Tampereen yliopisto

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PROFESSIONAL SERVICE AUTOMATION

Data classification and profiling from subcontracting point of view

Faculty of Information Technology and Communication Sciences
Master of Science Thesis
July 2021

ABSTRACT

Miia-Maarit Onikki: Professional Service Automation - Data classification and profiling from subcontracting point of view
Master of Science Thesis
Tampere University
Information Technology and Communication Sciences
October 2020

This thesis concentrated on classification and profiling of information from subcontractor point of view. The primary goal was to find an answer to the question *How should information be categorized and profiled in a new profession service automation system, so that subcontractors can get only needed information to do their daily work? In addition, aim is to define level where does the business risk taking capacity goes between usability and confidentiality?*

Used research method was design science research method. It is design method based on definition and analysis of alternative solutions. I started data collection with qualitative interviews and capabilities of the new PSA system. Unfortunately, during the design phase, I was not able to test or investigate very detailed level of the new system. Instead of that, I analyzed collected data from the current and coming system based on interviews and made improvement proposals for M-Files how to profile and share data to subcontractors. I used risk management method for searching the level of the criticality of sharing data.

Main results were new proposal for confidential classification of subcontracting data, impact analysis of most urgent risks and proposal for mandatory key factors for ensuring success delivery of the projects. According to the risk analysis, all money related data like budget, cost, invoices are most sensitive information. It needs to be ensured that visibility of those is locked from the subcontractors. Invoicing and budget planning needs to be done by M-Files internal employee instead of subcontractor. Delivery Item is the riskiest data because it includes several data in metadata card. Restriction of certain data are needed like money related data. Accounts and opportunities need to be restricted also from subcontractors. Those will be shared only need basis, because subcontractors can try to enlarge their own customer portfolio based on the information they receive.

All the other individual data are not so risky to share, but by combining individual knowledge, the subcontractor can get her/him hands on valuable information. More confidential the information, the more precise it must be in terms of information sharing. The conclusion was that finding and determining the exact risk level was difficult. Individual information and its sharing do not yet pose a very high risk, but providing more information and by combining those, there might be higher risk to provide business benefits to other companies.

Keywords: subcontractor, information sharing, data protection, data profiling, role-based access management, professional service automation, risk management

The originality of this thesis has been checked using the Turnitin OriginalityCheck service.

TIIVISTELMÄ

Miia-Maarit Onikki: Professional Service Automation - Data classification and profiling from subcontracting point of view
Diplomityö
Tampereen yliopisto
Informaatioteknologian ja viestinnän tiedekunta
Tietotekniikka
Lokakuu 2020

Tässä diplomityössä keskityttiin tutkimaan tiedon luokittelua ja profilointia alihankkijarajapinnasta katsoen. Ensisijaisena tavoitteena oli löytää vastaus kysymykseen *Miten tietoa pitäisi luokitella ja profiloida ammattimaisessa palveluautomaatiossa, jotta alihankkijat voivat saada heille välttämättömän tiedon työn tekemiseen? Lisäksi pyrin määrittelemään missä menee liiketoiminnallisen riskinottokyvyn raja eli tasapaino luottamuksellisuuden ja työn sujuvuuden ja käytettävyyden välillä?*

Tässä lopputyössä käytetty tutkimusmenetelmä oli suunnittelutiede. Se on suunnittelumenetelmä, joka perustuu ongelman määrittelemiseen ja vaihtoehtoisten ratkaisujen arviointiin ja analysoitiin. Aloitin tiedonkeruun laadullisilla haastatteluilla ja uuden PSA-järjestelmän mahdollisuuksien kartoittamiseen. Valitettavasti suunnitteluvaiheessa ei ollut mahdollisuutta päästä tutkimaan tai testataamaan uuden järjestelmän toiminnallisuuksia tarkemmin. Sen sijaan suunnittelu perustui nykyisen ja uuden järjestelmän tiedon analysointiin haastattelujen perusteella. Käytin riskienhallintamentelmää tietojen jakamisen kriittisyyden tason määrittämiseen.

Tutkimuksen tärkeimmät tulokset olivat uusi luottamuksellinen luokitteluehdotus alihankintatiedoille, kriittisempien riskien vaikutusanalyysi ja ehdotus pakollisista avaintekijöistä hankkeiden onnistumisen varmistamiseksi. Riskianalyysin mukaan kaikki rahaan liittyvät tiedot, kuten budjetti, kustannukset, laskut, ovat arkaluonteisimpia tietoja. On varmistettava, että alihankkijoilta estetään näkyvyys tietoihin, joita he eivät tarvitse. M-Filesin sisäisen työntekijän on huolehdittava laskutuksesta ja budjettisuunnittelusta alihakkijoiden sijaan. Riskianalyysin perustuen toimitustuote on riskialttein tieto, koska se on kooste useista yksittäisistä tiedoista metatietokortilla. Analyysin mukaan tiettyjen tietojen, kuten rahaan liittyvien tietojen, rajoittaminen on tarpeen. Käyttäjätilejä ja kaupallisia mahdollisuuksia on myös rajoitettava alihankkijoiden osalta. Oikeudet annetaan vain tarpeen mukaan, sillä nähdään riskinä, että alihankkijat voivat yrittää kasvattaa omaa asiakaskuntaansa saamiensa tietojen perusteella.

Yleensä ottaen yksittäisten tietojen jakaminen ei ole niin riskialtista, mutta yhdistämällä yksittäisiä tietoja, alihankkija voi saada kätensä arvokkaaseen tietoon. Mitä luottamuksellisempia tiedot ovat, sitä tarkemman niiden on oltava tietojen jakamisen kannalta. Tarkan riskitason löytäminen ja määrittäminen osoittautui kuitenkin vaikeaksi. Yksittäisten tietojen jakaminen ei vielä aiheuta kovin suurta riskiä, mutta riittävä lisätietojen tarjoaminen ja tietojen yhdistäminen saattaa olla suurempi riski tarjota liiketoiminnallisia etuja muille yrityksille.

Avaisanat: alihankinta, tiedon jakaminen, tiedon suojaaminen, tiedon profilointi, roolipohjainen oikeuksienhallinta, palveluautomaatio, riskienhallinta

PREFACE

With this Master of Science Thesis, I will complete my computer science studies in Tampere University. It has been a long journey. I am glad that I got opportunity to do this thesis for the company I work for, M-Files Oy. The topic was found quite quickly when I talked with Head of Customer Success Operations, Risto Kero.

I would like to thank you both of inspectors, University Instructor Marko Helenius and Head of Customer Success Operations Risto Kero for directing this thesis and showing guideline. I received many valuable pieces of advice and guidance to take this thesis forward. Warm thank you also to my family. I have completed my studies and this thesis alongside work. It has required lot of organizational skills and patience from my family.

In Tampere, Finland, on 23 June 2021

Miia-Maarit Onikki

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LIST OF ABBREVIATIONS AND SYMBOLS

AICPA	Association of International Certified Professional Accountants
CR	Change Request
CRM	Customer, Relationship and Management
DeCo	Delivery Collaboration Vault
DPA	Data Processing Agreement/Addendum
EMEA	Europe, the Middle East and Africa
GDPR	General Data Protection Regulation
IAM	Identity and access management
IEC	International Electrotechnical Commission
IFRS	International Financial Reporting Standards
IP address	Internet Protocol Address
ISMS	Information Security Management System
ISO Standard	International Organization for Standardization
ISO 9001	International Organization for Standardization, Quality Management System
ISO 27001	International Organization for Standardization, Information Security Management Standard
NDA	Non-disclosure agreement
PO	Purchase Order
PSA	Professional Service Automation
QMS	Quality Management System
T&M	Time & Material Delivery
SOC 2	System and Organization Controls, Trust Service Criteria
SWOT	Strengths-Weaknesses-Objectives-Threats

1 INTRODUCTION

1.1 Research background

Profitability and measuring of it are the cornerstones of every company's success. When the business expands, the amount of information to be managed increases and the most reliable data and the right kind of tools are needed to manage it.

M-Files Corporation is a Finnish information management company. I have been working there the past six years as a senior project manager. For more than ten years, M-Files used it is own data management solution to manage customer data. With the current customer relationship management system, called CRM, M-Files has managed, for example, customer accounts, delivery agreements, project deliveries and invoicing. However, the old system has come to an end as the amount of data increases and the organization expands. Because of those reasons, the information is starting to be fragmented and requires simultaneous use of several systems.

Subcontracting is constantly increasing part of M-Files' business. In almost all customer delivery projects in M-Files, subcontracting has been closely involved as part of project deliveries. The role of subcontractors varies depending on the project. Architect, system specialists and project manager are the most typical roles for subcontractors in projects. In practice one of big challenge during the project is sharing the information and documents between M-Files and subcontractors. It takes lot of effort to find ways how to share individual information for the right persons. Some of the information such as costs, opportunities, customers need to be protected from external parties, so that they cannot use the information in their own business. Only the information that is necessary to do the work is considered necessary to share.

M-Files Oy started Professional Service Automated project on the August 2020. Target of the project was to evaluate several PSA systems and replace current Customer Relationship Management (CRM) system with a selected new PSA system. I got opportunity to be part of the PSA project by defining requirements and evaluating new alternative systems. I was nominated as a Change Manager for this project in the beginning of the project. As a change manager my responsibility was to plan and ensure that a new PSA system will be deployed all over the company according to the roll out plan. My focus areas of system evaluation and design were project management and subcontracting point of view. In this Master of Science thesis, I focused on classified and profile data for collaborators to ensure that they have prerequisites to do their work effectively enough.

The project consisted of several phases. The first phase was to define and score the requirements for the new system. The second phase was to map and compare available service automation systems on the market. The aim of the third phase was to select a new system for coordinating management of customer data and the deliveries in the future. In the fourth phase the new system was design based on collected requirements. In the fifth phase system will be implemented and all the functionalities will be tested and deploy to the use. This Master of Science thesis focused on the first four phases. Aim of the thesis was to focus on the requirements of subcontracting and in particular the availability of information from the subcontractor's perspective.

1.2 Goal of the research and used research method

This thesis concentrates on classification and profiling of information from subcontractor point of view. The primary goal is to find an answer to the question how should information be categorized and profiled in a new profession service automation system, so that subcontractors can get only needed information to do their daily work? In addition, I try to define level where does the business risk taking capacity goes between the usability and confidentiality. The aim of this Master of Science thesis was to help M-Files to design a new PSA system to support daily basis operative work in subcontracting interface.

The type of this research method was design science research. It is design method based on definition and analysis of alternative solutions. I started data collection with qualitative interviews and capabilities of the new PSA system. Unfortunately, during this design phase, I was not able to test or investigate in very detailed level the new system. Instead of that, I analyzed collected data and made some improvement proposals for M-Files how to profile and share data to subcontractors. I used risk management for searching the level of the criticality of sharing data. Main results were new confidential classification proposal for subcontracting data, impact analysis of most urgent risks and proposal for mandatory key factors to ensure success delivery of the projects.

1.3 Structure of research

At the beginning of this study, we dive into the backgrounds and goals of the work and research method used in the work. The second chapter deals with the search for information for research. Based on the literature found hypotheses are formed about factors that may affect the sharing of information to subcontractors. Those factors and hypothesis are handled more deeply in chapter eleven. The third chapter dives into the backgrounds and theories of the work, covering M-Files as a company and professional service automation system. Fourth chapter covers different laws and regulations like GDPR, privacy protection law. Fifth chapter dives to the ISO standard world, introduction ISO 9001 [22] and ISO 27001 [12]. SOC2 framework is covered also in chapter five. Sixth chapter introduces role-based access management. Seventh chapter goes deeper to data profiling and sharing rules in current CRM system. Eight chapter opens the world of the PSA project phase by phase. The most important phase is design phase from master of thesis point of view. Chapter nine covers user stories of subcontracting and analysis of those subcontracting requirements. Tenth chapter covers data profiling and sharing rules for subcontractors in the new PSA system. At the end of the work discussions were taken into the place and bulled to the together.

2 RELATED RESEARCH AND USED METHODS

2.1 Data collection method

Qualitative interviews were used as the data collection method. The data collection method was based on two different interviews: current data analysis interview and PSA capability interview. Both interviews were made via teleconference because of Covid-19 situation. In this chapter both of those interview research methods are described more detailed. Processing of the results are discussed in more detailed in chapter 8.3.3.

Current Data Analysis Interview based on these questions:

- What information is shared with subcontractors?
- Which processes are the data related to?
- How is data currently classified and how it should be classified in the future?
- Which roles handle/need data?
- What are the dependencies between data?
- What are the used methods for sharing data?
- What are the needed access rights to certain data?
- Whether information is shared in need basis or by default?

As sources of information were used five professionals from subcontracting interface. Four of the professionals were M-Files employees who are working closely with collaboration interface and one of professionals was M-Files' supplier. I also utilized my own knowledge when analyzing current state of information sharing for subcontractors. I have managed 20 projects in M-Files and at least half of those have had subcontractors delivering the projects.

Other Qualitative interview was made in design workshop via teleconference. Interview based on 11 predefined user stories created by PSA project team (Annex 1). Also, few of additional questions were raised up during the interview. Interviewee were System Architect and system specialist of PSA system supplier. All the user stories are described in Annex 1. Processing of the results are opened in more detailed in chapter 9.

2.2 Used research method

The type of this research method was design science research. It is design method based on problem definition and analysis of alternative solutions. According Iivari and Venable "design research involves the analysis of the use and performance of designed artifacts to understand, explain and very frequently to improve on the behavior of aspects of information systems" [1].

I started data collection with qualitative interviews and capabilities of the new PSA system. Unfortunately, during this design phase, I was not able to test or investigate very detailed level the new system, because supplier of PSA system did not provide any sandbox environment for the project. Instead of that, I analyzed collected data and made some improvement proposals for M-Files how to profile and share data to subcontractors. I used risk management method for searching the level of the criticality of sharing data. Main results were new confidential classification proposal for subcontracting data, impact analysis of most urgent risks and proposal for mandatory key factors for ensure success delivery of the projects. Those results are opened more detailed in chapters 10-12.

2.3 Searching of information

I used several databases for searching information like Jufo Portal, Information Studies and Google Scholar. It was quite difficult to find peer-reviewed articles or publications related to subcontracting or professional service automation. Most suitable articles were found from Information Studies published by Association of Information Science. Instead, several interesting publications were found related to information sharing and data profiling keywords. In chapter 11 I compared two scientific articles, *Network Economy, and Information Management* [24] and *Trust influencing factors in main contractor and subcontractor relationships during projects* [22], to my own research findings observations.

3 BACKROUND AND THEORIES

3.1 M-Files ltd

M-Files Ltd is Finnish technology company, which develops and provides intelligent information management solutions for Customers in all over the world. There are over 500 employee all over the world. Head office is in Tampere. M-Files Ltd has developed own platform, which helps companies to manage their information and documents more effectively based on the metadata.

I have worked in M-Files over six years. I am managing two different roles: Senior Project Manager and Project Delivery Manager. I am taking care of delivering midmarket projects as a project manager. Other role is to resource, support and taking care of quality of project deliveries in project management office team. I wrote this thesis from the perspective of both roles, because target of the PSA project is to improve and simplify processes for project manager's daily work.

Also subcontracting is closely related to the part of project deliveries in M-Files Ltd. Subcontractors act acting in many roles. They can act as project manager, architect, or system specialists. They need to report working hours and create, edit, and share different project documents. As a project manager role, they need to invoice, analyze risks, and follow the used workloads.

3.2 Professional service automation

I tried to search for information about PSA from different databases. I noticed quite soon that it was not very easy to find lot of information related to PSA. My assumption is that PSA system is quite new solution and therefore not much written history can been found. According to Catherine Rozyczko history of PSA system is not very old, "In late 1997, a Silicon Valley company came to the Aberdeen Group in Boston with a concept called PSA (Professional Services Automation)". [2].

Based on Renata Matousoval, "The PSA market has been first identified in 1999 by the Aberdeen Group. Currently, the market is followed by all major research groups, including IDC, Gartner Group and META Group, although Aberdeen is still recognized as the leading authority on this market. Aberdeen has identified twelve modules within the PSA solutions: Project Management, Collaboration Management, Opportunity Management, Engagement Management, Practice Management, Time and Expense Management, Resource Management, Partner Relationship Management, Invoice Management, Help Desk, CRM, Business Intelligence and Knowledge Management."[15]

According FinancialForce, "PSA describes the technology for managing and automating businesses processes surrounding service delivery. The goal is simple: Optimize these processes holistically to improve delivery execution and overall profitability. By managing resources, projects, time and expenses, budgets, financials, billing, and customer interactions from a single dataset, a PSA solution gives you a complete view of delivery, leading to more insights and improved business agility."[30]

There are several PSA systems in the market. In this project M-Files evaluated five different PSA-systems. One of those was selected as a new PSA system for M-Files Ltd.

In M-Files there are several business processes and elements, which needs to be covered with new PSA system. I gathered most important PSA elements to Figure 1. Business processes can form either a life cycle from starting point (opportunity) to end (customer success management) or ongoing loop without clear start or end point. Chapter 8.3.3, Current data analysis, focuses on a more detailed analysis of the data elements.

Figure 1. M-Files PSA elements

4 LAWS, REGULATIONS AND AGREEMENTS

4.1 Laws, regulations, and agreement in M-Files

Co-operation with subcontractors requires several written agreements. Those agreements based on for example General Data Protection Regulation (GDPR) [26], Privacy protection law [4,23], non-disclosure agreements and Data Processing Addendum [14,26]. All the above are legal requirements outlined by European Commissions for all companies and M-Files complies with those also. Next chapters open each of those legal requirements more detailed.

4.2 General data protection regulation

"The right to privacy is part of the 1950 European Convention on Human Rights, which states, “Everyone has the right to respect for his private and family life, his home and his correspondence.” From this basis, the European Union has sought to ensure the protection of this right through legislation." [27]

"The GDPR entered into force in 2016 after passing European Parliament, and as of May 25, 2018, all organizations were required to be compliant" [27].

The primary target of this new legislation was to improve protection of individual's privacy. At first it confused many of the companies and organizations because it meant, that all the companies, organizations, associations, sport clubs who were processing personal data, must get data in shape required by the regulation. All the parties need to ensure that people can control their own data. In practice it means that all the parties need to look after individual's information and ensure that it has been used properly.

4.3 Privacy protection law

European Commission has outlined that "Everyone has the right to the protection of personal data concerning him or her and access to data which has been collected concerning him or her, and the right to have it rectified."[16]

According to Office of Data Protection Ombudsman, Processing of personal data base on law called privacy protection law. "All data related to an identified or identifiable natural person is personal data. Personal data can be stored in, for example, electronic files or databases, on paper, in a card file or folders, or on audio or video recordings. The data subject is the person to whom the personal data relates. A controller is a person, company, authority, or community that defines the purposes and methods of processing personal data. A processor is a third-party processing personal data on behalf of a controller".[4]

According to Office of Data Protection Ombudsman "All data related to an identified or identifiable person are personal data. In other words, data that can be used to identify a person directly or indirectly, such as by combining an individual data item with some other piece of data that enables identification, are personal data. Persons can be identified by their name, personal identity code or some other specific factor".[29]

"Examples of personal data:

- E-mail address, such as *firstname.lastname@company.com*
- Telephone number
- Identity card number
- Car registration number
- Positioning data (for example from a mobile phone)
- IP address
- Patient records
- A pet's veterinary records
- Data on the hereditary diseases of the person's great-great-grandparents.

" [29]

4.4 Non-disclosure agreement

"Non-disclosure agreements (NDA) are legal contracts that prohibit someone from sharing information deemed confidential. The confidential information is defined in the agreement which includes, but not limited to, proprietary information, trade secrets, and any other details which may include personal information or events." [14]

Companies are typically using either standard templates for NDA agreements or company might have own company-based template for that purpose. NDA agreements can be done either company level between companies or in personal level depends on case. M-Files are following both ways. Company level agreements will be made during the contract negotiations and personal one with subcontractors who will get account and accesses to M-Files or M-Files systems. Similar NDA agreements will be sign also between the M-Files customers and external employees, who are getting accesses to customer's environment.

Under the NDA agreements "the parties agree to enter into a confidential relationship with respect to the disclosure of certain proprietary and confidential information (“Confidential Information”)."[14]

4.5 Data Processing Agreement

" A data processing agreement (DPA) - also known as a data processing addendum - is a contract between data controllers and data processors or data processors and sub processors. These agreements are intended to ensure that each entity in the partnership is operating in compliance with the GDPR or other applicable privacy laws to protect the interests of both parties." [21]

"Virtually every business relies on third parties to process personal data. Whether it is an email client, a cloud storage service, or website analytics software, you must have a data processing agreement with each of these services to achieve GDPR compliance."[26]

"GDPR compliance requires data controllers to sign a data processing agreement with any parties that act as data processors on their behalf". [26]

"GDPR Article 28 [8], Section 3, explains in detail the eight topics that need to be covered in a DPA:

- The processor agrees to process personal data only on written instructions of the controller.
- Everyone who comes into contact with the data is sworn to confidentiality.
- All appropriate technical and organizational measures are used to protect the security of the data.
- The processor will not subcontract to another processor unless instructed to do so in writing by the controller, in which case another DPA will need to be signed with the sub-processor (pursuant to Sections 2 and 4 of Article 28).
- The processor will help the controller uphold their obligations under the GDPR, particularly concerning data subjects' rights.
- The processor will help the controller maintain GDPR compliance with regard to Article 32 [9] (security of processing) and Article 36 [10] (consulting with the data protection authority before undertaking high-risk processing).
- The processor agrees to delete all personal data upon the termination of services or return the data to the controller.
- The processor must allow the controller to conduct an audit and will provide whatever information necessary to prove compliance.

". [8]

5 STANDARDS AND FRAMEWORKS

5.1 Standards and frameworks in M-Files

This Master of Science thesis focuses on two quality ISO standards: ISO 9001 [28] and ISO 27001 [12, 31]. It also focuses in one quality framework SOC 2 [19] by the Assurance Services Executive Committee (ASEC) of the Association of International Certified Professional Accountants (AICPA). Those two ISO standards and SOC framework are most common international standards and control criteria for data protection. Also, M-Files' information security is compliance by those. In practice it means that M-Files' current information and systems are audited based on those ISO 9001, ISO 27001 standards and SOC 2 framework. New PSA system will be also audited in the future based on those same standard and framework.

"ISO standards were created to offer guidance, coordination, simplification, and unification of criteria to companies and organizations to reduce costs and increase effectiveness, as well as to standardize product and service standards for international organizations" [25]. Via standards companies can prove to their customers that products or services fulfill certain level of reliability and quality.

"ISO makes documents with required standards, specifications, guidelines, or characteristics that can be used by companies to ensure that materials, products, processes, and services are suitable for their purpose. Additionally, ISO ensures that these requirements are accepted in all member countries, to ensure standardization." [25]

The aim of the audit is to verify and ensure the functionality of the quality system and processes. It provides a regular mechanism to improve and maintain operations continuously. Companies can get certifications via audits. Audits can be done internally or by customers. Normally company or it is customer will order an audit from external supplier, who is objective and independent to perform the audit. Target of the auditing will be either to get or renewal certification or validate company or organization's processes and operations based on ISO standards.

In Finland there are several companies who are doing audits. For example, "Nixu Certification Ltd is an independent subsidiary of Nixu Corporation, acting as an official information security inspection body approved by the Finnish Communications Regulatory Authority Accreditation Service" [13].

5.1.1 ISO9001 - quality management system

"ISO 9001 is defined as the international standard that specifies requirements for a quality management system (QMS). Organizations use the standard to demonstrate the ability to consistently provide products and services that meet customer and regulatory requirements. It is the most popular standard in the ISO 9000 series and the only standard in the series to which organizations can certify." [28]

"ISO 9001 was first published in 1987 by the International Organization for Standardization (ISO), an international agency composed of the national standards bodies of more than 160 countries. The current version of ISO 9001 was released in September 2015." [28]

"Organizations of all types and sizes find that using the ISO 9001 standard helps them:

- organize processes
- improve the efficiency of processes
- continually improve.

" [28]

5.1.2 ISO27001 - information security management

"ISO27001 is the leading international standard focused on information security, published by the International Organization for Standardization (ISO), in partnership with the International Electrotechnical Commission (IEC). Both are leading international organizations that develop international standards." [31]

"ISO 27001 was developed to help organizations, of any size or any industry, to protect their information in a systematic and cost-effective way, through the adoption of an Information Security Management System (ISMS)." [31]

"The basic goal of ISO 27001 is to protect three aspects of information:

- **Confidentiality**: only the authorized persons have the right to access information.
- **Integrity**: only the authorized persons can change the information.
- **Availability**: the information must be accessible to authorized persons whenever it is needed.

" [31]

"The ISO 27001 standard and ISMS provides a framework for information security management best practice that helps organizations to:

- Protect client and employee information
- Manage risks to information security effectively
- Achieve compliance with regulations such as the European Union General Data Protection Regulation (EU GDPR)
- Protect the company's brand image.

" [12]

5.1.3 SOC 2 standard

"The AICPA Assurance Services Executive Committee (ASEC) has developed a set of criteria (trust services criteria) to be used when evaluating the suitability of the design and operating effectiveness of controls relevant to the security, availability, or processing integrity of information and systems, or the confidentiality or privacy of the information processed by the systems at an entity, a division, or an operating unit of an entity." [24]

"SOC for Service Organizations are internal control reports on the services provided by a service organization providing valuable information that users need to assess and address the risks associated with an outsourced service" [19]. M-Files is following SOC 2 report from information security point of view.

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6 ROLE BASED ACCESS MANAGEMENT

6.1 Identity and access management in general

"Identity and Access Management (also known as access control) is the basis for all security disciplines, not just IT security. The purpose of access management is to allow authorized users access to appropriate data and deny access to unauthorized users." [5] "Identity and access management (IAM) is the discipline that enables the right individuals to access the right resources at the right times for the right reasons" [11]. This Master of Science thesis concentrates on investigate role-based access management. How it can be built to the new PSA system and share information to collaborators.

6.2 Roles

Working role describes the permissions that a person needs to perform she or he is working duties. Those working roles based on the position or role in organization. In the new PSA system there will be several users with different kind of working roles. Roles can be divided either internal or external roles or system and working roles. Internal role means M-Files employee, who can have different kind of working roles like for example sales manager, line manager, program manager, project manager, architect, system specialist. External role from system point of can be a customer, subcontractor, partner. This thesis concentrated to subcontracting role only and tried to find solution how to share and profile data for those. System role means managing system access rights based on system roles. Those can be for example editor, reader, administrator of certain system.

6.3 Subcontracting roles

Subcontracting roles can be, for example, program manager, project manager, architect, or system specialist. Figure 2 illustrates subcontracting roles from program and project point of view and the connection between different working groups.

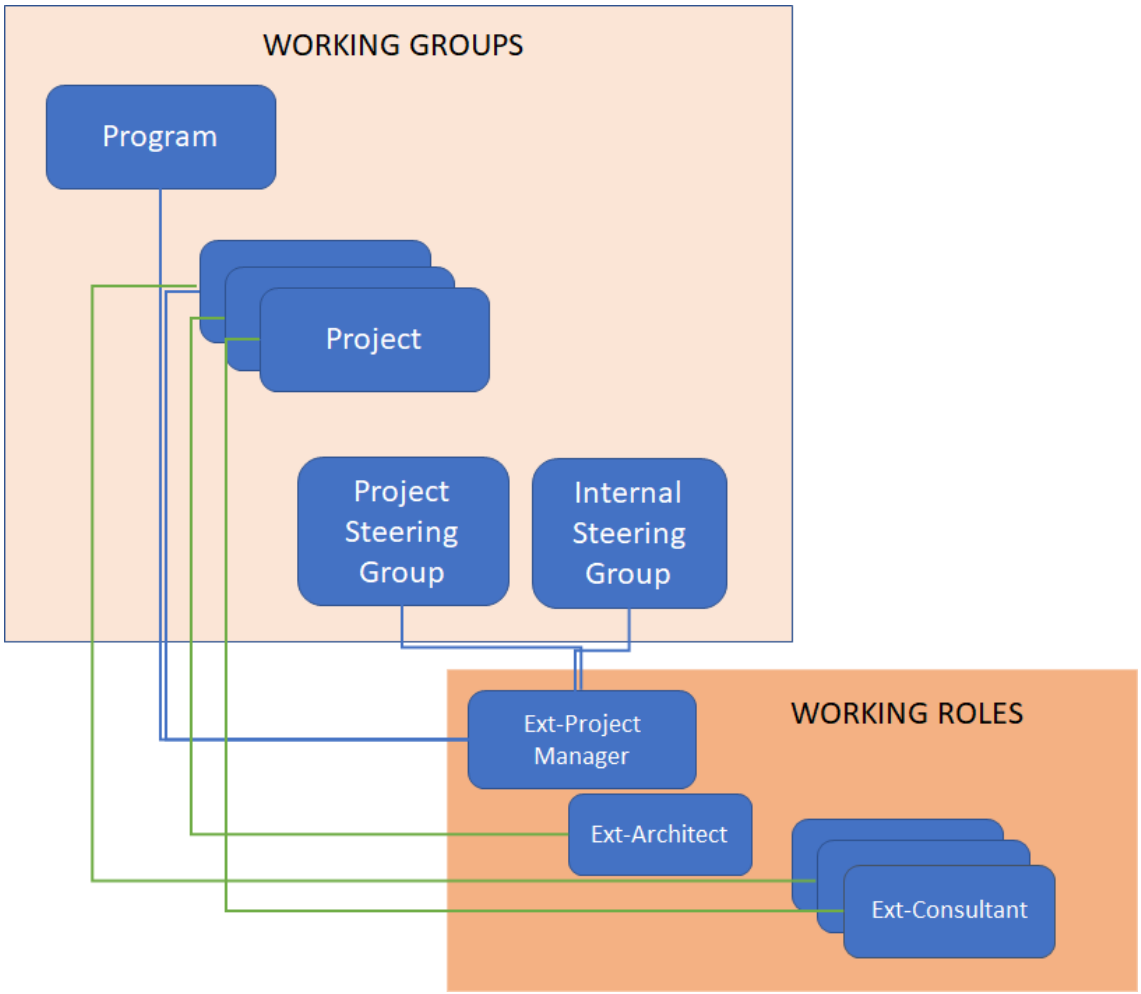

Figure 2. Working groups and roles of subcontractor

7 DATA PROFILING AND SHARING IN CURRENT CRM SYSTEM

As already mentioned in chapter 6.1, the purpose of access management is to allow authorized users access to appropriate data and deny access to unauthorized users. The focus of this chapter is to profile different data based on the needs. There are certain data which cannot be shared to any subcontractors and the data that needs to be shared with certain limitations.

This thesis follows case study as a comparison method. I compared sharing date in the current systems and the new coming one. Aim of the new solution was to find some common rules and security levels for sharing data to collaborators based on their roles and project they are working for.

I concluded that data which needs to be shared are almost the same in old and new system, but I need to fine concept how to profile data and find out the right risk level of sharing data. In Figure 3 I have divided data to two different high-level categories: sharing data and protected data. This categorization is based on the current CRM system.

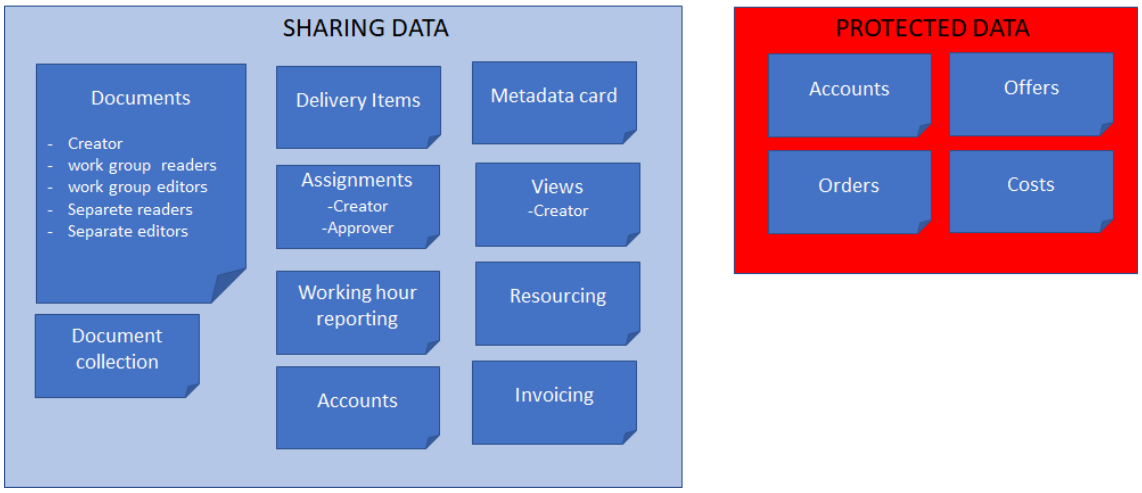

Figure 3. Date profiling based on sharing and protecting

8 PROFESSIONAL SERVICE AUTOMATION PROJECT

8.1 PSA project in general

M-Files Ltd named project team for the PSA project during September 2020. Project team consisted of several different business representatives for example architects, IT, order management, project management, sales, finance, and collaboration. Target of the project was to find a new PSA system for replacing current CRM. Project team evaluated several PSA systems and select the one based on analysis of functionalities. Project team defined requirements for the new system. Project itself was divided to the five phases and this thesis focused on the first four phases. The following paragraphs introduces different phases in detailed.

8.2 Project methodology - SWOT analysis

"SWOT analyses consist of four fields: strengths, weaknesses, opportunities, and threats. According to Dyson SWOT analysis aims to identify the strengths and weaknesses of an organization and the opportunities and threats in the environment" [20].

According Helms & Nixon, "The origin of the term “SWOT” is unknown. SWOT analysis was described by Learned *et al.* (1969) and has grown as a key tool for addressing complex strategic situations by reducing the quantity of information to improve decision-making. On-line wikis credit SWOT's origination with Stanford University Professor Albert Humphrey who led a research project in the 1960s and 1970s based upon the United States' Fortune 500 companies but no academic references to support this claim can be found (King, 2004). Haberberg (2000) stated SWOT was a concept used by Harvard academics in the 1960s while Turner (2002) attributed SWOT to Igor Ansoff (1987)." [6]

"Koch (2000) credited the contributions of Weihrich (1982), Dealtry (1992), and Wheelan and Hunger (1998) to SWOT's further development and innovation. Wheelan and Hunger (1998) used SWOT to find gaps and matches between competences and resources and the business environment in their popular business policy and strategy text while Dealtry (1992) approached SWOT in terms or groups and vectors with common themes and interactions. Regardless of the exact historical credit for coining the term “SWOT”, it has a half-century of use and documentation in the literature." [6]

According Dyson "SWOT analysis aims to identify the strengths and weaknesses of an organization and the opportunities and threats in the environment" [20].

In this project each epic owner made own SWOT analysis for each of the PSA candidates after demos and after that those were gathered. More detailed about that analysis in in Figure 5 and 6.

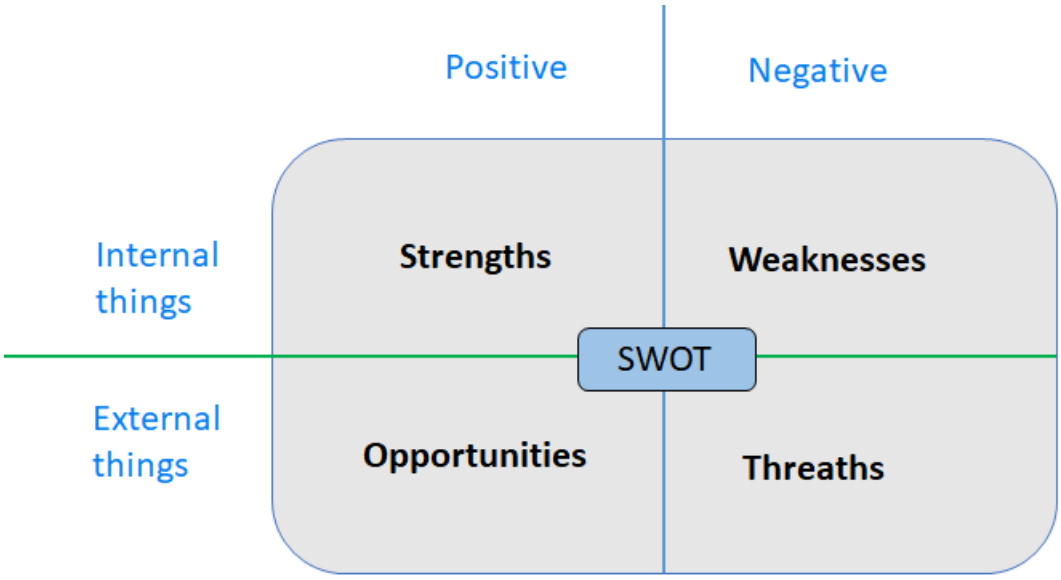

Figure 4. SWOT Analysis adapted from [7]

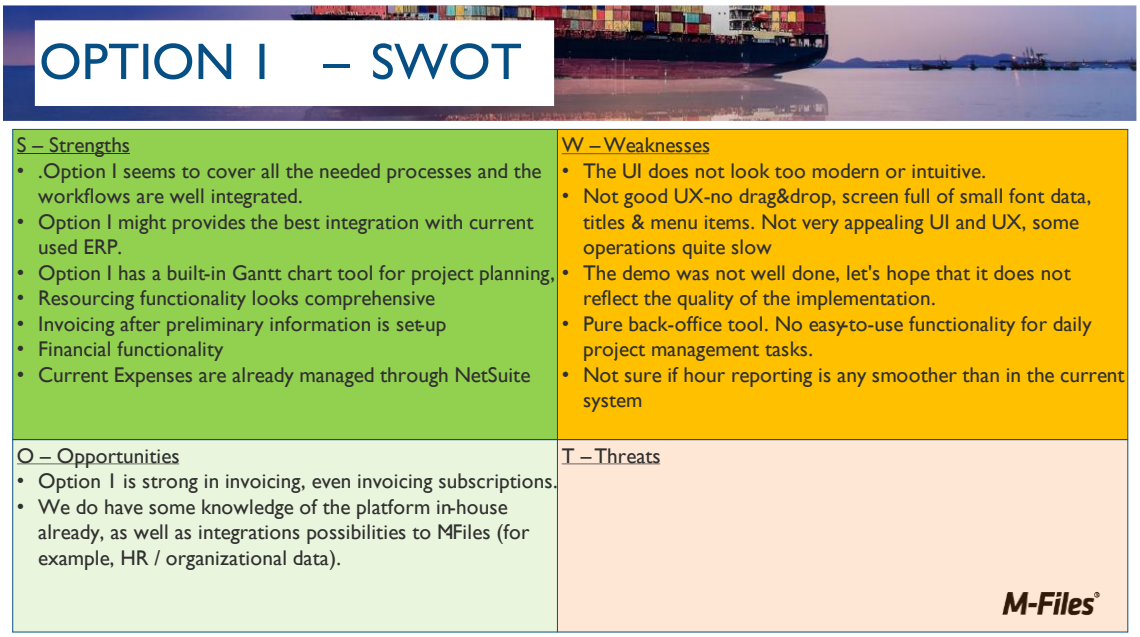

Figure 5. SWOT Analysis of PSA system option 1 [17]

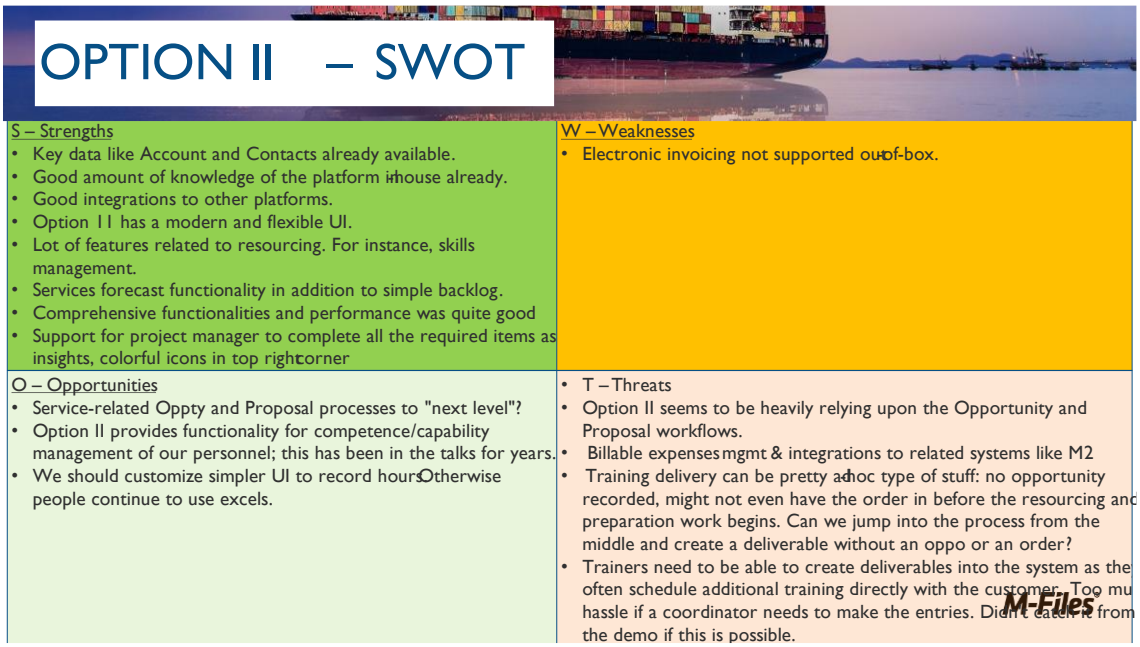

Figure 6. SWOT Analysis of PSA system option 1 [17]

8.3 Project phases

8.3.1 Phase 1 - PSA system candidate evaluation and requirements

In the 1st phase M-Files identified system and vendor candidates. Five different candidates were selected for evaluation.

Project Teams gathered requirements for the new system via user stories. M-Files evaluated all the selected candidates based on the requirements. Comparison of the different vendors was made based on demos and SWOT analysis.

"Top 16 user stories were:

1. Run through the life cycle of big project
2. Run through the life cycle of small delivery
3. Run through the life cycle of packaged deployment and packaged services & recurring services
4. Run through the life cycle of trainings delivered
5. Collaboration with external delivery partners including subcontractors and the customer
6. Planning and allocation of resources and follow-up of utilization
7. Resource skill inventory
8. Really smooth recording of work hours
9. Extremely easy invoicing of work
10. Financial - Revenue recognition & IFRS
11. Commissions
12. Bookings - from order to budget and value of the delivery
13. Management view to project portfolio
14. Managing daily project management tasks, front office
15. Data flows between PSA and other M-Files IT environments including invoicing and reporting capabilities.
16. Non-functional and IT requirements.

" [17]

This thesis focuses on the 5th user story: "Collaboration with external delivery partners including subcontractors and the customer"[17]. Those Collaboration with external delivery partners including subcontractors and the customer user stories is opened more detailed in chapter 9, because those was handled more detailed in design phase.

8.3.2 Phase 2 - PSA system and vendor selection

Target of this 2nd phase was to select the new PSA system, select the vendor, estimated the costs, and made the overall project plan.

Comparison of the different vendors was made via SWOT analysis and demos. Based on demos and analysis two finalist vendors were selected to commercial discussions. Both candidates provided two separate demos. 1st on was overview of basic functionalities and 2nd one based on user stories; M-Files provided to the vendors. Agreement was made with the winner 29th of January 2021.

8.3.3 Phase 3 - Current data analysis

The baseline for this research was analyzing current data in CRM system. I focused on analyzing collaboration related data. As it was already mentioned in chapter 2.1 analyzing based on qualitative interview related to current data sharing for subcontractors. Questions of interview were listed also in chapter 2.1. Goal for the current data analysis was to perform overall picture of current situation, what and how data is shared for subcontractors. I got good and consistent picture of current state. In the old solutions all the data were shared either manually or by replicating data between M-Files vaults. All the access was given separately case by case based on needs, without any kind of automatization or rules. All the interview answers were collected and analyzed in Table 1.

In Table 1 are listed all the data elements. I added processes to those data, which are related to collaboration point of view. I also added data classification to each of data elements and roles, who are using or needs that certain data to certain purpose. Last element of this table was analyzing dependency of the data. In practice it meant that which data is mandatory as background information to share certain data element.

Data	Process	Current Data Classification	Collaboration Roles	Dependency	Shared/Not shared currently	Shared method currently	Rights	More info
Account	Sales, Project Management	Confidential	Consult, Project Manager		Shared	DeCo	Read	Need basis
Budget	Invoicing, Project Management	Confidential		Account	Not shared		No rights	
Contact	Delivery, Project Management	Confidential	Consult, Project Manager	Account, Role	Shared		Read	
Customer Contract	Sales, Project Management	Confidential	Project Manager	Account	Not shared			Relevant information needs to be shared
Cost	Sales, Invoicing	Confidential			Not shared		No rights	
Delivery Item	Project Management	Confidential	Consult, Project Manager	Account, Role	Shared		Read	
Delivery Task	Project Management	Confidential	Consult, Project Manager	Account, Role	Shared	Deco	Edit	
Documents	Sales, Project Management	Confidential	Consult, Project Manager	Account, Role	Shared	Deco	Edit	
Employee	HR, Project Management	Confidential	Consult, Project Manager	Account, Role	Shared	Deco	Read	Need basis
Invoice	Invoicing	Confidential		Account, Role	Not shared		No rights	
Opportunity	Sales, Project Management	Confidential		Account, Role	Not shared		No rights	
Order	Sales, Project Management	Confidential		Account, Role	Not shared		No rights	
Order row	Sales, Project Management	Confidential		Account, Role	Not shared		No rights	
Planned hours	Project Management, Invoicing	Confidential	Project Manager	Account, Role	Shared		Read	Need basis
Requirement	Sales, Project Management, Change Management	Confidential	Consult, Project Manager	Account, Role	Shared		Read	Need basis
Report	Sales, Project Mangement	Confidential	Project Manager	Account, Role	Not shared		No rights	
Resource Request	Project Management	Confidential	Consult, Project Manager	Account, Role	Shared	Deco	Edit	Need basis
Risk	Project Management	Confidential		Account, Role	Not shared		No rights	
Schedule	Project Management	Confidential	Consult, Project Manager	Account, Role	Shared	Deco	Read	Need basis
Subcontractor Agreements		Confidential	Management Users	Account, Role				
Other Subcontactor info	Project Management	Confidential		Account, Role	Not shared		No rights	
Workloadestimation (effort, used)	Project Management	Confidential	Project Manager	Account, Role	Shared	Deco	Read	Need basis
Workpackage	Project Management	Confidential	Consult, Project Manager	Account, Role	Shared	Deco	Read	Need basis

Table 1. Current system CRM data analysis

Currently documents, credentials, resource request and working hours are shared via Delivery Collaboration Vault (DeCo) between M-Files and collaborators. The intension is that in the future PSA system will replace the DeCo and same information can be shared directly from PSA via Collaboration Community.

During the interviews and data analysis it was noticed that current data classification is not enough. More categorization is needed. Based on that discussion I divided current confidential classification to three different levels and made definition proposal of each of those. Those new confidential classifications are defined later in chapter 10.1.

According Lehikoinen "for organization it was easier to control its own personnel and their accounts as they could be somewhat estimated, and processes were known. However, third party persons outside organization might have to have different kind of roles or needs that were not needed inside organization or they needed unique kind of settings".[3]

During the analyzing current data I made the same kind of observations. Basically, the need is the same than with internal employees, but the way data will be shared is different. Some of the data needs internal co-operation or restrictions to certain part of the data.

8.3.4 Phase 4 - PSA system design

3rd phase of the project covered system design. The design phase started with several workshops related to project management, invoicing, collaboration, reporting, migration. As for this thesis, collaboration workshop was the most important one. Discussion of workshop based mainly on requirements of the user stories PSA project team defined in phase 1. All the user stories are opened more detailed on chapter 9.

8.3.5 Phase 5 - PSA System implementation, testing and deployment plan

After the design phase, PSA system implementation will start. The implementation based on PSA solution design document was approved by the PSA project team. The goal of implementation phase is to get trial version for M-Files to test configured functionalities. This thesis does not cover any more later project phases after the design phase. The target of this thesis was to get the concept ready during the design phase for implementation.

During autumn 2021 there will be made user acceptance testing for the new system and start usage of it. The planned timeframe for 1st deployment is Q4/2021. The future will show how the concept developed in this thesis will be implemented and the implementation will work in practice.

9 USER STORIES OF SUBCONTRACTING

All the user stories are opened in detailed level in this chapter. Those are described at first. Each of the user story design proposal got comments from supplier's architect. After the interview I made data and risk analysis for each of the user stories based on discussions. Most of the user stories are defined from M-Files' subcontractor manager point of view, not directly form subcontractor resources like consults or project manager point of view. Nevertheless, it was necessary to understand what is behind of each user story and what data is required from subcontractors to meet the requirements of the user stories. Additional questions were also raised up during design workshop and those are handled separately in chapter 9.12. Risk analysis of data and mitigation plan related to user stories and are gathered in chapter 10.2.

9.1 User story 1, working hour and expense reporting

"As a subcontractor employee I want to report hours and expenses to deliveries to be invoiced from the customer and invoiced by the subcontractor.

- I can only book hours and expenses to deliveries to which I am allocated as a resource

- I can see my earlier hour/expense bookings.

" [Annex 1]

Supplier's comments: "Functionality will be completed via a Subcontractor Community via Timecard and Expense Entry implementations (Figure 7 and 8). Subcontractors will be assigned by internal users to projects. Subcontractors will get views of previous expenses and time recording." [Annex 1]

Data Analysis: Delivery tasks (date, working hours, travel hours, description), account, delivery item (project) data are needed in new PSA system for reporting hours via timecard and expense entry.

Risks: Manual accesses to project will be the risk if internal user gives accidently accesses to wrong project. Special care is required in granting accesses.

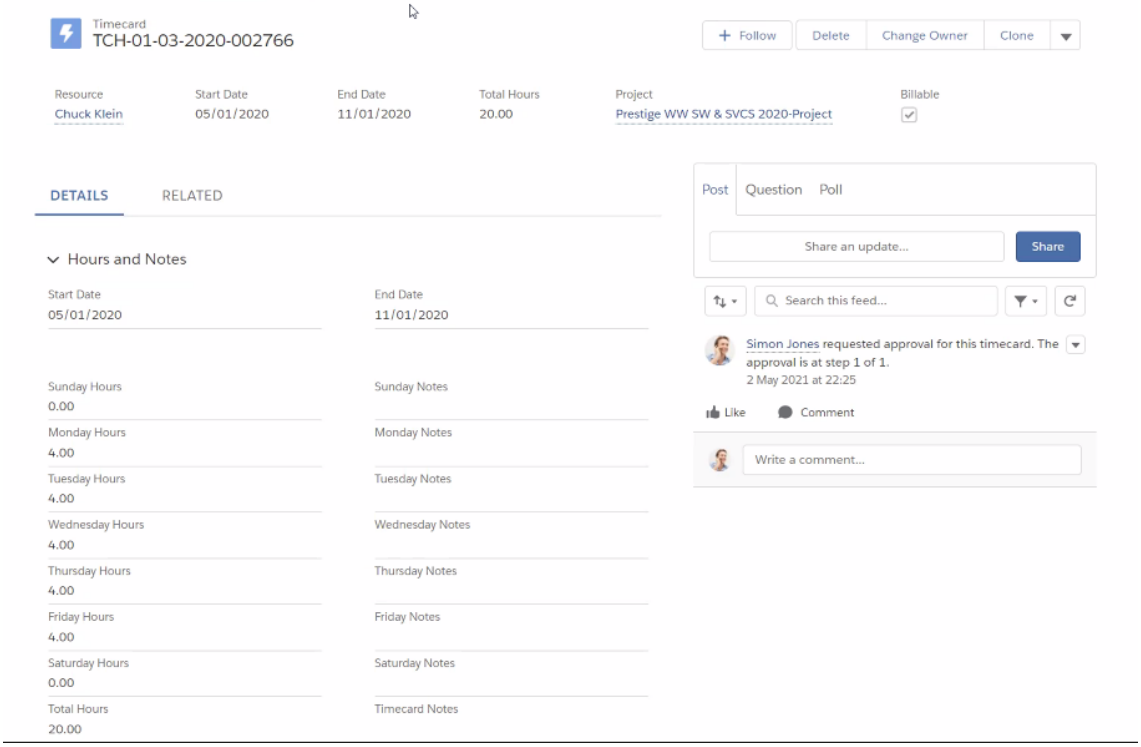

Figure 7. Timecard for working hours reporting [18]

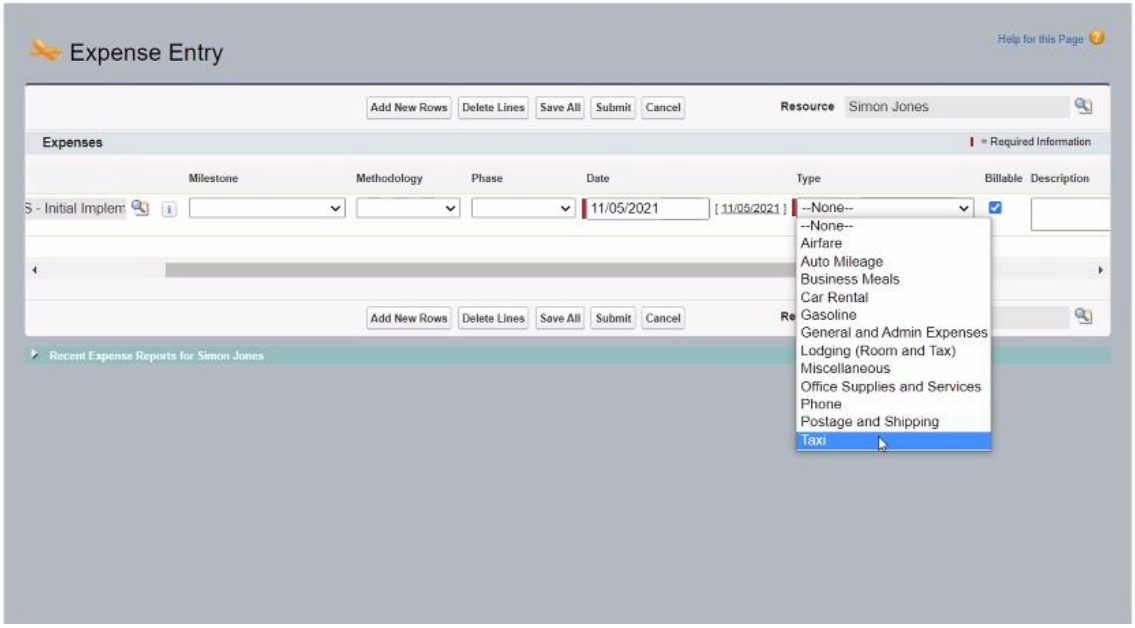

Figure 8. Expense entry [18]

9.2 User story 2, pricing models

"As a subcontracting manager I want to define the cost of subcontracted work so that the cost and margin of the delivery is calculated correctly.

- The system supports different pricing models; hourly rate per person, hourly rate per subcontractor, subcontractor hourly rate per project, fixed price, % of customer price etc.

- It is possible to define price per delivery, for example exception to the standard price list.

- There are templates for each subcontractor's pricing that can be copied to each delivery.

- It is possible to change the pricing (for example annual rate increases) during the delivery so that the cost of past entries is not changed.

" [Annex 1]

Supplier's comments: "Subcontractors will have a cost and can be allocated a vendor/supplier budget/PO. T&M hourly or fixed price milestones. Use fixed price milestone for fixed fee items. Contractor costs can be on a per project basis or taken from rate card or default cost rate." [Annex 1]

Data Analysis: Account, delivery item, price, pricing model are needed in new PSA system for define cost of subcontracted work. Separate template/rate card is needed for sharing needed information for subcontractors via Partner community.

Risks: Selecting wrong pricing model will be the risk for the budget. Special care is required with selecting the pricing model and costs.

9.3 User story 3, reports

"As a subcontracting manager, I want to get reports on subcontracting so that I can manage the subcontractor portfolio.

- The reports are on-line or there is a minimal delay between data entry and its appearance in the report.

- M-Files employees can customize the reports or create new ones.

- There is a report for delivered hours by subcontractor company by year, month, and delivery.

- There is a report for delivered hours by subcontractor employee by year, month, and delivery.

- There is a report for the total cost by subcontractor company by year and month.

- There is a report for the average hourly cost by subcontractor company by year and month.

- There is a report for the gross margin of subcontracted work by subcontractor company, year and month.

- There is a report with the delivery status and health indicators that can be accessed by M-Files employees

- It is possible to export the report data to for example Excel.

" [Annex 1]

Supplier's comments: "Achieved through using reports and these can be built by M-Files. Will need to review each report (Figure 9) and see how each can be achieved.

Suggest a set of reports are created to cover these requirements." [Annex 1]

Figure 9. View of reports [18]

Data Analysis: Delivery tasks (date, working hours, travel hours, description), account, delivery item (project) data are needed in new PSA system for reporting hours via time-card and running all the needed data from timecards to the reports. Subcontractor PM Manager can get visibility to certain reports via Partner Community. All the needed reports will be checked separately after implementation of system trial is ready for testing.

Risks: Quick changes/corrections might take lot of time because of separate M-Files resources for report customize. Special care is required with giving visibility to needed reports.

9.4 User story 4, invoice checking and approval

"As a subcontracting manager, I want to check the subcontractors' invoices against the reported hours and cost so that the subcontractor invoicing is correct.

- Checking the invoices against hours and cost is user-friendly and can be done in one view without hopping between views or applications.

- It is possible to mark approved cost/expense items as invoiced (by subcontractor).

- There is a procedure for requesting corrections to the invoice (if the reported cost and expenses are correct) or to the reported hours and expenses (the invoice is correct) if there are differences.

- There is a report telling how much of the reported hours and expenses have been invoiced by the subcontractors, by subcontractor, month, and year.

" [Annex 1]

Supplier's comments: "PSA Vendor Billing, a subcontractor can generate a Vendor Invoice from subcontractor time recordings so there is a correct match.

Reports to be developed as above. Suggest a set of reports are created to cover these requirements." [Annex 1]

Data Analysis: Delivery tasks (date, working hours, travel hours, description), account, delivery item (project) data are needed in new PSA system for reporting hours via time-card and expense entry. Needs to be ensure that that subcontractor will have access to make corrections to invoices.

Risks: Invoices are incorrect, and subcontractor needs to have possibility to correct those.

9.5 User story 5, information of delivery

"As a project manager of a subcontracted delivery, I want to see and update the information of the delivery so that I can manage the delivery properly.

- Subcontracted delivery = delivery that is managed by the subcontractor and there is no M-Files project/service manager.

- Data to see effort budgets and actuals, resource allocations, entered hours and cost.

- Data NOT to see: Customer pricing and other contractual/commercial information between M-Files and the customer.

- Data possible to edit tasks, schedule, status indicators and other fields related to managing the project.

"[Annex 1]

Supplier's comments: "Assume subcontractor managed projects will still need to be from the Community. Will need to review security permissions. Internal manager will need to create and allocate a subcontractor resource and budget to the project." [Annex 1]

Data Analysis: Planned hours as effort budgets, total hours as actuals, resource allocations, delivery tasks and cost are needed in new PSA system.

Risk: Internal resources are needed to manage this user story in overall. Quick changes/corrections might take lot of time because of separate M-Files resources are needed for report customize. Special care is required with security permissions.

9.6 User story 6, resource management

"As a subcontracting manager I want to keep track of available and allocated subcontractor capacity so that I can manage the subcontractor resource pool.

- It is possible to enter the available resources per subcontractor as x md per week (subcontractor capacity), on company or employee level.

- It is possible for a subcontractor resource to update their resource availability

- It is possible to make resource allocations for subcontractor employees to a specific delivery, either as x md /week or with a total amount of effort.

- It is possible to make "bulk allocations" for a subcontractor employee for a specific time, either as x md /week or with a total amount of effort.

- It is possible to make "planned" allocations for a subcontractor (company) for deliveries that have not yet started or where we do not have the order yet.

- There is a report indicating available capacity vs. allocated/planned resources by subcontractor, by region (for example. all EMEA subcontractors) or for all subcontractors.

" [Annex 1]

Supplier's comments: "Subcontractor can use resource planner to view, allocate and schedule subcontractors via Assign Resource to Project implementation (Figure 10). Subcontractor can create Resource Request placeholders for subcontractors and report on subcontractor capacity.

Will need to use Gantt Chart

1. Is Real-time
2. Tasks are only connected within the same project, no cross-project links
3. Can add dependency
4. Can add additional person but need to follow consistent process.

" [Annex 1]

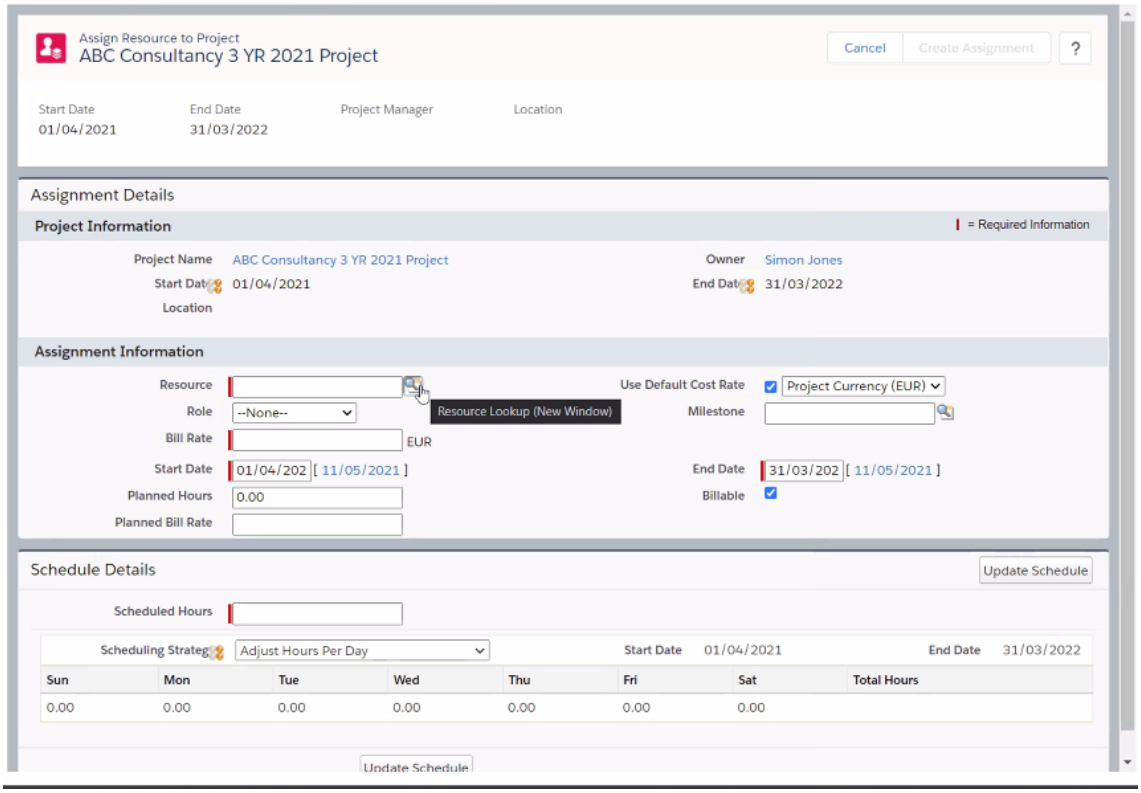

Figure 10. Assign resource to project [18]

Data Analysis: Project/Opportunity, list of resources, start date, end data, planned hours, location are needed in new PSA system.

Risk: Subcontractors will see other subcontractors by accidently. Special care is required with permissions.

9.7 User story 7, project status report

"As a project manager I want to automatically generate a project status report to be shared with the customer.

- There are templates for different kinds of deliveries (small project, big project, managed service etc.)

- The reports are on-line or there is a minimal delay between data entry and its appearance in the report, for example when having to correct data in the system.

- Reporting supports different pricing models; for example, actual cost is not shown in fixed-priced deliveries.

- The report can be modified in PowerPoint/Word before sending to the customer.

- The fields to be included in the report can be configured.

- The templates can be modified by M-Files personnel.

" [Annex 1]

Supplier's comments: "Will need to review if Conga could be used for Status Reports but not in scope. Some data will be need to generated overnight in batch, but most data can be real time. Actual costs are not shown on reports depends on content of report." [Annex 1]

Data Analysis: Delivery type, schedule, delivery item and account are needed in new PSA system.

Risk: There are risk with nonrealtime reports. Subcontractor will get visibility to cost accidently.

9.8 User story 8, reviewing delivery hours

"As a customer I want to review delivery hours before they are invoiced and request corrections/clarifications so that the invoicing is correct.

- Limited to time-and-materials deliveries

- Optional functionality that can be enabled per delivery.

- Can be done according to the invoicing schedule of the delivery (monthly, quarterly, by milestones)

- Customer can see the hours directly in the system, and request corrections/clarifications directly in the system.

" [Annex 1]

Supplier's comments: "Subcontractor PM can manually generate or release billing events before invoice sent to ZUORA." [Annex 1]

Data Analysis: Delivery tasks (date, working hours, travel hours, description), account, delivery item (project) data are needed in new PSA system for reporting hours via time-card and expense entry. Accesses to needed working hour reporting and billing events are needed.

Risk: Corrections of the invoices. Needs to be ensure that subcontractors will have enough accesses to make needed corrections to invoices.

9.9 User story 9, invoice checking

"As a customer I want to see which hours have been included in the invoice sent to me.

- In other words: what is the work done what I am paying for.

- Like User Story 8 but here it is "for information", not "for approval".

- Optional functionality that can be enabled per delivery.

- Can be done according to the invoicing schedule of the delivery (monthly, quarterly, by milestones)

- Information is included in the actual invoice, or if not possible, sent as an e-mail attachment or available via a link.

" [Annex 1]

Supplier's comments: "Billing Events have summary of information. Additional information can be added as a report." [Annex 1]

Data Analysis: Project, working hour reports (resource, date, working hour, travelling hour, description) are needed in new PSA system via Customer Portal.

Risk: Some working hours are missing from the invoice. The Invoice has wrong PO number.

9.10 User story 10, risk management

"As a subcontractor project manager, I want to follow up and mitigate risks and deviations of project, so that I can share the risk/deviation analysis with the customer and subcontractors easily

- Visible data for subcontractors: risk/ deviation title, description, probability, impact, deviation plan

- Hidden data for subcontractors: price information

- Risks will be fulfilled automatically based on project metrics

- The report can be modified in PowerPoint/Word before sending to the customer or subcontractor.

" [Annex 1]

Supplier's comments: "Can use PSA risks to track this. Security permissions will need to be applied. Risk Automation is to be reviewed. Report can be downloaded for export." [Annex 1]

Data Analysis: Risk/ deviation title, description, probability, impact, and deviation plan are needed in new PSA system

Risk: Incorrect security permissions, subcontractor will see price information or data of wrong projects. Special care is required with security permissions.

9.11 User story 11, follow up deliveries

"As a customer, I want to have access to the system to view and submit delivery information so that I have a clear picture of my deliveries.

- My deliveries = deliveries where I am the customer.

- Information visible and editable for the customer can be configured.

- Information to see for example, schedule vs. plan, effort vs. budget, invoicing status etc.

- - Information to edit risks, issues, comments, tasks etc.

" [Annex 1]

Supplier's comments: "Access to external stakeholders via PSA Communities (Figure 12) [Annex 1]. Subcontractors can get accesses to certain projects with certain roles (Figure 13) and look at those own projects via Partner Community/My Projects (Figures 11)." [Annex 1]

Data Analysis: Project, schedule, plan, budget, invoice information is needed. Will be shared via Customer Community (Figure 11).

Risk: Incorrect accesses to projects. Special care is required with access management of projects.

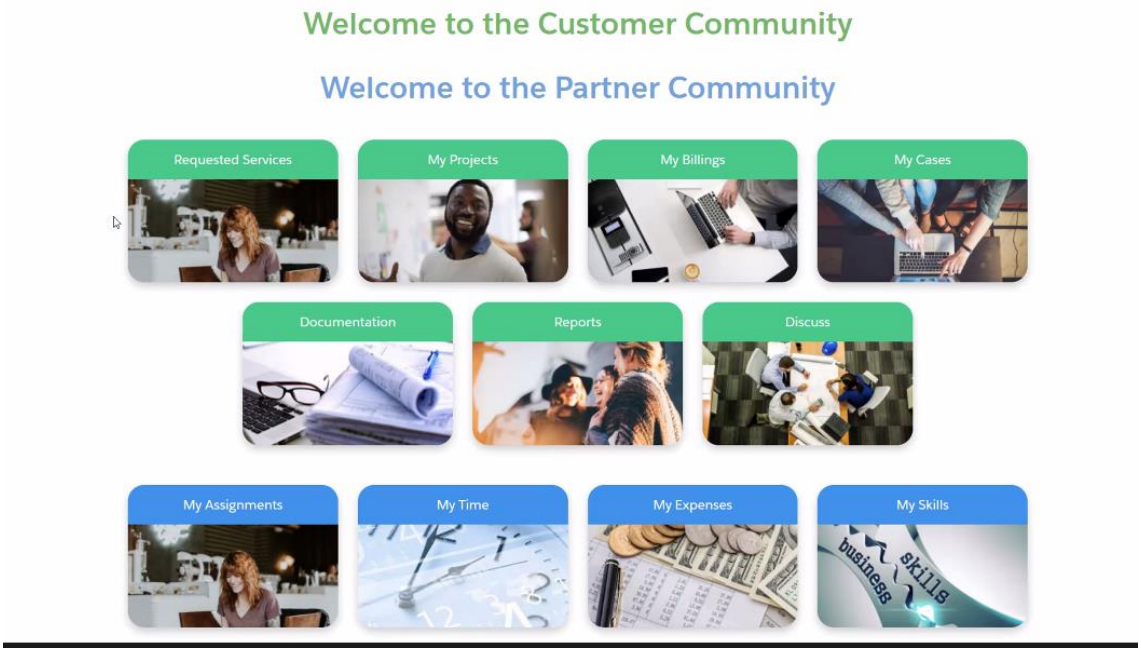

Figure 11. PSA Customer/Partner Community [18]

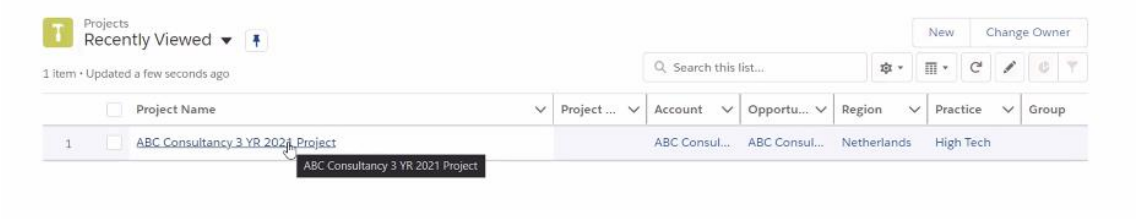

Figure 12. List of subcontractor's projects [18]

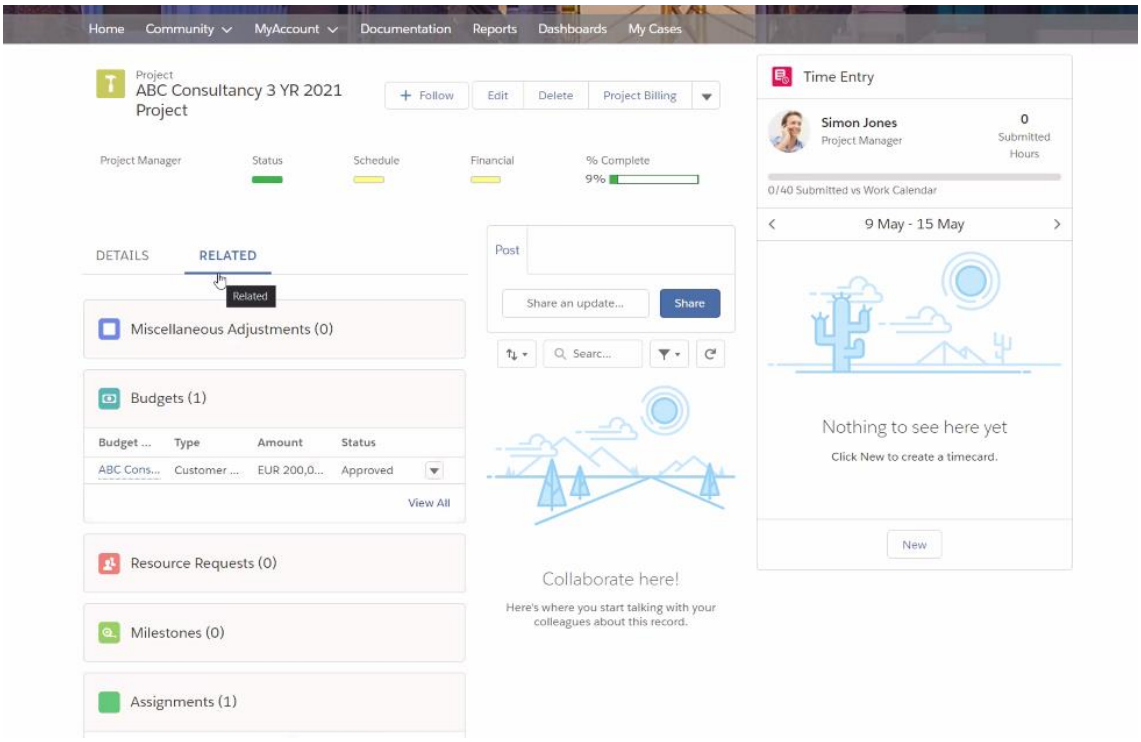

Figure 13. Project view for subcontractors [18]

9.12 Additional Questions and requirements of the design phase.

During the discussion about user stories, few more specific questions arose in the design workshop. Here are those questions and comments by supplier's architect. I made short data and risk analysis also to those ones.

1. How to ensure that subcontractors of different companies cannot see any other sub-contractors?

Supplier's comments based on interview: "Visibilities will be controlled via assign resource of projects.

Data Analysis: Project related visibility is needed."

Risks: Incorrect accesses to projects. Special care is required with access management of projects.

2. Is it possible to provide visibility to certain requirements and change requests for subcontractors?

Supplier's comments based on interview: "Needs to be clarify"

Data Analysis: Project, requirements, change request specific accesses are needed in the new PSA system.

Risks: Missing visibility to certain requirements might affect scope of the delivery.

During the interview I noticed that these additional requirements were not covered enough detailed in earlier on and needs to be added to the design documentation:

- Pre-sales resources can be handled by subcontractors. Pre-sales work should be recorded as pre-sales work, not using coming project budget already beforehand. Pre-sales cases needs to have own projects called pre-sales project.
- Resource Request should include information can/cannot use subcontractors as resources in project or cannot use due to contract limitations.
- Contact information (Person name + company name) were missing
- There should be limitation to make changes to timecards.

10 DATA PROFILING AND SHARING RULES FOR SUBCONTRACTORS

Currently all the subcontractors shared data are managed and shared manually in M-Files. The plan is that in the future data will be shared automatically to subcontractors via PSA system based on access management rules. I have gathered all the shared data into table (Table 2) and profile those date for the new PSA system. PSA system has been designed based on user stories and data profiling I have made. Implementation is now on going so in the future, it will be tested during Q2-Q3/2021 how the data sharing concept will work in practice.

Next phase was to analyze divisible for subcontractor roles and way of sharing data. I added yes or no depending on whether the data should be shareable in the new system.

Data	New Data Classification	Collaboration Roles	Shared for Subcontractor PM Manager	Shared for Subcontractor Consult	Rights	More info
Account	Customer Confidential	Subcontractor Consult, Subcontractor PM Manager	yes	yes	Read	Need basis
Budget	Customer Confidential	Internal Subcontractor Team, M-Files Project Manager	no	no	No rights	
Contact	Customer Confidential	Subcontractor Consult, Subcontractor PM Manager	yes	no	Read	
Customer Contract	Customer Confidential	Subcontractor PM Manager	no	no		Relevant data needs to be shared
Cost	Customer Confidential	Internal Subcontractor Team, M-Files Project Manager	no	no	No rights	
Delivery Item	Customer Confidential	Subcontractor Consult, Subcontractor PM Manager	yes	yes	Read	
Delivery Task	Customer Confidential	Subcontractor Consult, Subcontractor PM Manager	yes	yes	Edit	
Documents	Customer Confidential	Subcontractor Consult, Subcontractor PM Manager	yes	yes	Edit	
Employee	Subcontractor Confidential	Subcontractor Consult, Subcontractor PM Manager	yes	yes	Read	Need basis
Invoice	Customer Confidential	Internal Subcontractor Team, M-Files Project Manager	no	no	No rights	
Opportunity	Customer Confidential	Internal Subcontractor Team, M-Files Project Manager	no	no	No rights	
Order	Customer Confidential	Internal Subcontractor Team, M-Files Project Manager	no	no	No rights	
Order row	Customer Confidential	Internal Subcontractor Team, M-Files Project Manager	no	no	No rights	
Planned hours	Customer Confidential	Subcontractor PM Manager	yes	yes	Read	Need basis
Requirement	Customer Confidential	Subcontractor Consult, Subcontractor PM Manager	yes	yes	Read	Need basis
Report	Customer Confidential	Subcontractor PM Manager	yes	no	No rights	
Resource Request	Customer Confidential	Subcontractor Consult, Subcontractor PM Manager	yes	yes	Edit	Need basis
Risk	Customer Confidential	Internal Subcontractor Team, M-Files Project Manager	no	no	No rights	
Schedule	Customer Confidential	Subcontractor Consult, Subcontractor PM Manager	yes	yes	Read	Need basis
Subcontractor Agreements	Subcontractor Confidential	Internal Subcontractor Team	yes	yes	Read	
Other Subcontactor info	Subcontractor Confidential	Internal Subcontractor Team, M-Files Project Manager	no	no	No rights	
Travel Time	Customer Confidential	Subcontractor Consult, Subcontractor PM Manager	yes	yes	Edit	
Workloadestimation (effort, used)	Customer Confidential	Subcontractor PM Manager	yes	yes	Read	Need basis
Workpackage	Customer Confidential	Subcontractor Consult, Subcontractor PM Manager	yes	yes	Read	Need basis
Work Time	Customer Confidential	Subcontractor Consult, Subcontractor PM Manager	yes	yes		

Table 2. Data profiling for subcontractors in PSA

10.1 New confidential classification

During the data analysis phase, it was noticed that current confidential data classification is not enough. More levels were needed. I made proposal for that by dividing current classification three different categories and made definition of those (Figure 14). Definitions were based on the current data analysis, interview of M-Files Subcontractor Manager Risto Kero and my own experience as a project manager role. New classifications will be tested in practice when the new PSA system will get to the production use. It will be easy to make some changes to those if needed.

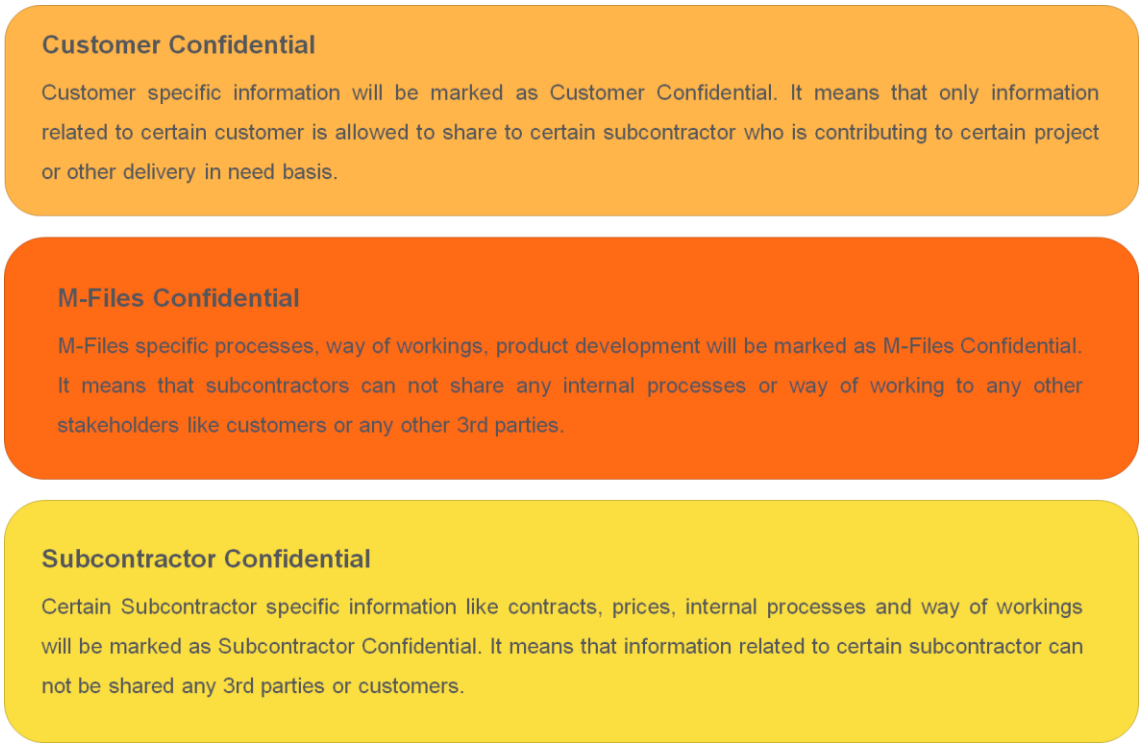

Figure 14. New confidential classification

10.2 Risk level of data sharing for subcontractors

The aim was to define level where does the business risk taking capacity goes between the usability and confidentiality. Risks of the data were listed in Table 3. I defined mitigation for each of the risk in Table 4. Most urgent risks were listed in Table 5 based on the criticality. The risks are evaluated with the usual probability - impact -method. In this method the probability of occurrence and negative impact are evaluated on a scale of 0-5 (Figure 15). Based on the evaluation the risks are placed in a probability-impact matrix (Figure 15). I named all four matrix squares based on needed actions: accepted, prevention, mitigation, avoid. Risk assessment table (Table 6) helps to find correct level for each of the risks.

Number	Data	Propability	Impact	Total	Risk
1	Account	2	3	6	Subcontracor will see other customer's accounts.
2	Budget	1	5	5	Subcontracor will see real budget of the project.
3	Contact	2	2	4	Subcontracor will see other customer's contacts.
4	Customer Contract	1	4	4	Subcontracor will see customer contracts.
5	Cost	1	5	5	Subcontracor will see costs of the project.
6	Delivery Item	2	4	6	Subcontracor will see other projects.
7	Delivery Task	1	1	1	Subcontracor resource will see other emplyee's delivery tasks. Subcontracor manager will se other project's delivery tasks.
9	Documents	1	4	4	Subcontracor resource will see other project's/prohibited documents. Subcontracor manager will se other project's/prohibited documents.
10	Employee	1	1	1	Subcontracor will see emloyees of the project.
11	Expense type	1	1	1	No risk
12	Invoice	1	5	5	Subcontracor will see invoices of the project.
13	Opportunity	1	5	5	Subcontractor will see opportunities.
14	Order	1	4	4	Subcontractor will see orders.
15	Order row	1	4	4	Subcontractor will see order rows.
16	Planned hours	1	1	1	Subcontracor resource will see other project's planned hours. Subcontracor manager will se other project's planned hours.
17	Requirement	1	2	2	Subcontracor resource will see other project's/prohibited requirements. Subcontracor manager will se other project's requirements.
18	Report	1	4	4	Subcontracor will see prohibited reports.
19	Resource Request	1	2	2	Subcontracor will see other project's resource requests.
20	Risk	1	3	3	Subcontracor will see prohibited risks.
21	Schedule	1	2	2	Subcontracor resource will see other project's schedule. Subcontracor manager will se other project's schedules.
22	Subcontractor Agreements	1	4	4	Subcontracor will see other subcontractor's agreements.
23	Other Subcontactor info	1	2	2	Subcontracor will see other subcontractor's info.
24	Travel Time	1	1	1	No risk
25	Workloadestimation (effort, used)	1	1	1	Subcontracor resource will see other project's worloadestimations. Subcontracor manager will se other project's worloadestimations.
26	Workpackage	1	1	1	No risk
27	Work Time	1	1	1	No risk

Table 3. Risk analysis of shared data for subcontractors 1/3

Number	Data	Mitigation of risks
1	Account	To ensure that supplier will see accounts only in need basis
2	Budget	To ensure that budget visibility has been locked from subcontractors.
3	Contact	To ensure that subcontractor will see only needed contacs of own projects.
4	Customer Contract	To ensure that customer contracts has been locked from subcontractors.
5	Cost	To ensure that cost information has been locked from subcontractors
6	Delivery Item	To ensure that subcontractor will see delivery items/projects only in need basis
7	Delivery Task	To ensure that subcontractor will see only own delivery tasks. Subcontractor project manager can see delivery tasks of own projects
9	Documents	To ensure that subcontractor will see documents only in need basis/own projects.
10	Employee	To ensure that subcontractor will see only needed contacs of own projects
11	Expense type	No need for mitigation
12	Invoice	To ensure that invoice visibility has been locked from subcontractors.
13	Opportunity	To ensure that opprtunity visibility has been locked from subcontractors.
14	Order	To ensure that order visibility has been locked from subcontractors.
15	Order row	To ensure that order row visibility has been locked from subcontractors.
16	Planned hours	To ensure that subcontractor resource/manager will see only planned hours of own project.
17	Requirement	To ensure that subcontractor resource/manager will see only requirements of own project.
18	Report	To ensure that report visibility has been locked from subcontractors reosurces, only subcontractor mananger can see reports of own project based on needs.
19	Resource Request	To ensure that subcontractor resource/manager will see only resouce requests of own project.
20	Risk	To ensure that risks visibility has been locked from subcontractors.
21	Schedule	To ensure that subcontractor resource/manager will see only schedule of own project.
22	Subcontractor Agreements	To ensure that subcontractor agreement visibility has been locked from subcontractors reosurces, only subcontractor mananger can see agreements of own project based on needs.
23	Other Subcontactor info	To ensure that other subcontracor info visibility has been locked from subcontractors.
24	Travel Time	No need for mitigation
25	Workloadestimation (effort, used)	To ensure that subcontractor will see only needed workloadestimations of own projects.
26	Workpackage	No need for mitigation
27	Work Time	No need for mitigation

Table 4. Risk analysis of shared data for subcontractors 2/3

Number	Data	Propability	Impact	Total	Risk	Mitigation of risks
6	Delivery Item	2	4	6	Subcontracor will see other projects.	To ensure that subcontractor will see delivery items/projects only in need basis
1	Account	2	3	6	Subcontracor will see other customer's accounts.	To ensure that supplier will see accounts only in need basis
2	Budget	1	5	5	Subcontracor will see real budget of the project.	To ensure that budget visibility has been locked from subcontractors.
5	Cost	1	5	5	Subcontracor will see costs of the project.	To ensure that cost information has been locked from subcontractors
12	Invoice	1	5	5	Subcontracor will see invoices of the project.	To ensure that invoice visibility has been locked from subcontractors.
13	Opportunity	1	5	5	Subcontractor will see opportunities.	To ensure that opprtunity visibility has been locked from subcontractors.
4	Customer Contract	1	4	4	Subcontracor will see customer contracts.	To ensure that customer contracts has been locked from subcontractors.
9	Documents	1	4	4	Subcontracor resource/manager will see other project's/prohibited documents.	To ensure that subcontractor will see documents only in need basis/own projects.
14	Order	1	4	4	Subcontractor will see orders.	To ensure that order visibility has been locked from subcontractors.
15	Order row	1	4	4	Subcontractor will see order rows.	To ensure that order row visibility has been locked from subcontractors.
18	Report	1	4	4	Subcontracor will see prohibited reports.	To ensure that report visibility has been locked from subcontractors reosurces, only subcontractor mananger can see reports of own project based on needs.
22	Subcontractor Agreements	1	4	4	Subcontracor will see other subcontractor's agreements.	To ensure that subcontractor agreement visibility has been locked from subcontractors reosurces, only subcontractor mananger can see agreements of own project based on needs.
3	Contact	2	2	4	Subcontracor will see other customer's contacts.	To ensure that subcontractor will see only needed contacs of own projects.

Table 5. Risk analysis of shared data for subcontractors 3/3

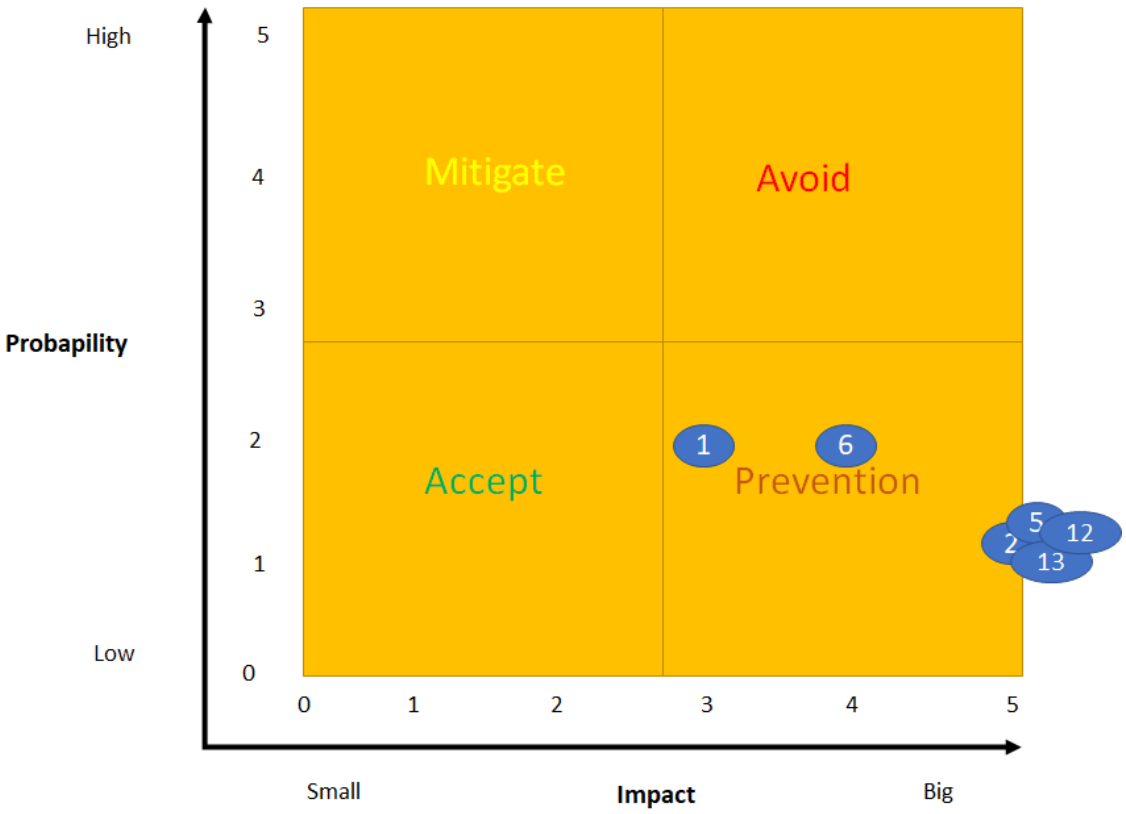

Figure 15. Risk matrix of shared data for subcontractors

Level	Probapility	Impact
1	Rare	Low
2	Unlikely	Medium
3	Possible	High
4	Likely	Critical
5	Almost certain	Show Stopper

Table 6. Risk assessment

This risk matrix (Figure 15) showed that sharing accounts, budget, costs, and delivery items are most risk items, because those have the most serious impact if wrong data ends up to wrong hands. My assumption, however, is that risk level is much higher if we do not provide necessary data and thereby successful project delivery is prevented. I decided to investigate more about data by analyzing which data are mandatory key factors for ensuring successful delivery of the project. If some of the mandatory data has not been shared or updated there will be risk that project delivery fails or at least the schedule will be delayed. I shared those key factors (Table 7) to three different sharing categories:

Mandatory – Data needs to be shared for subcontractors on need basis

Optional – Data can be shared for subcontractors on need basis

No need – There is no need to share data to subcontractors.

Data	Success factors for project delivery
Account	Mandatory
Budget	No need
Contact	Mandatory
Customer Contract	Mandatory
Cost	No need
Delivery Item	Mandatory
Delivery Task	Mandatory
Documents	Mandatory
Employee	Mandatory
Invoice	No need
Opportunity	No need
Order	No need
Order row	No need
Planned hours	Mandatory
Requirement	Mandatory
Report	Optional
Resource Request	Optional
Risk	No need
Schedule	Mandatory
Subcontractor Agreements	Optional
Other Subcontactor info	No need
Workloadestimation (effort, used)	Mandatory
Workpackage	Optional

Table 7. Success factors for project delivery

11 DISCUSSION

According to Hautamäki [24], "when the data is viewed in the light of knowledge it is possible to assess the significance of the data, draw useful conclusions, analysis and so on i.e obtain information. Information = data + knowledge + conclusions".

I also made similar observations during analyzing the risk levels that sharing a single crumb of information or individual data may not yet pose a very high risk. Instead of combining the grains of knowledge or data, can generate very valuable information that can have commercial value for external actors.

As Hautamäki [24] stated "information is of strategic importance to the company". The same is true for outsiders when information ends up in the wrong hand.

"Each unit needs at least enough information to be able to maintain its transaction field. When a company or other entity seeks to change its transaction field by analyzing what it is worth doing itself and what to acquire from outside (intensive growth) and expanding it, for example, by creating new customer relationships (extensive growth), more information is needed on transaction friction to slow down. In general, a free unit needs information to cross its own transaction field, i.e., it needs information that other units, especially competitors, have". [24]

The same applies also to subcontractors as to competitors. Sharing information is not only one-sided but also necessary for both directions. Information sharing is mandatory for getting out needed results from subcontractors.

During profiling the data and defining sharing rules, I started to think how much actually other factors like confidence, interpersonal relationships or the history of co-operation might affect information sharing. Whether information is shared equally to all subcontractors or are there other factors which might be affect that information sharing? What are the prerequisites of for success in fact? Are there some external factors, which affects or enable to get keys of the success in hands? Does it make sense to profile data if some other externals factors will affect anyway. Are there some security risks with those external factors?

Manu [22] "found six key factors that emerged from the analysis as influential to trustfulness and trustworthiness of main contractors and subcontractors were: change management process, payment practices, economic climate, perception of future work opportunity, job performance and the project-specific circumstances." [22]

During writing this thesis I came to the same conclusion that it is much easier to find some concrete key factors and risk levels than to try defining soft human key factors which might affect to the trust and data sharing.

12 CONCLUSIONS

As a starting point for sharing information or the decision not to share information to subcontractors, it is good to consider facts instead of assumptions, because assumptions increase risk and uncertainty. The more confidential the information, the more precise it must be in terms of information sharing. The conclusion was that finding and determining the exact risk level was difficult. Individual information and sharing of it, do not yet pose a very high risk, but providing more information and by combining those, there might be higher risk to provide business benefits to other companies. As the risk matrix (Figure 15) showed, sharing accounts, budget, costs, and delivery items are the riskiest items to be shared outsiders.

Based on the risk impact analysis I made observations for sharing and more like protecting data:

- According to the risk analysis, all money related data like budget, cost, invoices are most sensitive information. It needs to be ensured that visibility of those is locked from the subcontractors. Invoicing and budget planning needs to be done by M-Files internal employee.
- Delivery item is the riskiest data because it includes several data items in the metadata card. Restrictions of certain data are needed, like money related data.
- Accounts and opportunities need to be restricted also from subcontractors. Those will be shared only on need basis, because subcontractors can try to large their own customer portfolio based on the information they receive.
- All the other individual (marked in yellow in Table 3-5) data are not so risky to share, but by combining individual knowledge, the subcontractor can get her/him hands on valuable information.

Sharing information through the system is still easily prevented via access management, but sharing protected data via telcos, meetings, coffee table discussions are much more difficult to prevent or noticed. Other factors like confidence, interpersonal relationships or the history of co-operation might affect also to information sharing.

I assume the biggest risk are the subcontractors, who have worked at M-Files in the past. This is especially true if they are just starting their own business. It is easy for them to collect for information because not everyone may know that they are currently acting as a subcontractor. Information sharing is very multifilament topic, and many external factors can affect what information we share without knowing or understanding all the factors around us. Even human mistakes can get information to the wrong hands unintentionally.

The thesis was successful even though the subject of the study was very multifilament. I had not worked directly in subcontracting unit, so I did not know all the details of practicalities beforehand. The analysis of the result would have been significantly facilitated by obtaining rights to the test environment of the new PSA system. The subject of further research could be user acceptance testing based on the design research results.

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APPENDIECES

ANNEX 1: M-Files PSA BRR Matrix

Theme	Epic	User story	Supplier's Comments
Collaboration	Collaboration with external delivery partners including subcontractors and the customer	User story 1: As a subcontractor employee I want to report hours and expenses to deliveries to be invoiced from the customer and invoiced by the subcontractor. - I can only book hours and expenses to deliveries to which I am allocated as a resource - I can see my earlier hour/expense bookings	Completed via a Subcontractor community Subcontractors will be assigned by internal users to projects. Views of previous expenses and time recording
Collaboration	Collaboration with external delivery partners including subcontractors and the customer	User story 2: As a subcontracting manager I want to define the cost of subcontracted work so that the cost and margin of the delivery is calculated correctly. - The system supports different pricing models; hourly rate per person, hourly rate per subcontractor, subcontractor hourly rate per project, fixed price, % of customer price etc. - It is possible to define price per delivery, e.g. exception to the standard price list. - There are templates for each subcontractor's pricing that can be copied to each delivery. - It is possible to change the pricing (e.g. annual rate increases) during the delivery so that the cost of past entries is not changed.	Subcontractords will have a cost and can be allocated a vendor/supplier budget/PO. There is no integration with Netsuite. T&M hourly or fixed price milestones. There is no % billing Use fixed price milestone for fixed fee items Subcontractor template pricing? To Review Contractor costs can be on a per project basis or taken from ratre card or default cost rate.
Collaboration	Collaboration with external delivery partners including subcontractors and the customer	User story 3: As a subcontracting manager, I want to get reports on subcontracting so that I can manage the subcontractor portfolio. - The reports are on-line or there is a minimal delay between data entry and its appearance in the report. - M-Files employees can customize the reports or create new ones. - There is a report for delivered hours by subcontractor company by year, month and delivery. - There is a report for delivered hours by subcontractor employee by year, month and delivery. - There is a report for the total cost by subcontractor company by year and month. - There is a report for the average hourly cost by subcontractor company by year and month. - There is a report for the gross margin of subcontracted work by subcontractor company, year and month. - There is a report with the delivery status and health indicators that can be accessed by M-Files employees - It is possible to export the report data to e.g. Excel.	Achieved through using reports and these can be built by M-Files. Will need to review each report and see how each can be achieved. Suggest a set of reports are created to cover these requirements
Collaboration	Collaboration with external delivery partners including subcontractors and the customer	User story 4: As a subcontracting manager, I want to check the subcontractors' invoices against the reported hours and cost so that the subcontractor invoicing is correct. - Checking the invoices against hours and cost is user-friendly and can be done in one view without hopping between views or applications. - It is possible to mark approved cost/expense items as invoiced (by subcontractor). - There is a procedure for requesting corrections to the invoice (if the reported cost and expenses are correct) or to the reported hours and expenses (the invoice is correct) if there are differences. - There is a report telling how much of the reported hours and expenses have been invoiced by the subcontractors; by subcontractor, month and year.	PSA Vendor Billing , a subcontractor can generate a Vendor Invoice from subcontractor time recordings so there is a correct match. Reports to be developed as above.

Collaboration	Collaboration with external delivery partners including subcontractors and the customer	User story 5: As a project manager of a subcontracted delivery I want to see and update the information of the delivery so that I can manage the delivery properly. - Subcontracted delivery = delivery that is managed by the subcontractor and there is no M-Files project/service manager. - Data to see: effort budgets and actuals, resource allocations, entered hours and cost. - Data NOT to see: Customer pricing and other contractual/commercial information between M-Files and the customer. - Data possible to edit: tasks, schedule, status indicators and other fields related to managing the project.	Assume contractor managed priojects (solo projects?) will still need to be from the Community. Will need to review security permissions. Internal manager will need to create and allocate a subcontractor resource and budget to the project
Collaboration	Collaboration with external delivery partners including subcontractors and the customer	User story 6: As a subcontracting manager I want to keep track of available and allocated subcontractor capacity so that I can manage the subcontractor resource pool. - It is possible to enter the available resources per subcontractor as x md per week (subcontractor capacity), on company or employee level. - It is possible for a subcontractor resource to update their resource availability - It is possible to make resource allocations for subcontractor employees to a specific delivery, either as x md /week or with a total amount of effort. - It is possible to make "bulk allocations" for a subcontractor employee for a specific time, either as x md /week or with a total amount of effort. - It is possible to make "planned" allocations for a subcontractor (company) for deliveries that have not yet started or where we don't have the order yet. - There is a report indicating available capacity vs. allocated/planned resources by subcontractor, by region (e.g. all EMEA subcontractors) or for all subcontractors.	-- FF Sales Comment-- Can use Resource Planner to view subcontractors Can allocate and schedule subcontractors Can create Resource Request placehodlers for subcontractors Can report onm subcontractor capacity --FF PS Comment-- Will need to use Gantt Chart 1. Is Real-time 2. Tasks are only connected within the same project, no cross project links 3. Can add dependency 4. Can add additional person but need to follow consistent process 5. What is the responsible person? What task
Collaboration	Collaboration with external delivery partners including subcontractors and the customer	User story 7: As a project manager I want to automatically generate a project status report to be shared with the customer. - There are templates for different kinds of deliveries (small project, big project, managed service etc.) - The reports are on-line or there is a minimal delay between data entry and its appearance in the report, e.g. when having to correct data in the system. - Reporting supports different pricing models; e.g. actual cost is not shown in fixed-priced deliveries. - The report can be modified in PowerPoint/Word before sending to the customer. - The fields to be included in the report can be configured. - The templates can be modified by M-Files personnel.	Will need to review if Conga could be used for Status Reports but not in scope. Some data will be need to genererated overnight in batch but most data can be realtime. Actual costs is not shown on reports depends on content of report.
Collaboration	Collaboration with external delivery partners including subcontractors and the customer	User story 8: As a customer I want to review delivery hours before they are invoiced and request corrections/clarifications so that the invoicing is correct. - Limited to time-and-materials deliveries - Optional functionality that can be enabled per delivery. - Can be done according to the invoicing schedule of the delivery (monthly, quarterly, by milestones) - Customer can see the hours directly in the system, and request corrections/clarifications directly in the system.	PM can manually generate or release billing events before invoice sent to ZUORA. Will need to review billing options Actual Invoices are in ZUORA In the community customer can see details of information. Could requests clarification via chatter
Collaboration	Collaboration with external delivery partners including subcontractors and the customer	User story 9: As a customer I want to see which hours have been included in the invoice sent to me. - In other words: what is the work done what I am paying for. - Similar to User Story 8 but here it is "for information", not "for approval". - Optional functionality that can be enabled per delivery. - Can be done according to the invoicing schedule of the delivery (monthly, quarterly, by milestones) - Information is included in the actual invoice, or if not possible, sent as an e-mail attachment or available via a link.	Billing Events have summary of information additional information can be added as a report. With ZUORA integration need to review this.

Collaboration	Collaboration with external delivery partners including subcontractors and the customer	User story 10: As a project manager, I want to follow up and mitigate risks and deviations of project, so that I can share the risk/deviation analysis with the customer and subcontractors easily - Visible data for subcontractors: risk/ deviation title, description, probability, impact, deviation plan - Hidden data for subcontractors: price information - Risks will be fulfilled automatically based on project metrics - The report can be modified in PowerPoint/Word before sending to the customer or subcontractor.	Can use PSA risks to track this. Security permissions will need to be applied. Risk Automation is to be reviewed Report can be downloaded for export.
Collaboration	Collaboration with external delivery partners including subcontractors and the customer	User story 11: As a customer, I want to have access to the system to view and submit delivery information so that I have a clear picture of my deliveries. - My deliveries = deliveries where I am the customer. - Information visible and editable for the customer can be configured. - Information to see: for example, schedule vs. plan, effort vs. budget, invoicing status etc. - Information to edit: risks, issues, comments, tasks etc.	Access to external stakeholders via PSA Communities