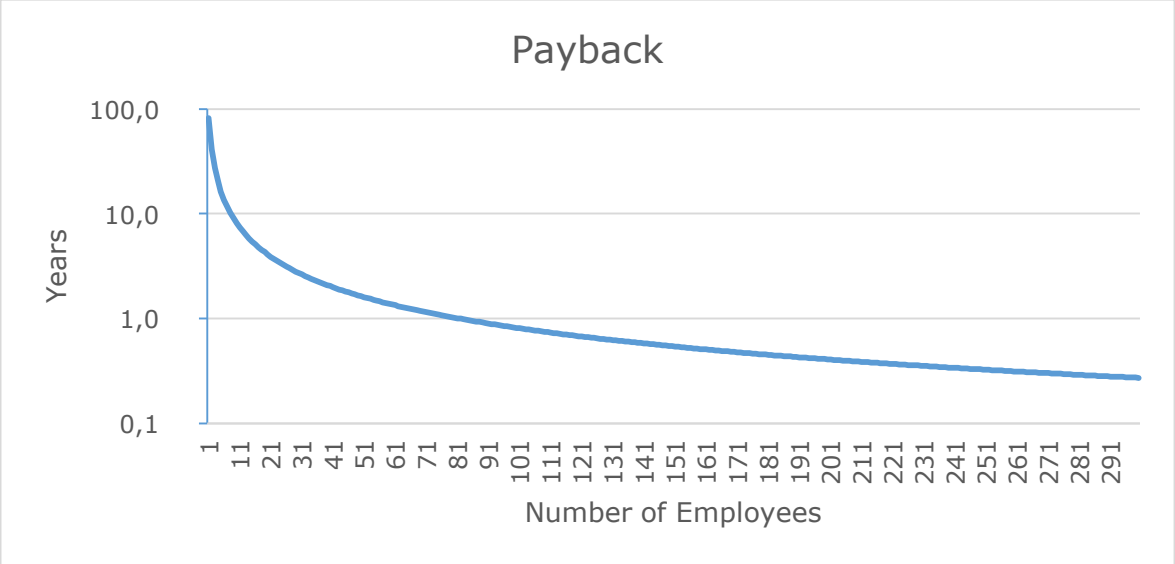


Figure 21 Payback (employees)

Figure 21 Payback (employees) has been used to calculate the payback time of the different offices and the results are shown in Table 15 Payback example.

Table 15 Payback example

IPS Office	Employees	Payback
Spain	20	4,1 years
France	9	8,2 years
Germany	25	3,3 years
Belgium	110	9 months
Group IPS	200	5 months

This analysis is very interesting since it opens the possibility to start in the company a new line of business implementing this application in different clients.

It's important to understand if a custom solution fits the needs of the company. To analyze this aspect of the project an analysis comparing the projects outcome with the different products studied in Online Software that where interesting to study. Figure 22 Benchmark analysis compares Procore, TeamGantt and the Overall Project Tool assuming lower rates of return for Procore (60%) and for TeamGantt (7%). The result is clear, a custom made application allows for IPS to maximize the outcome of the investment due to the perfect fit that it provides.

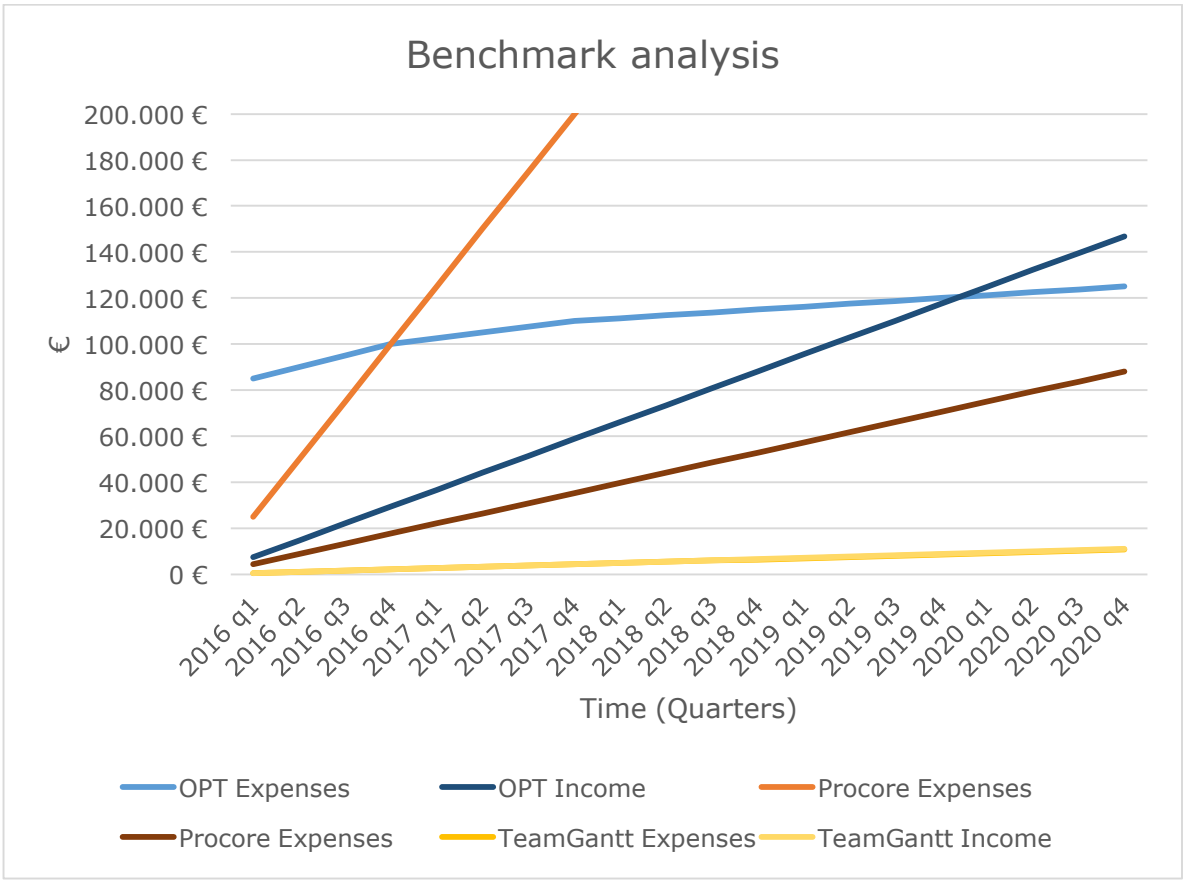


Figure 22 Benchmark analysis

Conclusion

The financial analysis results are very positive. The Overall Project Tool has been estimated to have an important effect in the company's efficiency in a way that will result in a short payback time. Pursuing this investment can bring profit to the company in two different ways:

- Improving efficiency and reducing the company's OPEX
- Opening a new business line of providing clients with project management tools for their internal projects

VI. NEXT STEPS

Next steps for Group IPS

The Feasibility Study was presented in Belgium in March 2016, since then the first steps for the implementation of the product have been made.

The tool will be implemented in different phases expanding the modules of the current platform. Currently the modules are the following:

MyTracker

Keeps track of the resource expenses and the progress of the project. The main function is to allocate resources to the different parts of the project. It can potentially be the main center for staff planning and task tracker. The first part of the development will be used to adapt this module to the new structure of the company's platform. The same type of module can be implemented for the DTS editor and the OTS.

MyTimesheets

It is used to report hours dedicated to each of the projects. It allows the user to keep track the number of hour spent in each block of the project. Combined with MyTracker provides useful information regarding the current status of the project.

ERP

It contains the database of all the contacts of the clients and the different actions taken to approach each client. The ERP will be the base of the information contained in the Contact List.

Suppliers List

The Suppliers List has registered usual Suppliers of IPS. It will also be joined with the Contact List. The Contact list will be independent for each project but will draw the information from the same database.

Quotations editor

The Quotations in IPS can be made through an online editor that performs some of the operations to minimize human error in the elaboration. The same structure of program can be used to implement the PDF editor. Therefor this tool will be designed starting from the code of this module.

Planning

IPS is currently working on the elaboration of pending projects such as the Suppliers List. Although the implementation of some changes are currently being performed. Table 16 Next Steps Planning shows the planning for the development of the platform according to the Feasibility.

Table 16 Next Steps Planning

Module	Start	End	Progress
MVP	June 1st	June 29th	40%
Task Tracker	June 1st	September 15th	5%
PDF	December 12th	February 2017	0%
DTS & OTS	January 2017	March 2017	0%
Document Manager	April 2017	June 2017	0%
Procurement	June 2017	October 2017	0%

VI.A MINIMUM VIABLE PRODUCT

MVP Proposal Introduction

After the previous analysis of IPS's tools it seems necessary to start developing a Minimum Viable Product (MVP) to try the concept of improving IPS methodology by upgrading the tools. This first implementation will allow Group IPS to test the results of the tool in the company. The MVP will target three main modules adapting existing tools of Group IPS to the new format.

The implementation will consist in three modifications regarding the tasks manager. First the *Action Plan* will be improved and sync with the rest of MyTracker to link tasks to resources and dates (OTS & DTS). Secondly the option to add subtasks in Quotations will be implemented in order to distribute work among team members (DTS & Staff planning). Finally, the option to see the available time left from resources will be implemented in the Project Tracker to facilitate staff planers allocate resources to different projects (Staff Planning).

This part of the project will account for a 10% of the whole development. The changes proposed in this chapter will fulfill the following goals:

- Provide a deeper level of detail in task definition and assignation
- Simplify staff planning for better resource allocation
- Amplify the impact of the resources in the projects to account for intern inefficiencies in projects in training periods

The development of this changes will be a first approach into the new dynamics of work procedures in the company. It will allow to understand the penetrability of the tool within the company, the efficiency improvements in early adopters. Finally it will be used to check if the budget estimation is correct or if there will be a need to allocate more budget for this project.

Proposal

Action Plan

Currently the action plan is a part of the Project Tracker which helps Project Manager record pending actions to be done in the project. This is inherited from the previous version of the Project Tracker, an Excel book. It has the main features as then, record actions and use different fields to specify responsible agent, due date and other comments.

Implementation

The Action Plan will be linked with the task manager system. This will allow to assign tasks to people and notify them of the pending tasks on their agenda.

The tasks will be shown in the current dashboard dedicated to assigned tasks from deliverables in the quotation. Figure 23 Action Plan implementation shows the current view of the Action Plan. The implementation should be regarding background connections instead of developing new modifications.

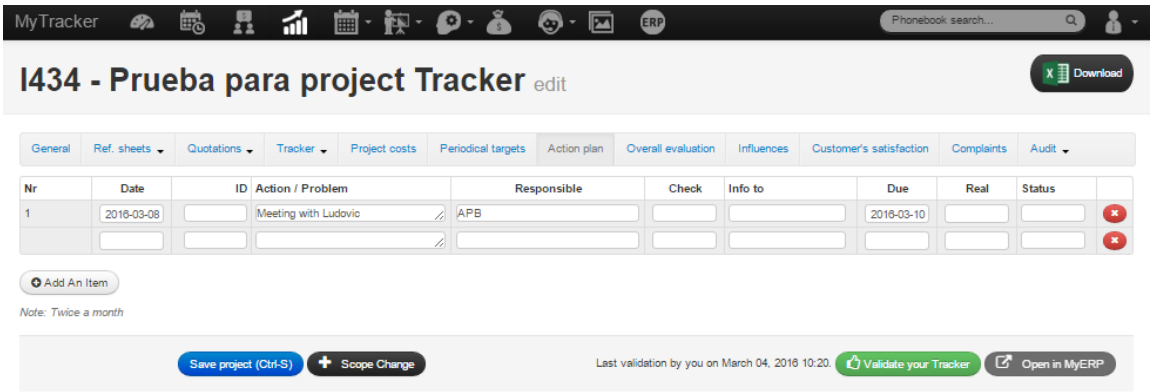


Figure 23 Action Plan implementation

Split tasks in Tracker

Currently when a quotation is created an approved, a project tracker is created to keep track of the project. This implies that all activities that where offered will

have an independent control to ensure cost control inside of the company. Currently the Project tracker is frozen and there is no option to add new subtasks to the tracker. The proposal implies allowing the tool to include sublines to better define the tasks that want to be implemented. Each of the subtask can be assigned to different resources and will allow to assign and control more efficiently the workload of the employees.

Implementation

The goal of this upgrade is to allow the PM to add new sub-tasks for each of the tasks to distribute work among team members. In Project Tracker the option to add new sublines to the different task should be implemented. The new subtask can be assigned to a resource that is assigned to the project. The task will add the costs of all subtasks to keep an accurate estimation of the hours spent in the project.

The format will be similar to the one used currently for developing Quotations but with all approved tasks by the client blocked. Figure 24 Editing the project tracker illustrates how the project tracker should handle editing in the new format.

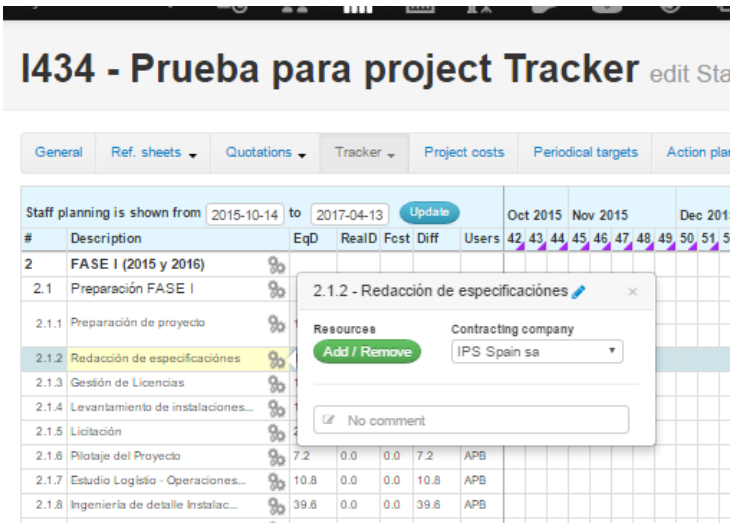


Figure 24 Editing the project tracker

Staff planning visibility

Currently when the staff planner is allocating resources, he has not the ability to see how much time left has each of the resources across projects and in that same project, making it complex to perform this task. Currently the staff planner can see the overall availability of a resource on the staff planning window. This increases the complexity of the staff planning making it mandatory to change between windows and computing partial calculations to estimate the availability of the person across projects.

Implementation

The proposed solution is to include in the bottom part of the staff planning view a new table displaying the used percentage (or hours) of each of the project resources. The consolidated view with all employees will be maintained but with the purpose of having an overview of all the resources of the Operating Unit. Figure 25 Staff planning proposal provides a rough example of how the interface should look like.

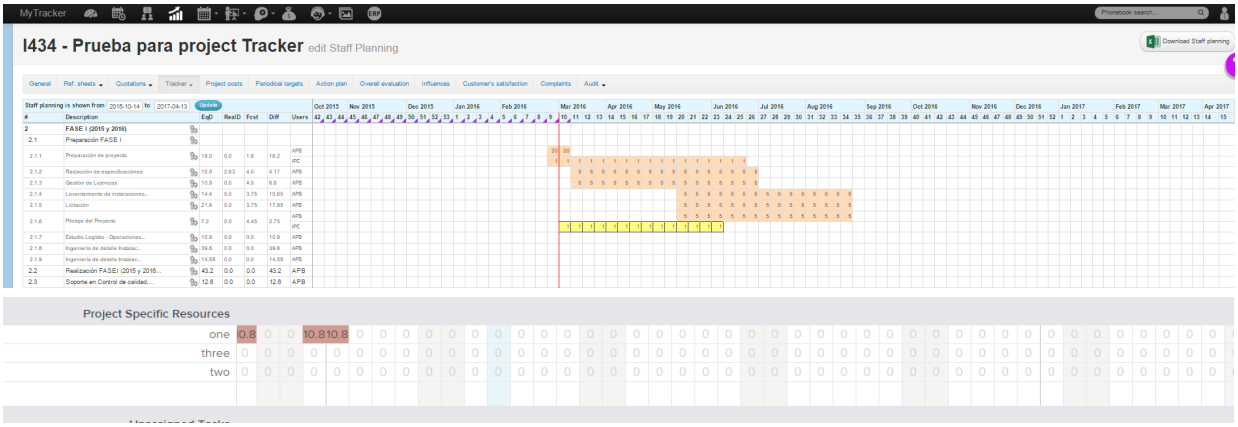


Figure 25 Staff planning proposal

Resource Efficiency

The Project Tracker controls the total amount of costs (resources) used on the project. This total cost is then compared with the offer to calculate deviations and to see how profitable the project was. The project tracker keeps track of the

resources used in the project by counting the hours invested in the project. The problem with this approach is that the hours from managers and junior are accounted in the same way. This leads to miscalculations and losses due to tracking errors.

Currently Interns are not billable and therefore cannot be used in My Tracker to fill hours. This leads to a problem controlling where are the interns assigned to the project. For the minimum viable product, the possibility of assigning a training coefficient should be implemented.

Implementation

By adding a billing rate to all resources the Manager/Staff Planner of each OU can set a lower rate to Interns in a way that they can be assigned to projects as back office resources without affecting negatively the project balance. This coefficient will be used only for training purposes. This rate will also take into account the rates of the different resources since it is not he same the billing rate of a Junior Project Engineer as the one from a Project Engineer.

Cost

This upgrade has a programing cost that has been calculated based on the programing time by the internal IT employee in Belgium. The cost calculated cab be seen in Table 17 Budget for development shows the internal bill of quantities for this project. The cost is an estimation due to the lack of the exact rate of the person in charge of developing the project.

Table 17 Budget for development

	Days	Monthly rate	Dedication	Total
Total	**28**		**67%**	**10.065 €**
Action Plan	8		63%	2.640 €
Connecting field to DB	2	11.000 €	60%	660 €
Updating Dashboard	4	11.000 €	50%	1.100 €
Commissioning	2	11.000 €	80%	880 €
Split tasks in Tracker	8		66%	1.815 €
Designing new interface	1	11.000 €	50%	275 €

Implementing changes in quotations tool	2	11.000 €	80%	880 €
Connecting new DB to Dashboard	2	11.000 €	60%	660 €
Updating MyTimsheets	1	11.000 €	60%	330 €
Commissioning	2	11.000 €	80%	880 €
Staff planning visibility	6		70%	2.145 €
Modifying current view	1	11.000 €	80%	440 €
Linking new view to DB	3	11.000 €	50%	825 €
Commissioning	2	11.000 €	80%	880 €
Resource Efficiency	6		70%	2.255 €
Modify DB to include new property	3	11.000 €	60%	990 €
Implement computation to update results	1	11.000 €	70%	385 €
Commissioning	2	11.000 €	80%	880 €

Planning

The total estimation time has been calculated to be 6 months. This will be done in parallel of the development of the OPT and will be used as an exit mechanism. In case the success rate is bellow expected, there will be a special steering meeting to evaluate the reasons why the project fail and what has to be avoided to reach success.

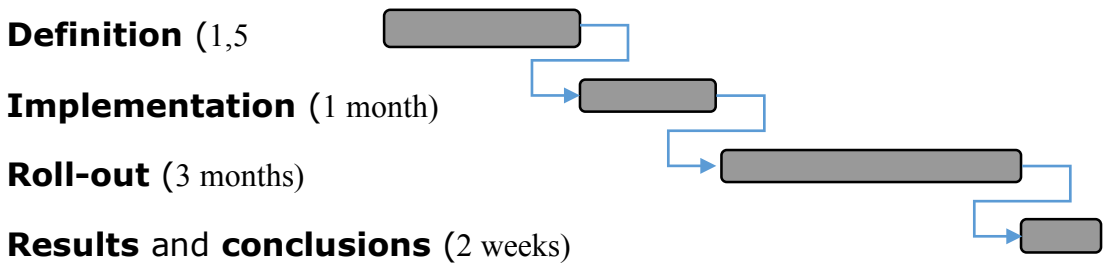
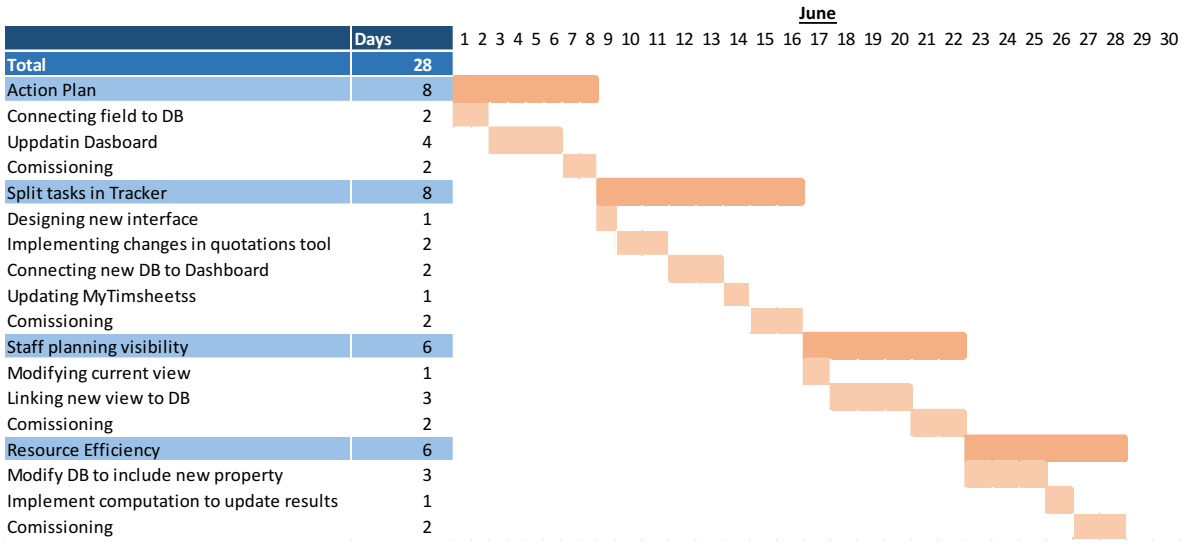


Figure 26 OTS of the MVP

The planning for the development can be seen in Figure 27 DTS of the MVP. This planning is provisional and can be modified in case of needs of other projects.



	Days
Total	28
Action Plan	8
Connecting field to DB	2
Uppdatin Dasboard	4
Comissioning	2
Split tasks in Tracker	8
Designing new interface	1
Implementing changes in quotations tool	2
Connecting new DB to Dashboard	2
Updating MyTimsheetss	1
Comissioning	2
Staff planning visibility	6
Modifying current view	1
Linking new view to DB	3
Comissioning	2
Resource Efficiency	6
Modify DB to include new property	3
Implement computation to update results	1
Comissioning	2

Figure 27 DTS of the MVP

Indicators of success

This project will be used to compare the results with some predictions like the ones used to determine the feasibility of this project and understand the behavior of the company to this type of changes.

The goals that will be measured will be participation and efficiency.

Participation

For the project to succeed, everyone must use it, otherwise the notifications will not distribute work correctly. In such small time it expected to reach 40% of the company's employees. Currently there are some tools that are part of the MVP that are been used therefore it will be a small adaptation to the current situation. For this reason, is acceptable to pretend to reach a 40% of the employees within the first three months of roll out. The metric will be checked using the current system application and comparing the number of employees that where using the previous version of the application and that will start using the new features implemented in the system. New users will also be accounted for since the

tendency in the company is to unify tools and to centralize the control of all projects into one single tool.

Efficiency

This part of the tool focalizes the target work in better communication and better distribution of the work. For this reason, efficiency will be improved by reducing emails and checkup notifications. In further developments of the project the efficiency rates are expected to be much higher. The efficiency will be measured comparing the change in time spent in this task. Currently all Staff Planning agents report to MyTracker the number of hours spent to perform this task. The time spent in staff planning should be improved by a 20% with the implementation of this project.

VI.B ANTICIPATOR

Introduction of the *Anticipator*

After the Functional Definition was made the decision to develop the OPT was taken and a phase plan was stablished to divide the whole development into different parts. The first block will consist on the task manager, the *Anticipator.* The Anticipator is a software based tool that will integrate the work performed by IPS staff in all projects.

Currently there are three main phases in the development of a project: feasibility analysis, project preparation and project realisation. The two phases that cause most of the problems are feasibility and project preparation because of the preconception that there is enough time left to change aspects of the project. This idea is dangerous, the key to a good project execution comes with good preparation and good planning.

The Anticipator will feed from a database with all the tasks that must be performed by all team members. For that reason, the database structure will associate the preparation tasks to durations, due dates and person in charge of the task developing a DTS1 with the working schedule of the project.

The elaboration of all deliverables will be guided by the tool. Once a document is schedule, the team member will have the option schedule this task on his weekly planning. Aside for anticipating tasks and allowing employees to schedule the different tasks from all current projects, the Anticipator will provide help in all aspects of the task. Who is responsible for the previous task, templates for that document and trainings will be shown in the tasks dashboard.

One of the main goals of the Anticipator is to minimise the redundancies in document elaboration by defining a coherent order of document elaboration. The PM of the project will define the tasks from the quotation and will assign resources to each of the tasks to be done. This will create a workflow among documents that will facilitate the generation of them.

Functionality Definition

In order to do so, the Anticipator will start by drafting a rough schedule from the Quotation. This Quotation will transform into a Tracker and will generate several main standard tasks. The tasks will be revised by the PM and all team members to ensure that the times workloads associated with the tasks are adequate. All this tasks will be subdivided into specific subtasks that will be allocated in the schedule of each of the team members. The sum of the subtasks of one task should conform the task itself. If it does not add up, the PM will receive a conflict alert to indicate a potential problem. To be able of defining standard tasks, there is a need to define a set of standard deliverables to make the quotations as standard as possible. This will allow the PM to present to the client a well-defined Quotation with examples to show him what to expect from each deliverable. Having the deliverables clarified in the offer will help to define the scope of the works needed to be done by the team members. As a consequence, all team members will find easy to self-assign subtasks to ensure the realisation of the works needed to be done.

Since the tasks of the project will be linked with project definition deliverables, all tasks will have previous requirements that need to be met in order to start with said document. As well as the requirements of each document, every document will have different stages using different resources to complete them such as: drafting (ENG), revision (SENG) and approval (PM). The different stages of each document will be defined in the tool by PM. This will create some paths and priorities among tasks that will define a sequential working schedule.

Once all the tasks are defined a DTS1, of all the work needed to be done, can be generated with the schedule resources of the project. Every employee with will have control over the tasks that are assigned to them and will be able to schedule them in their weekly planning. Only employees with ownership can modify key properties of the task such as resources, length or due date. From a staff planning point of view this will allow resources to be allocated according with their availability (in hours, not in percentages). In case the team runs out of resources it will help to identify how many extra people for how many hours will be needed to accomplish the due dates assigned.

There will be two levels of control, the management level and the detailed level. The management level will have full ownership of the project and it will allow the PM to

check the overall process of the project including the progress of all tasks on the different areas involved. The detailed level is focused on allowing each team member to control their own work. It will centralize the particular subtasks needed to be done in order to finish the task on time and will allow the team member to manage his own workload.

The Anticipator will suggest employees when to schedule their tasks based on the progress of the task and the remaining time. The tool will alert employees when they are behind schedule on any of the specific tasks that are assign to them. The tool will also alert the PM and the PC of the project in case the project has run out of resources and will leave to their choice to make arrangements for the project to succeed. This changes might include postponing the task, if it is not on a critical path, or even demanding more resources punctually to the engineering department to finish the task on time.

Essentially the work performed by the PP, involving team control and task control, can be implemented in the tool. The implementation of this activities will save time of the PP associated with these activities and will leave him more time to make decisions related with the management of the project.

On an individual level the tool will allow each employee to schedule their work from different projects over the week. If there are conflicts with the required task time and the available time of the employee, the PM of the projects involved will receive an alert to inquire him to take action on that matter and resolve the conflict.

Field properties

According to the type of data the Anticipator will generate different slots to enter each of the data.

This fields will be:

- Task name: name of the task.
- Number of hours: number of hours that are assigned to perform the task
- Task Responsible: person responsible for completing the task assigned

- Time spent on the task: the amount of hours that have been used to performed the task. This property will substitute the current field of MyTracker that keeps track of the number of hours
- Left time: How much time there is left to perform the task
- Collaborator: Another member that is also included in the task
- Due date: date in the calendar by which the task must be finished
- Task name a meeting*: is the task a meeting or not
- Team: defines all members included in the team
- People attending the meeting: includes all members attending the meeting. This property is an array of members
- Time of the meeting: Includes the time of the day of the meeting to define the event in the calendar
- Is the meeting mandatory? when the meeting is mandatory, the time will be blocked by the creator of the meeting. Otherwise anyone can propose a change in the hour of the meeting
- Info: includes additional information of the task
- Result: defines the outcome of the scheduled call
- Subject: defines de subject of the call or the pending email
- Receiver: contact information of the recipient from the call or email
- Reminder: date and time of the reminder
- Status: current status of the task

Table 18 Variables with properties summarizes all the variables with the name used for them as well as the type of variable that they will be.

Table 18 Variables with properties

Variable	**Name**	**Type**
Task name	task.name	Text
Number of hours	task.hours	Number
Task Responsible	task.responsible	Member (tbd)
Time spent on the task	task.hoursWorked	Number
Left time	task.hoursLeft	Number
Collaborator	task.colaborator	Member (tbd)
Due date	task.date	Date
Task name a meeting*	task.isMeeting	Boolean
Team	task.team	Member[N] (tbd)
People attending the meeting	task.meetingParticipants	Member (tbd)
Time of the meeting	task.timeOfMeeting	Hour

Is the meeting mandatory	task.isMandatory	Boolean
Info	task.info	Text
Result	task.result	Text
Subject	task.subject	Text
Receiver	task.receiver	Member (tbd)
Reminder	task.reminder	Text
Status	task.status	Text

General Layout

The Anticipator will provide a global overview of the planned work of an employee and will provide useful information to schedule new tasks. The layout shown in Figure 28 Layout preview has the main blocs of the Anticipator highlighted:

- Weekly planning: week view of the week with scheduled tasks
- Project # Tasks: pending tasks in each of the projects
- Personal Project Tasks: pending tasks in the personal project
- Personal Tasks: pending tasks independent to any project
- My Teams: Meetings or tasks with your team
- Business development: pending actions on your business development assignments
- Calls and Mails: pending calls and emails to be sent
- Collaboration: to be defined
- Anticipation: to be defined
- Task / DOC Details: contains all details of the selected task. Duration, due date, person in charge, predecessors, successors, brief definition…
- Project Dashboard: contains specific information for the development of a particular action. Examples, trainings, templates, …

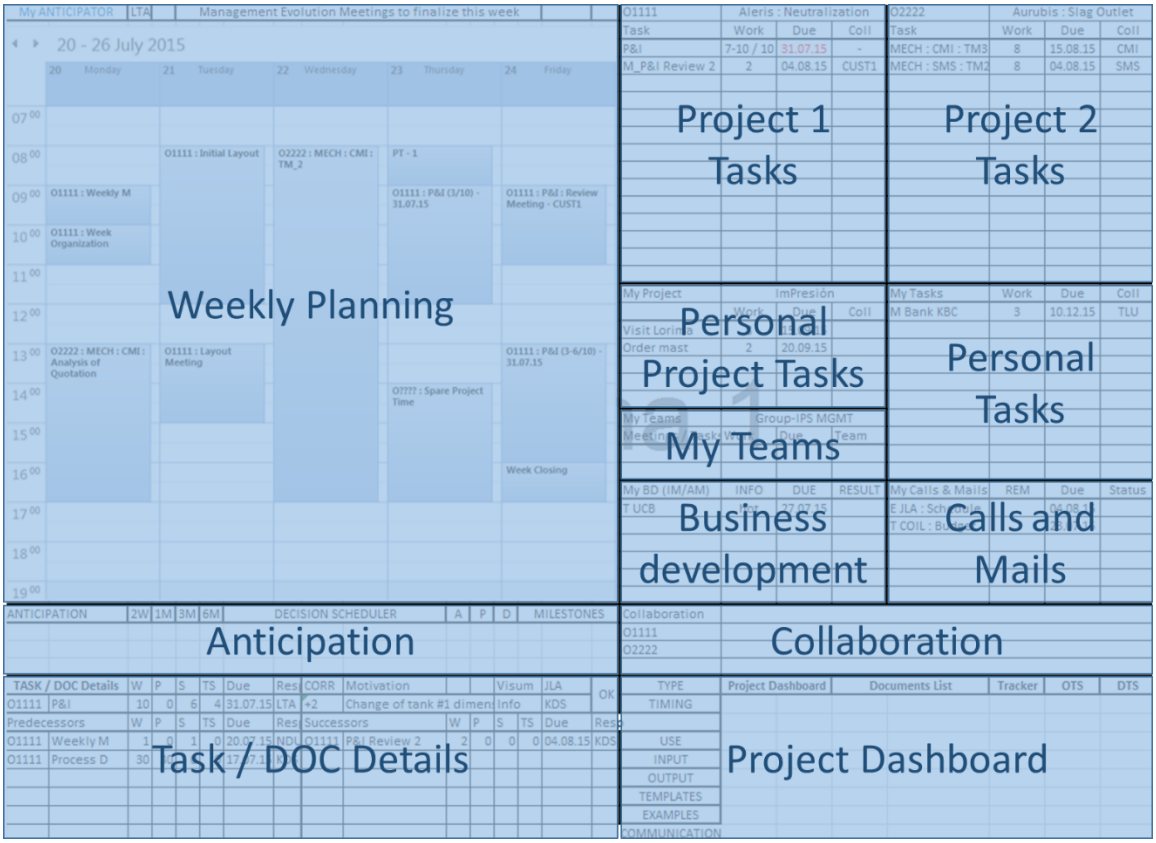


Figure 28 Layout preview

Weekly Planning

The Weekly Planning dashboard will display a week view to allow the employee plan the week and schedule tasks. Once the tasks are planned the weekly planning will store the amount of hours worked on set task. In coming phases of the Anticipator, the editor will let you work on a task if it is scheduled. Otherwise the Anticipator will not let the employee work on it. In the Anticipator tasks will be related either to a document (i.e. develop DTS) or to a task (i.e. meeting with contractors). Both types of tasks will be developing in the same way. By selecting any of the tasks scheduled, the Anticipator, will load all properties from the task.

From the Weekly Planning perspective, event tasks will have the following properties:

- Task name
- Task responsible
- Time spent on the task (MyTimesheets)

Project Tasks

The Project Task dashboard will display pending tasks for a specific project. There will be as many dashboards as Projects are assigned to a certain person. The Project Dashboard will display the tasks that can be schedule. By selecting any of the tasks scheduled, the Anticipator, will load all properties from the task. The Project Task editor will feed from the following tasks properties to display them:

- Task name
- Task Responsible
- Due date
- Total time estimated
- Left time
- Collaborator

Personal Project Tasks

The Personal Project dashboard will have the same structure as the Project Dashboards, the only difference is that it will be assigned to the Personal Project of the employee.

Personal Tasks

The Personal Tasks dashboard does not have anything to do with the Personal Project. This dashboard is to take into account different tasks that must be done in the week that are going to take time but are not related to any specific project.

This tasks will be independent of any Project Data DB. The properties of the tasks will be limited to:

- Task name
- Number of hours

- Due date
- Collaborator

My Teams

My Teams is the dashboard dedicated to your team. On it tasks related with meetings, or tasks that have to do with your team will be displayed. Task properties will be:

- Task name: can be a meeting*
- Number of hours
- Due date
- Team

In case the task is a meeting it will have specific tasks:

- People attending the meeting
- Time of the meeting
- Is the meeting mandatory? when the meeting is mandatory, the time will be blocked by the creator of the meeting. Otherwise anyone can propose a change in the hour of the meeting.

Business Development

The Business Development dashboard will feed from an independent database. This dashboard will remind the pending actions that must be done regarding acquiring new clients and new contacts. The Anticipator will extract the following information from the CMR:

- Task name
- Info
- Due date
- Result

Calls and Mails

The Calls and Mails dashboard records all pending calls and emails. This dashboard will be linked with IPSs contact list to provide the contact information when is needed. This Dashboard will display relevant information for the call/mail. This information will be:

- Subject
- Receiver
- Due date
- Reminder
- Status

BibliographyCAPTERRA. (2016). *CAPTERRA.COM.* Obtenido de Reviews of TeamGantt : Free Pricing & Demos : Project Management Software: http://www.capterra.com/project-management-software/spotlight/144808/TeamGantt/TeamGantt

CAPTERRA. (2016). *CAPTERRA.COM.* Obtenido de Reviews of RationalPlan : Free Pricing & Demos : Project Management Software: from http://www.capterra.com/project-management-software/spotlight/74048/RationalPlan/Stand%20By%20Soft

CAPTERRA. (2016). *CAPTERRA.COM.* Obtenido de Reviews of JIRA : Free Pricing & Demos : Project Management Software: http://www.capterra.com/project-management-software/spotlight/19319/JIRA/Atlassian

CONSTRUCTION PROJECT MANAGEMENT SOFTWARE. (2016). *CONSTRUCTION PROJECT MANAGEMENT SOFTWARE.* Obtenido de Asta Powerproject - Construction Project Management Software: http://www.astapowerproject.com/software/asta-powerproject/

LTD., S. (2011). *LTD., S.* Obtenido de RationalPlan - Project Management Software, Multi Project Planning Software: http://www.rationalplan.com/

AMAZON WEB SERVICES, INC. (2016). *About AWS.* Recuperado el 3 de February de 2016, de https://aws.amazon.com/about-aws/

AMAZON WEB SERVICES, INC. (2016). *AWS | Oracle and Amazon Web Services.* Obtenido de http://aws.amazon.com/oracle/

Ariba (Dirección). (2016). *Ariba_Procurement_on_Demand* [Película]. Obtenido de https://www.dropbox.com/s/12m20mpnfemrbbc/Ariba_Procurement_on_Demand.mp4?oref=e&n=429341268

Asta. (2016). *YOUTUBE.* Obtenido de Asta Powerproject Overview: https://www.youtube.com/watch?v=kV0KPedxgD4

ATLASSIAN.COM. (2016). Obtenido de JIRA Software - Issue & Project Tracking for Software Teams | Atlassian: https://www.atlassian.com/software/jira

Hollmann, J. K. (2006). *Total Cost Management Framework an Integrated Aproach to Portfolio, Program and Project Management.* Morgantown: AACE International.

Hollmann, J. K. (2015). *AACE International - About Us.* Retrieved from http://www.aacei.org/aboutUs/whatIsCE.shtml

ITQLICK. (2016). *ITQLICK.COM.* Obtenido de Procore - ITQlick.com: http://www.itqlick.com/procore

Microsoft Office. (2016). *Microsoft Office.* Obtenido de Top Features | What's New in Microsoft Project: https://products.office.com/en-us/Project/project-top-features?tab=5be62e8e-5c9c-50b2-6d90-fd024de6a69f

Njoku, D. (10 de December de 2013). *All things Oracle.* Recuperado el Enero de 2016, de Oracle for Absolute Beginners: Part 1 – Databases: http://allthingsoracle.com/oracle-for-absolute-beginners-part-1-databases/

ORACLE. (2016). *ORACLE.COM.* Obtenido de Primavera P6 Enterprise Project Portfolio Management | Oracle: https://www.oracle.com/applications/primavera/products/project-portfolio-management/index.html

ORACLE. (2016). *ORACLE.COM.* Obtenido de Primavera Enterprise Project Portfolio Management (PPM) | Oracle: https://www.oracle.com/applications/primavera/index.html?utm_source=Facebook

ORACLE. (2016). *ORACLE.COM.* Obtenido de PPM Solutions for Capital Projects and Programs | Oracle: https://www.oracle.com/applications/primavera/solutions/capital-projects-programs/index.html

Palacio, J., & Ruata, C. (2011). *Scrum Manager Gestión de Proyectos .* Safe Creative.

Pande, P. S., Neuman, R. P., & Cavanagh, R. R. (2000). *The Six Sigma Way how GE, Motorola and Other Top Companies Are Honing Their Performance.* McGraw-Hill.

Peterka, P. (n.d.). *Project Smart.* Retrieved from The Difference Between Typical Project Management and Six Sigma Project Management: https://cdn.projectsmart.co.uk/pdf/project-management-six-sigma-project-management.pdf

Primavera Scheduling. (2016). *Primavera Scheduling.* Obtenido de Primavera P6 Professional: http://www.primaverascheduling.com/home/buy-primavera-software/primavera-p6-professional/

PROCORE. (2016). *PROCORE.COM.* Obtenido de Construction Project Management Software by Procore: https://www.procore.com/

PROJECTCENTER. (2016). *PROJECTCENTER.US.* Obtenido de ProjectCenter | Project Management Software, Online Collaboration: http://projectcenter.us/

Project Management Institute. (2000). *A Guide to the Project Management Body of Knowledge (PMBOK Guide).* PMI Standard .

ThePGPro. (2013, April 15). *Ten Six Consulting.* Retrieved from https://tensix.com/2013/04/primavera-p6-vs-microsoft-project/

WRIKE. (2016). *WRIKE.* Obtenido de Wrike - Project Management: https://www.wrike.com/project-management?utm_source=capterra&utm_medium=cpc&utm_campaign=project-main

WRIKE. (2016). *WRIKE.* Obtenido de Wrike - Project Management: https://www.wrike.com/project-management/

WRIKE. (2016). *WRIKE.* Obtenido de Wrike - Enterprise Project Management: https://www.wrike.com/enterprise-project-management/

WRIKE. (2016). *WRIKE.COM.* Obtenido de Wrike.com - API: https://developers.wrike.com/

WRIKE. (2016). *WRIKE.COM.* Obtenido de Video tutorials - Wrike Help center: https://www.wrike.com/help/video-tutorials/

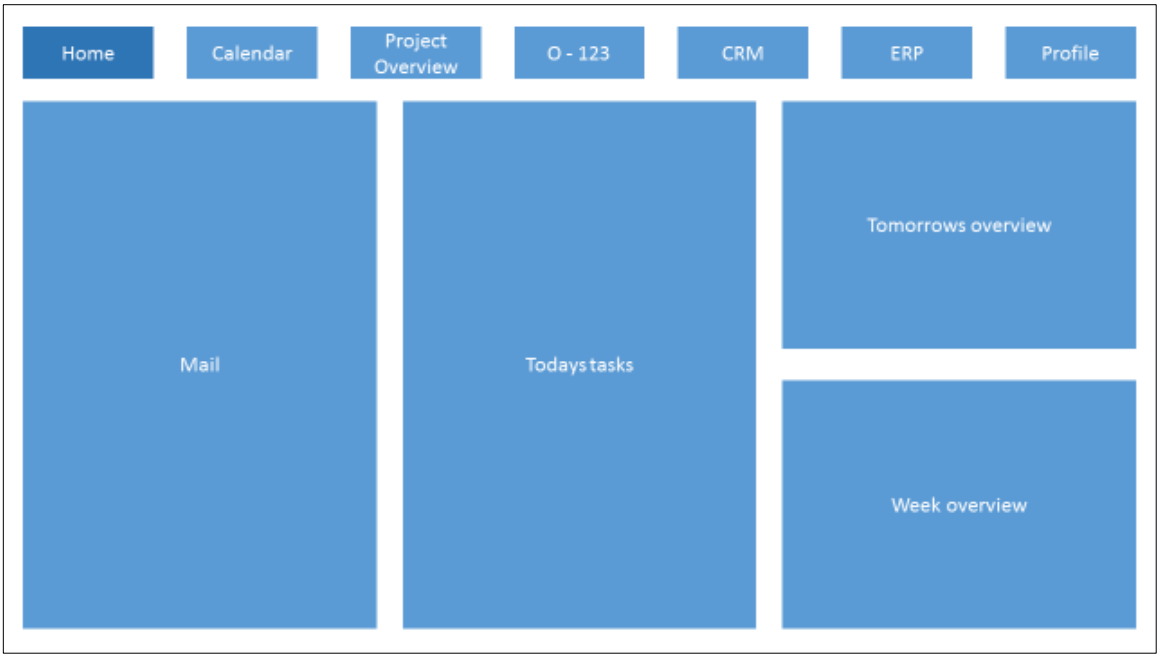
WRIKE. (2016). *WRIKE.COM.* Obtenido de Timeline: https://www.wrike.com/timeline/index.html?id=C7FRMbzPMHzzcqMM|IE4DONJUGM4S4UZW

WRIKE. (2016). *WRIKE.COM.* Obtenido de Wrike - Pricing: https://www.wrike.com/price/

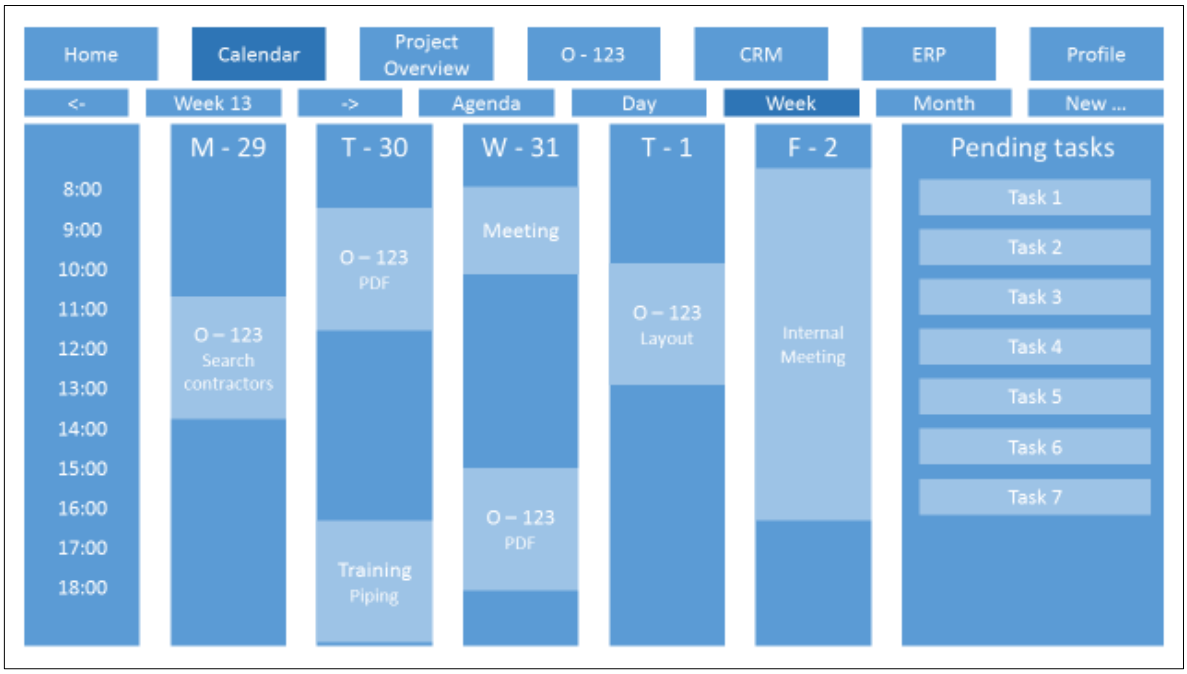
ANEX I

USER INTERFACE DESIGN

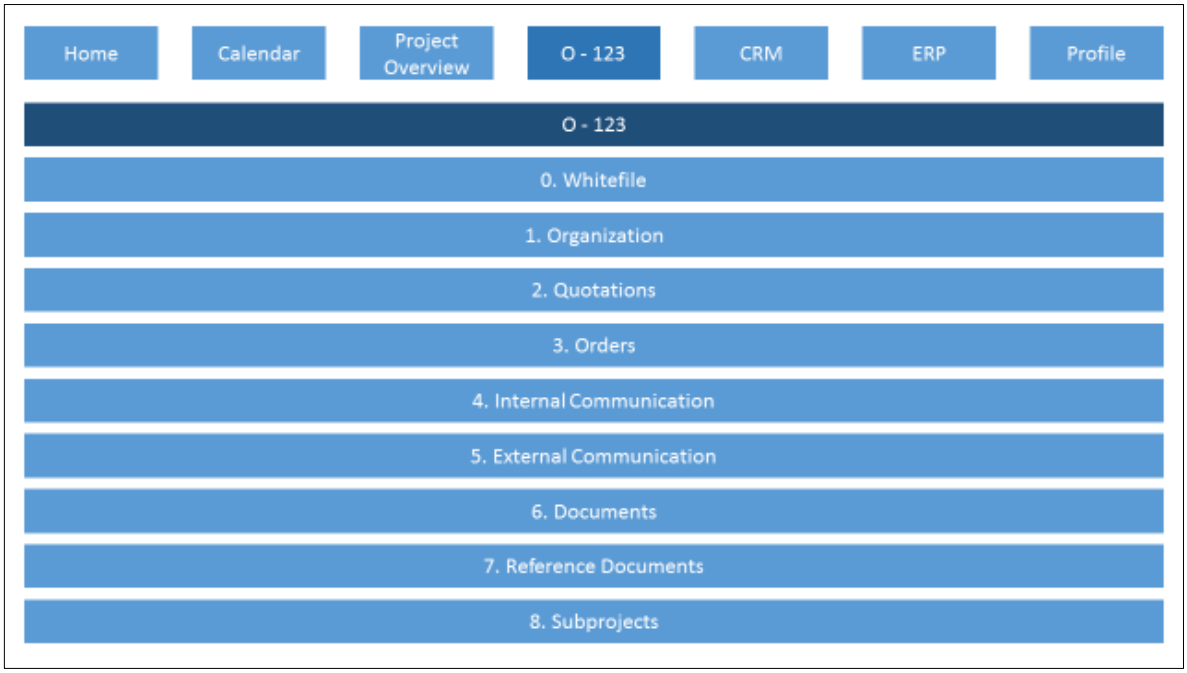
UI view 1 Login Screen



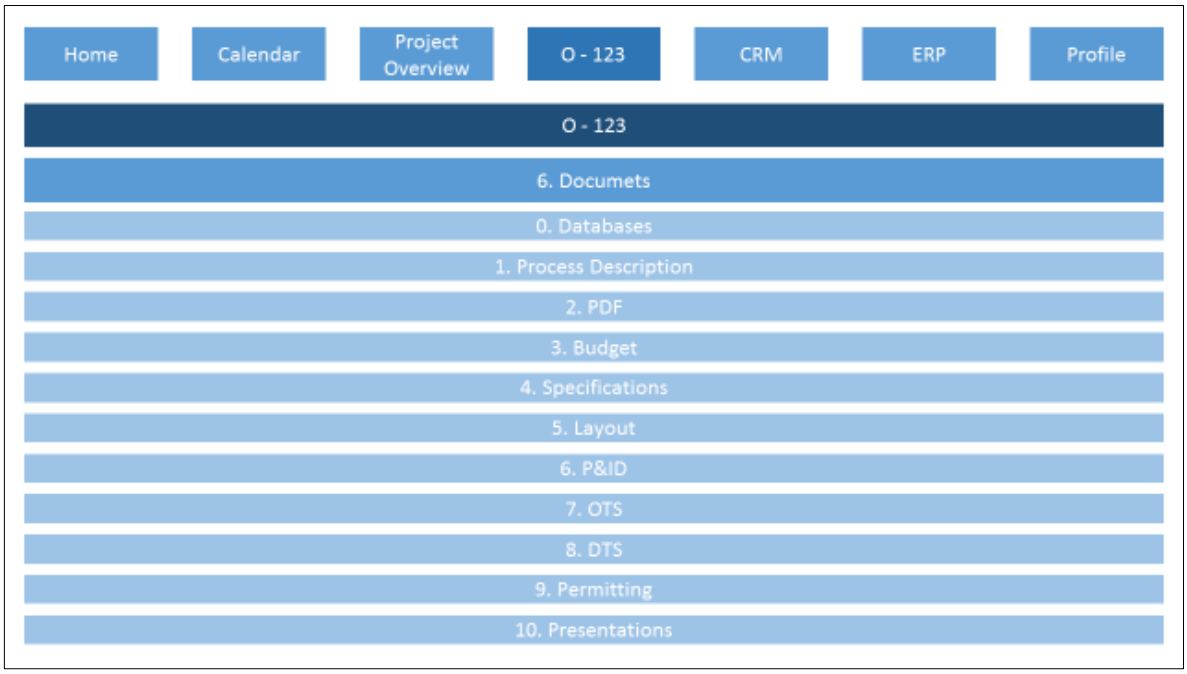
UI view 2 General Dashboard



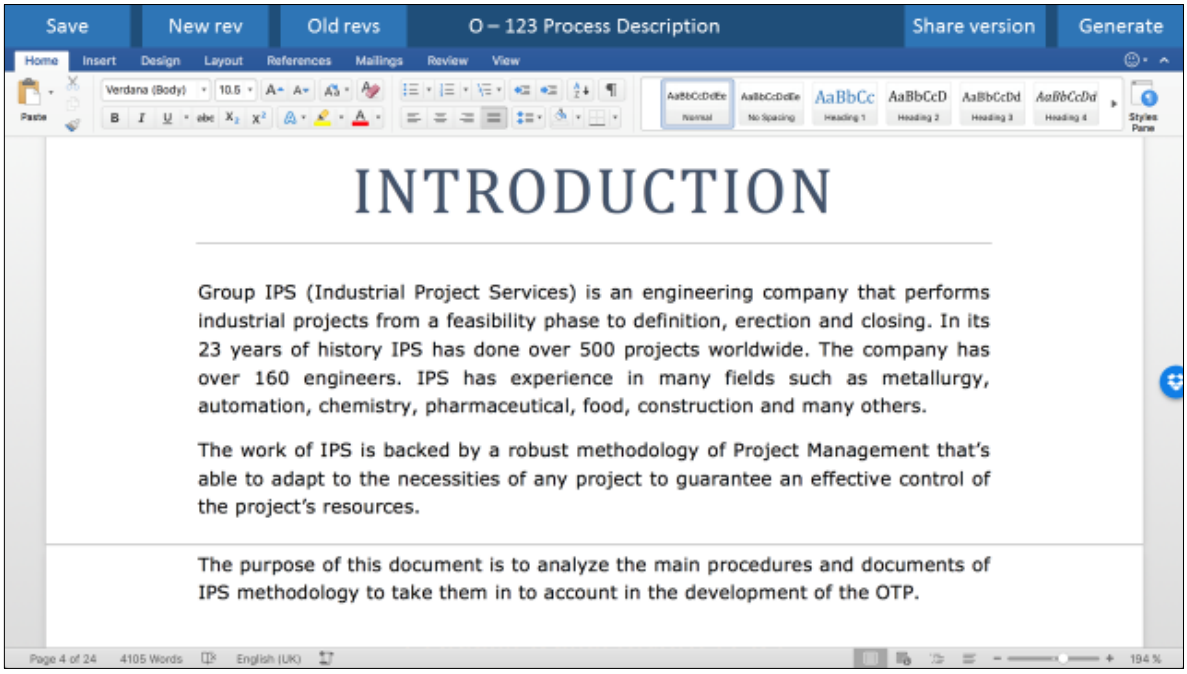
UI view 3 Weekly view



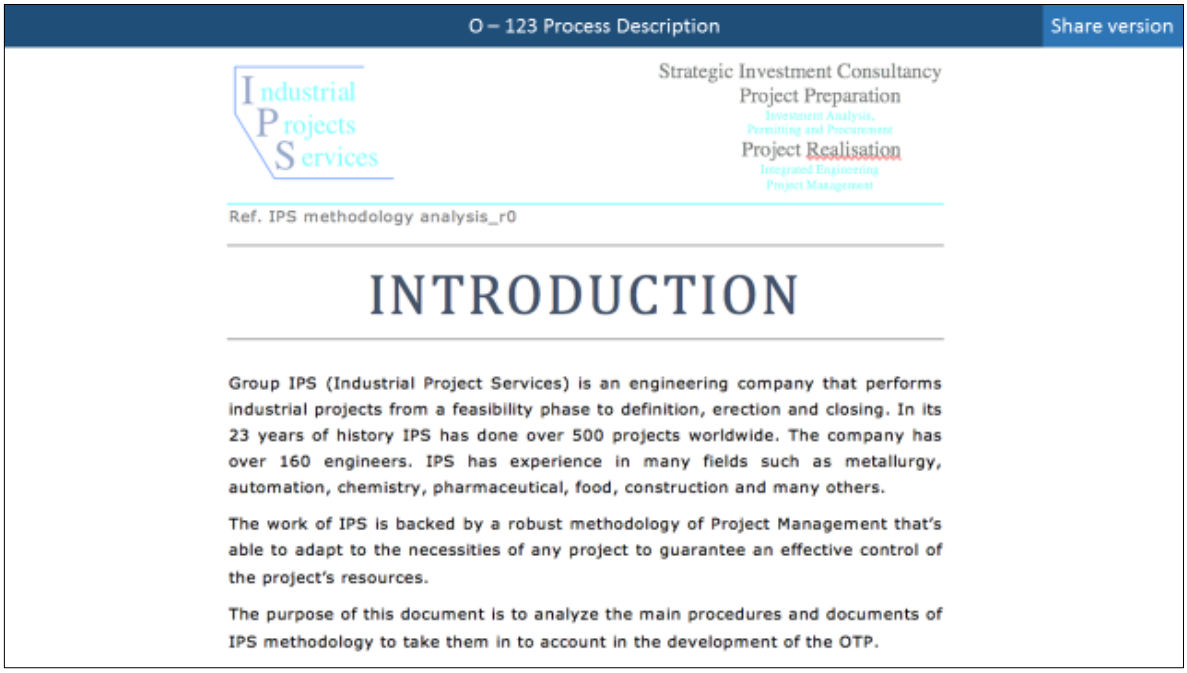
UI view 4 Document Manager View



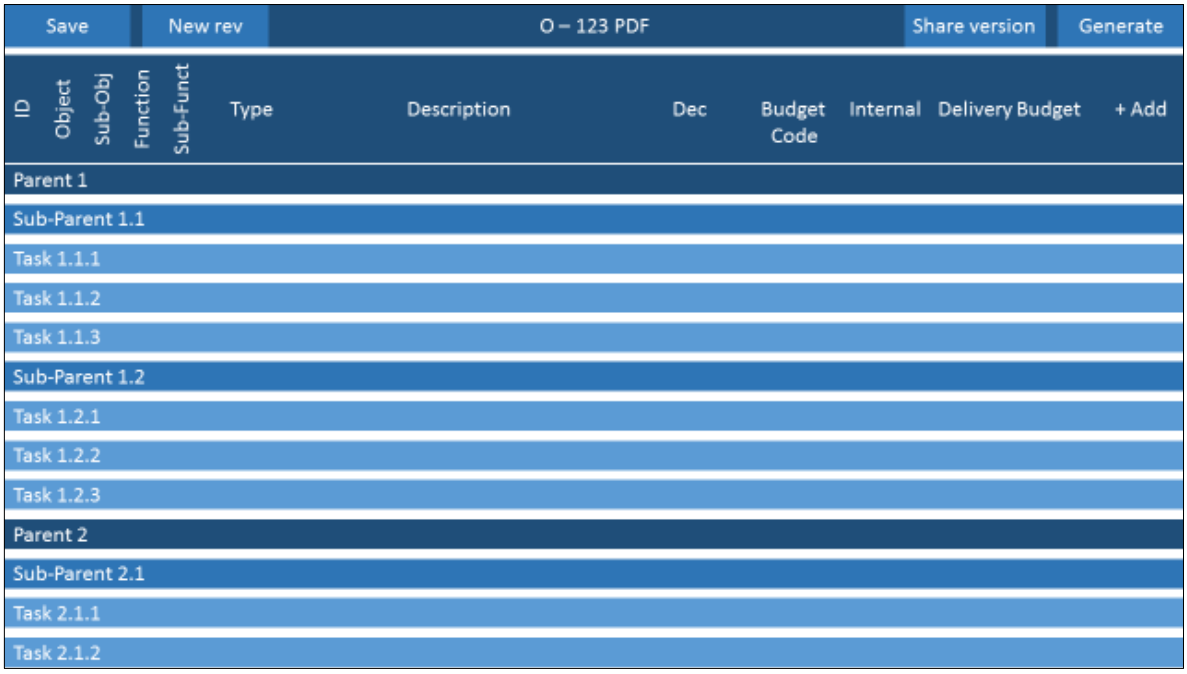
UI view 5 Documents



UI view 6 Text editor

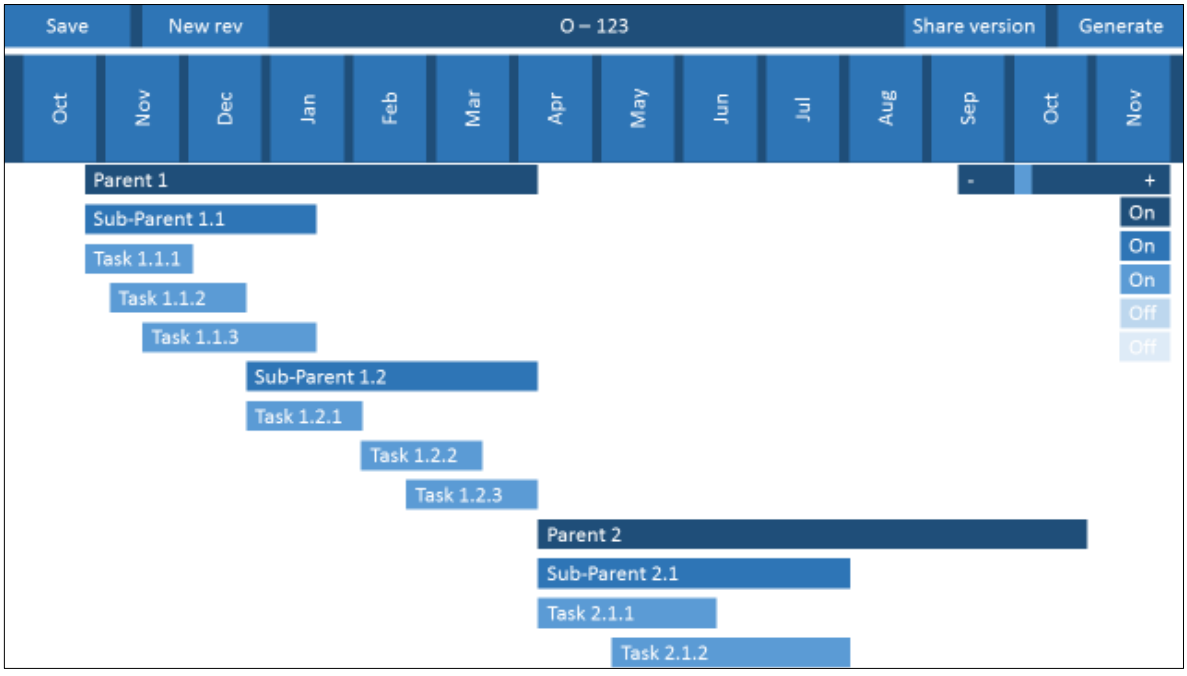


UI view 7 Preview PDS

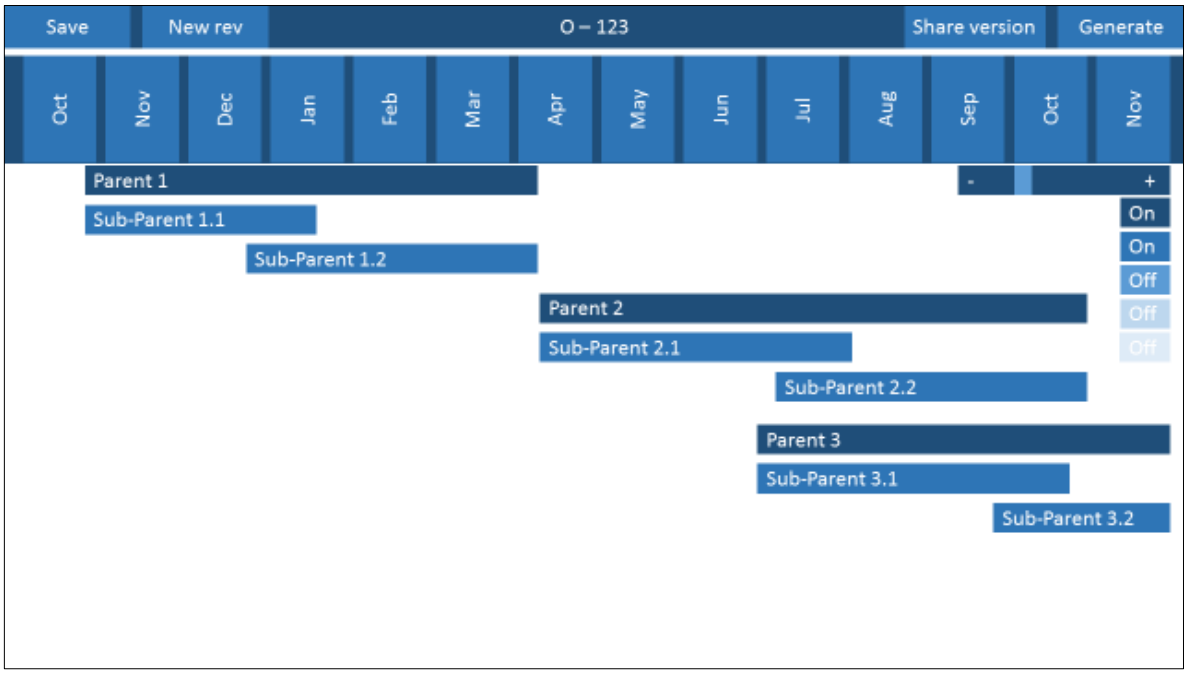


UI view 8 PDF editor

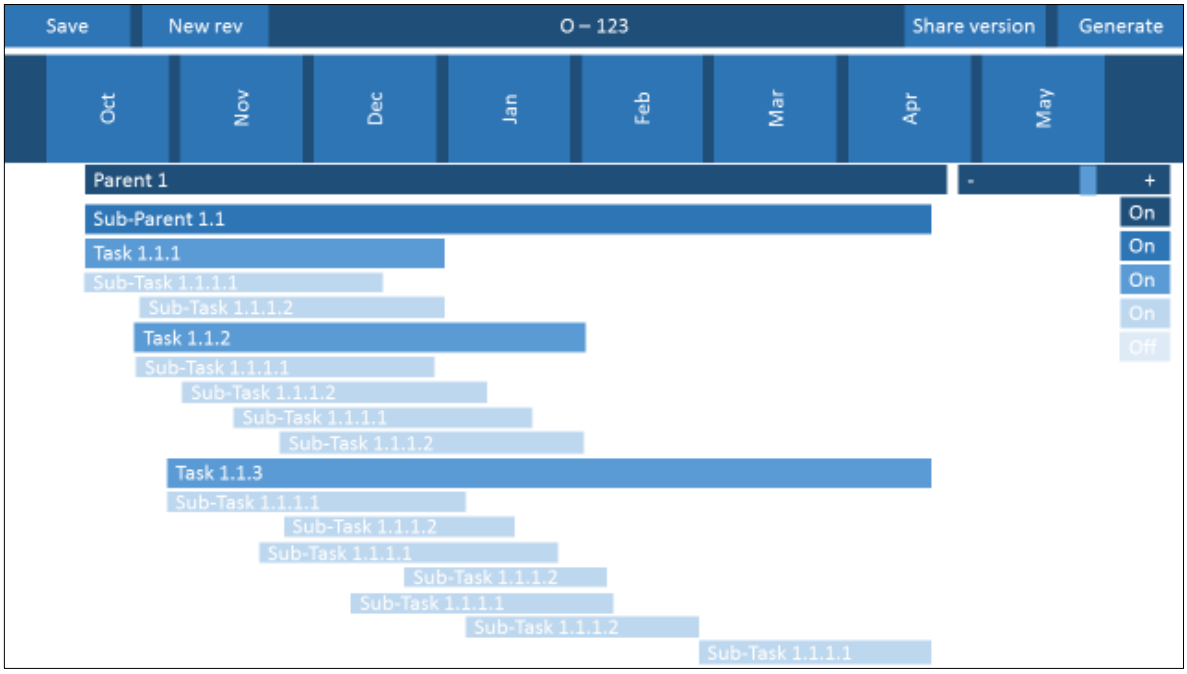
UI view 9 Budget Editor



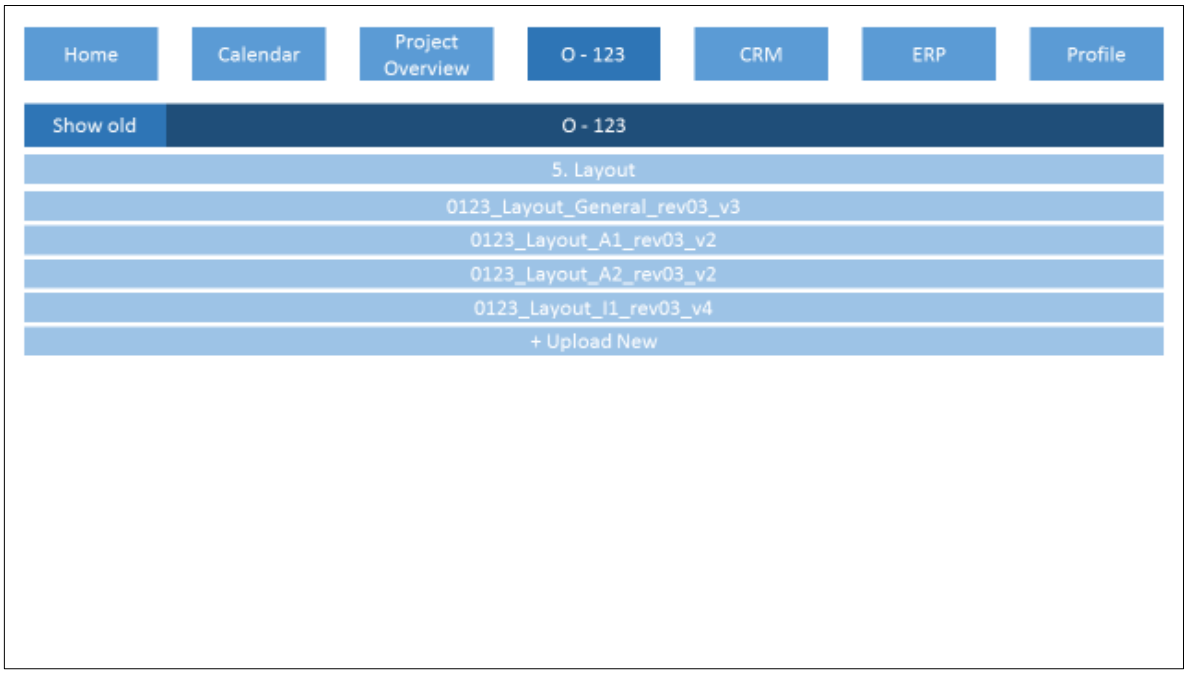
UI view 10 DTS editor



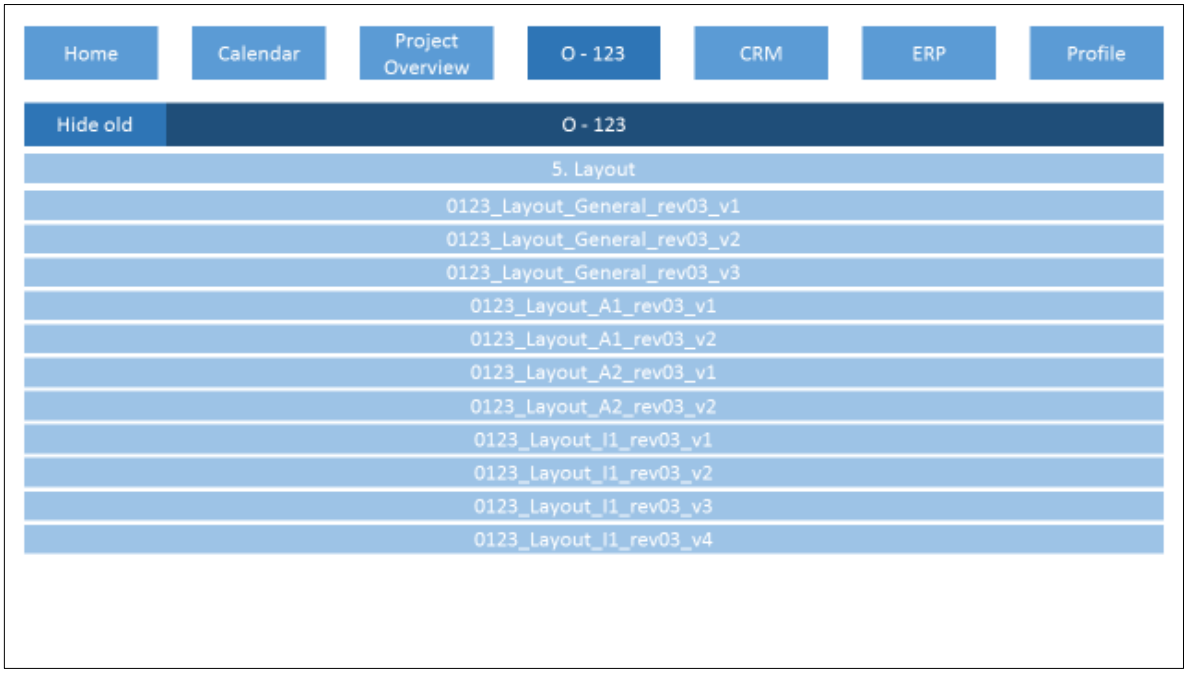
UI view 11 DTS zoom out



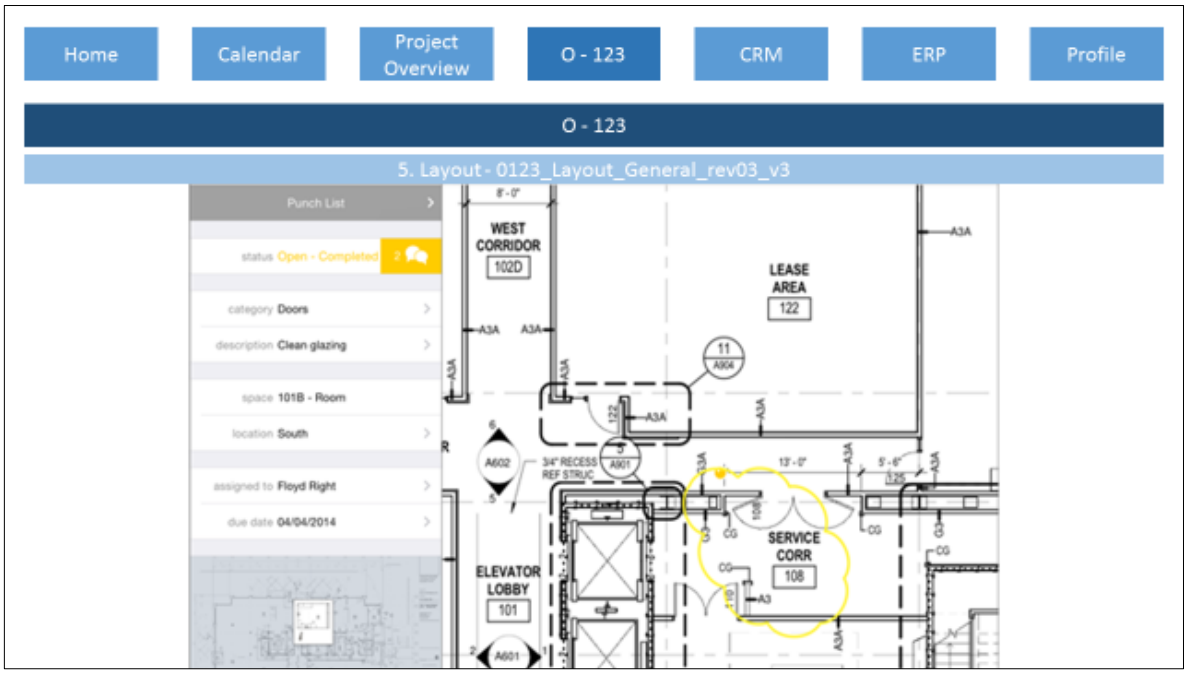
UI view 12 DTS zoom-in



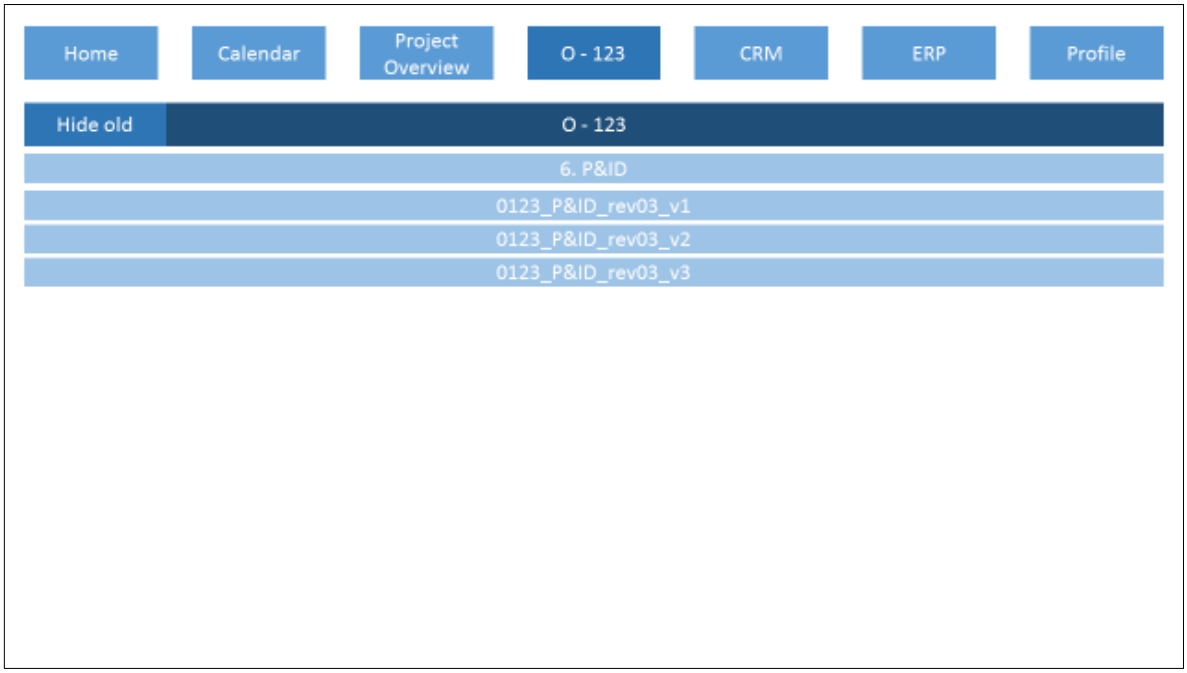
UI view 13 Layout Manager



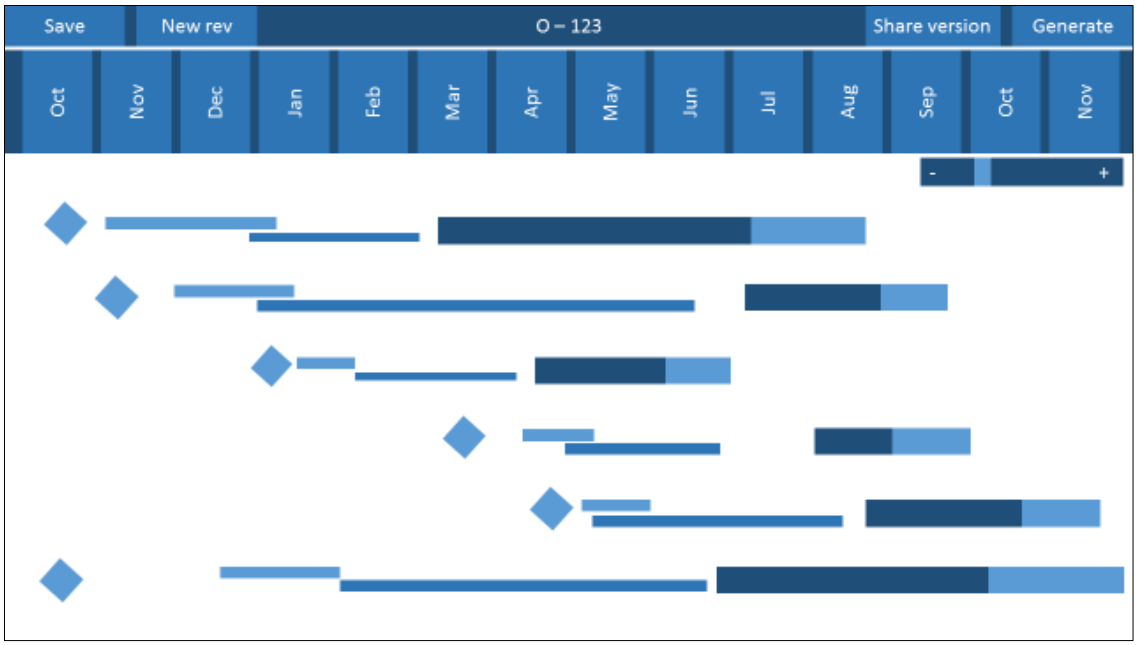
UI view 14 Layout previous versions



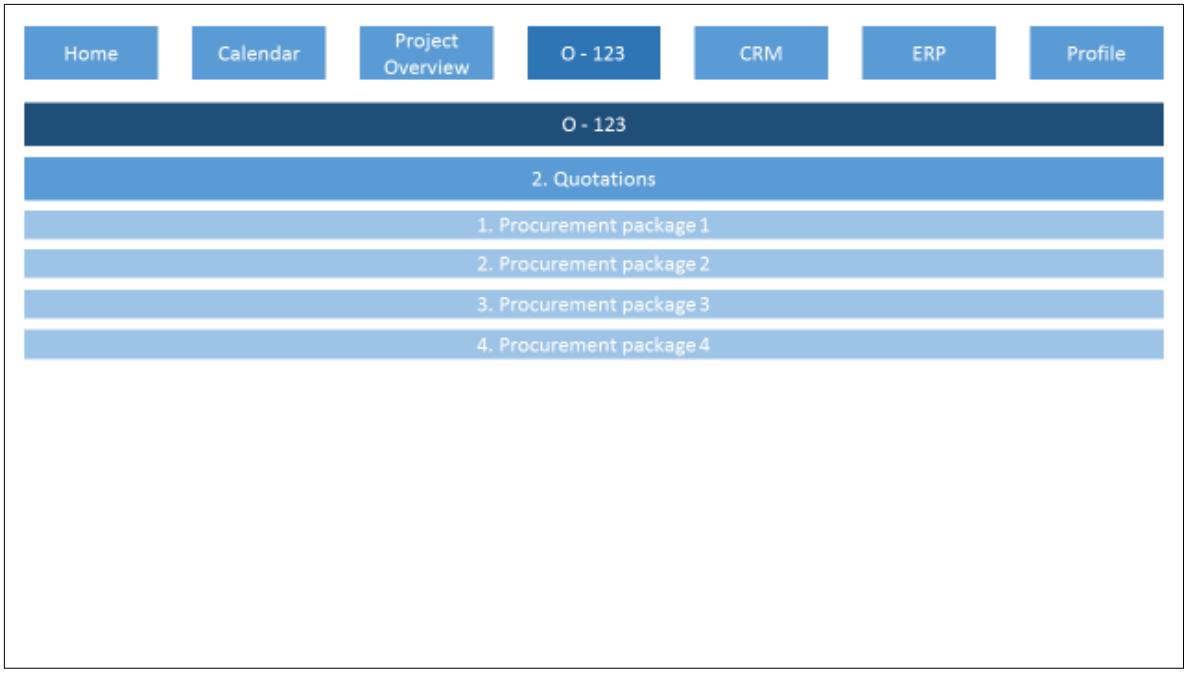
UI view 15 Layout advance editor



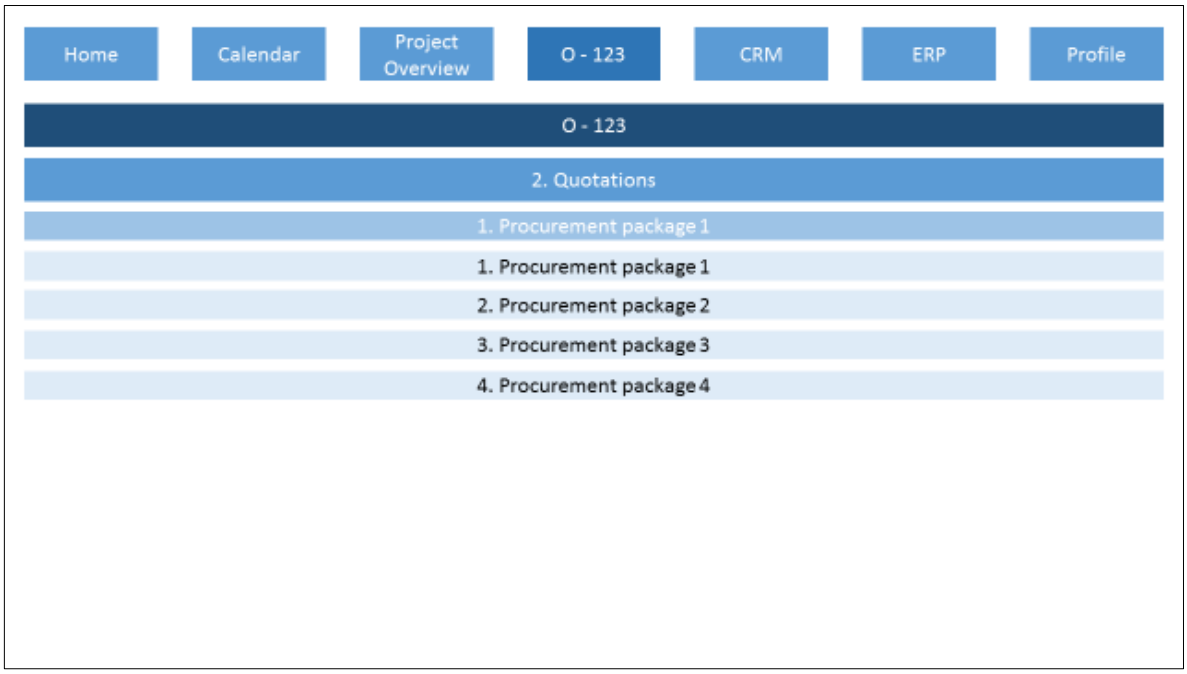
UI view 16 P&Id editor



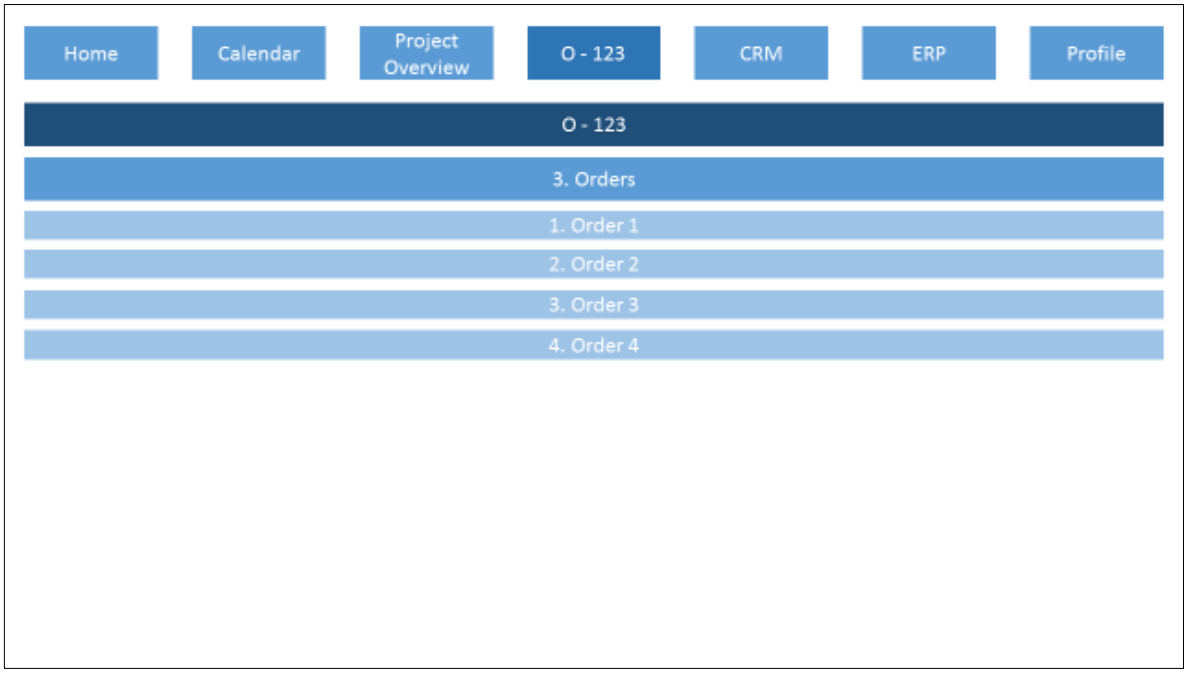
UI view 17 OTS editor



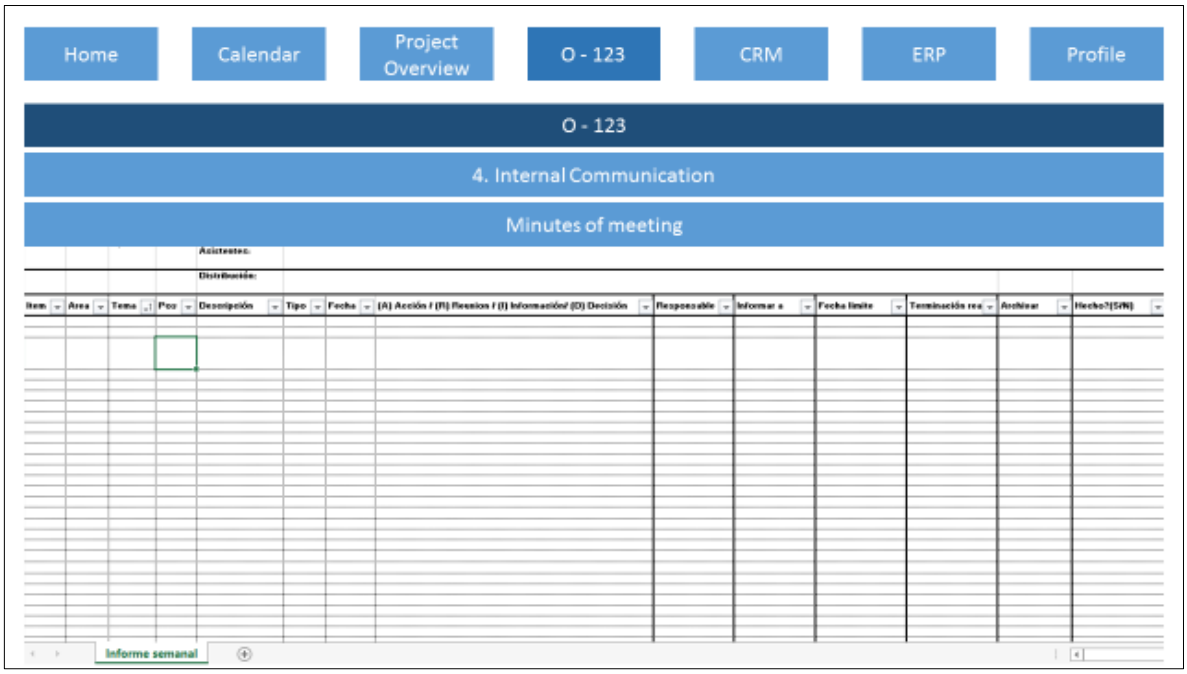
UI view 18 Quotations manager



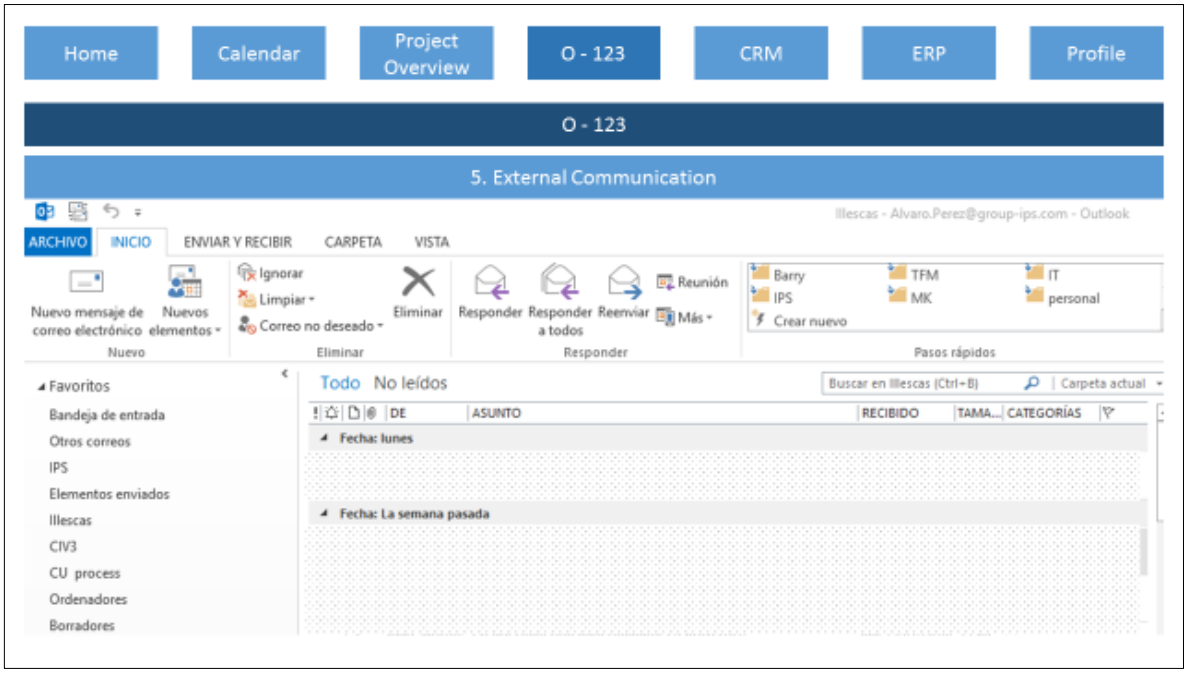
UI view 19 Procurement manager



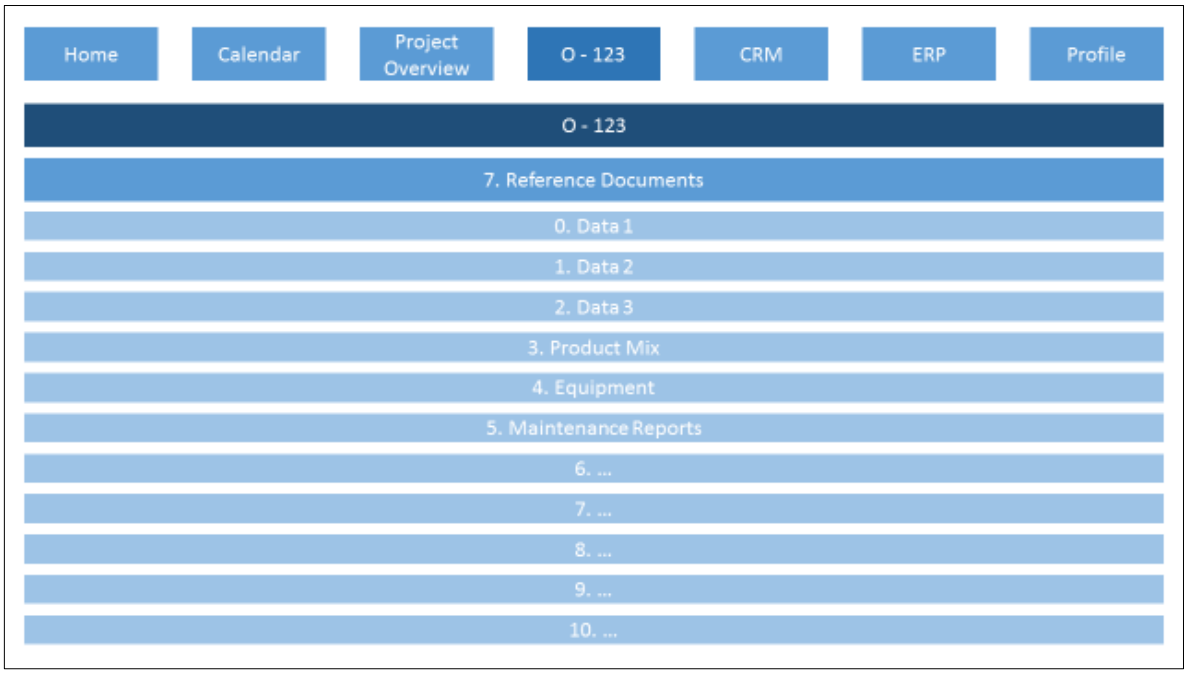
UI view 20 Orders manager



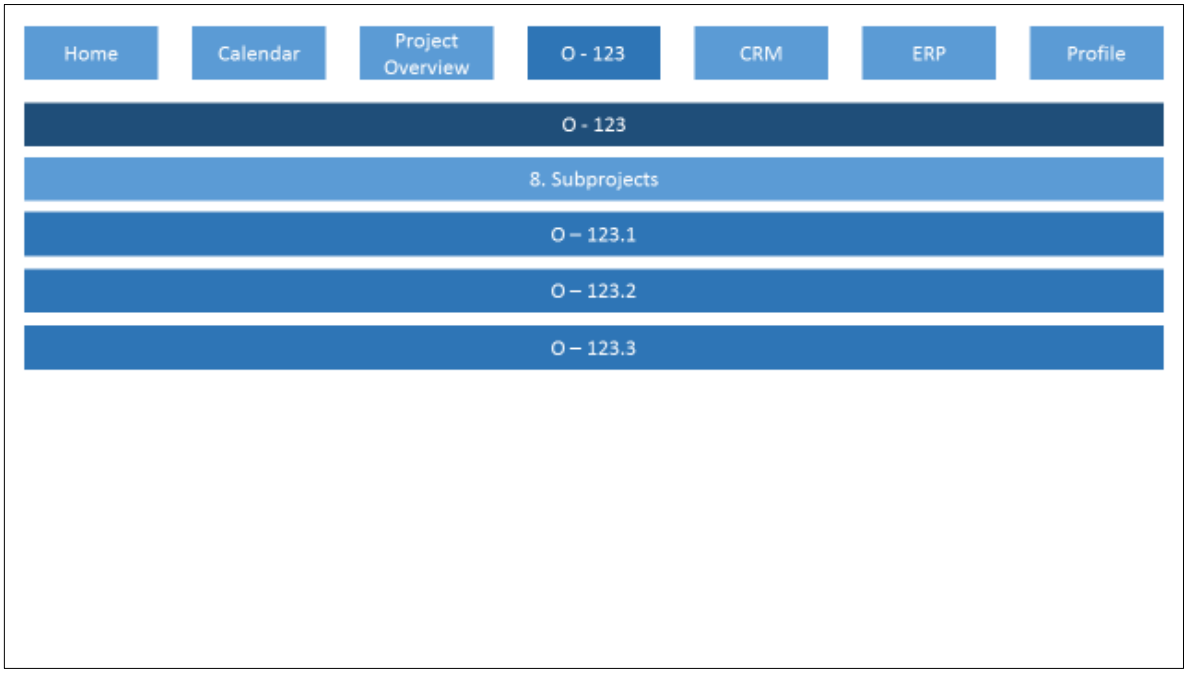
UI view 21 Internal communication MOMs



UI view 22 Outlook integration



UI view 23 Reference Documents Manager



UI view 24 Subprojects view