

BUSINESS PROCESS DEFINITION FOR TECHNICAL PUBLICATION NEEDS:
A DEFENSE COMPANY CASE

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A DEFENSE COMPANY CASE**

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ABSTRACT

BUSINESS PROCESS DEFINITION FOR TECHNICAL PUBLICATION NEEDS: A DEFENSE COMPANY CASE

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In large scale projects and organizations, standardization requirements in terms of customer documentations to integrate data created by different contractors or departments is a critical issue. Considerable amount of the defense system projects in Turkey are collaboration projects conveyed by leading actors in the industry. In this case, standardizing technical publications in terms of operators' and maintenance manuals, illustrated parts catalogs and multimedia publications become harder and more complex to follow and integrate. S1000D (International Specification for Technical Publications utilizing a Common Source Database) standardize the generation, management, use and exchange of technical publications with high level flexibility and functionality. Therefore, to provide interoperability of data, S1000D needs to be considered as a guide for all international technical documentation procured by all of the contractors in a project. In this thesis study, we interviewed the employees in defense industry by analyzing a previous multi-organizational S1000D dependent project and collected their experiences and thoughts about the specification. Through those interviews, we combined the results according to the S1000D related categories we defined. Regarding the technical publication and customer documentation requirements depending on S1000D in a specific Defense Company in Turkey, our work will draw a map of process work flow by harmonizing the existing processes in terms of planning, organization, production, transfer, revision controls and modifications in an integrated work-flow.

Keywords: Process Definition, S1000D, Technical Publications Specification, Defense Industry, Technical Manuals

ÖZ

TEKNİK YAYIN İHTİYAÇLARINA YÖNELİK SÜREÇ TANIMLAMA: BİR SAVUNMA SANAYİ ŞİRKETİ ÖRNEK ÇALIŞMA

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Büyük ölçekli Savunma Sanayi projelerinde müşteri dokümantasyonu söz konusu olduğunda gerek kurumlar arası entegrasyon, gerekse standart teknik yayın üretiminde ciddi sıkıntılar olduğu gözlemlenmiş ve bu sürece ilişkin bir iş akışı tanımlanmadığı, sorumlulukların ilgili kurum ve kuruluşlarca, uygun şekilde paylaşılmadığı anlaşılmıştır. Türkiye'deki Savunma Sanayi kuruluşları dikkate alındığında, projelerin birçoğunun farklı firmalarla imzalanan ortak projeler olduğu gözlemlenmektedir. Bu durumda, müşteri dokümanlarını tek tip üretmek ve teknik yayınların standardizasyonunu sağlamak karmaşık bir hal almakta, bu dokümanların revizyon kontrolleri, yönetim stratejileri ve entegrasyonları zorlaşmaktadır. Müşteri dokümantasyonları ve teknik yayın üretiminde birlikte çalışılabilirlik esasları gereği, verinin niteliği, maliyeti ve yönetimi söz konusu olduğunda, S1000D spesifikasyonu (Ortak Kaynak Veritabanı kullanan Uluslararası Teknik Yayınlar Spesifikasyonu) teknik yayın üretim sürecinde zorunlu olarak tüm katkıda bulunan şirketler tarafından kabul edilmelidir. Bu tez çalışması yürütülürken, daha önce çok-şirketli ve S1000D tabanlı bir projede yer almış çalışanlarla yarı yapılandırılmış görüşmeler yapılmış ve bu süreçteki deneyim ve fikirlerinin toplanması amaçlanmıştır. Bu tez çalışması ile, yapılan analiz sonuçları Türkiye' de belirli bir savunma sanayi firmasının S1000D tabanlı teknik yayın ihtiyaçları ile harmanlanarak; planlama, organizasyon, üretim, transfer, revizyon kontrolleri ve modifikasyonları ile ilgili halihazırdaki süreçlere entegre bir iş akışı tanımlanacaktır.

Anahtar Kelimeler: S1000D, Süreç Tanımlama, Savunma Sanayi, Teknik Yayınlar Spesifikasyonu, Teknik El Kitapları

dedicated to My Parents, Sister and Beloved Husband

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CHAPTER 1

INTRODUCTION

In large scale projects and organizations, standardization requirements of customer documentations in order to integrate data created in different contractors or departments is a critical issue. Regarding defense industry in Turkey, considerable amount of defense system projects are collaboration projects conveyed by leading actors in the industry. In this case, standardizing customer documents and technical publications like operators' and maintenance manuals, illustrated parts' catalogues and multimedia publications became harder and more complex to follow and integrate. In system of the systems projects; integration of systems, units and devices which are produced by different companies or departments and subcontractors is a critical task. Such integration can be supplied throughout the standardized methodologies that all of the contributors take into consideration during the production. By using the same method, if customer documentation and technical publications are created according to a standard or a specification, integration costs and irrelevancies can be decreased.

There is a military-based technical publications specification named S1000D (International Specification for Technical Publications utilizing a Common Source Database) which is also applied in civil projects in the long run. The aim of this specification is standardizing the generation, management, usage and exchange of technical publications with high level flexibility and functionality. Therefore, to provide interoperability of data, S1000D should be used mandatory as a specification for all international technical documentations produced by all of the contractors in a project.

In a worldwide perspective, most national defense industry organizations follow this obligation on their instructions; however in Turkey, there exists no obligation, guidance or directions about this specification. In this thesis study; regarding the technical publication and customer documentation requirements in a defense industry company in Turkey, our work draws a map of process work-flow considering S1000D specification in terms of planning, creating, organizing and transferring the information. Those map would be used for different types of publications by the help of previous experience. There is just one national project completed its first phase which implemented S1000D specification up to now in Turkey and there are very few employees of different levels in their organizations who had experienced this process.

While preparing this thesis study; we conducted semi structured interviews with the people who involved into S1000D process and collected their experiences and thoughts about usage of the specification. While analyzing those interview results, we combined each level of employees' thoughts and experiences in order to categorize the results in terms of:

- Senior management level
- Middle management level
- Engineering level

Turkish defense industry has a previous non-specification based mechanism for technical publications. Our purpose is to combine and integrate S1000D process to the existing mechanism for the improved work-flow definition. Guidance of using S1000D specifications and our analysis would be beneficial for meeting the new expectations of projects' technical publications.

S1000D dependent technical publication creation process is new for the defense industry of Turkey. Only Turkish companies that contributed to the international projects used this specification as mandatory. Current situation brings uncertainty and lack of feasibility for large-scale companies. To facilitate, figuring out the critical points of the S1000D issues in a Technical Manual creation process and tailoring those points to define S1000D dependent process work-flow in a specific defense company is performed while keeping the existing processes, controls and mechanism. We seek answers for the research questions defined at the Research Questions part of this chapter.

Research Questions

- What are the challenges, critical issues and experiences about implementation of S1000D specification in an international military based technical publication creation project in Turkey?
- Are there internal and inter-organizational issues, conflicts and gaps on the implementation of S1000D?
- May the experienced users have any suggestions to solve those problems?

1.1 History of S1000D

Historical development of S1000D specification and the related organizations during the progress are stated at the presentation of S1000D Users Forum 2010 which S. & N.. (2010) mentioned as follows:

1984 - The Aircraft European Contractors Manufacturers Association (AECMA) and the British Ministry of Defense (MoD) initiated the development of an international specification for technical publications to harmonize all existing specifications into a specification based on the Air Transport Association of America (ATA) Spec 100.

1989 - The first release of the S1000D specification.

1998 - Initial involvement by the US Military and several key contractors to jointly develop the specification to include US concerns.

2002 - A Memorandum of Understanding signed between the AECMA community and the Aircraft Industries Association (AIA) that transferred the overall responsibility of future specification development to be under the auspices of AIA.

2003 - Release of "Issue 2" of the specification which included requirements requested by the US Military and also included an option to use an XML DTD or Schema. Memorandum of Understanding (MoU) between AIA and ASD signed. AECMA Spec 1000D becomes S1000D. Release of Issue 2.0 which is considering Air-Land-Sea platforms.

The following improvement of the specification is described by Blais et al. (2010) as follows:

2004 - ASD signed an MoU with the US Advanced Distributed Learning (ADL) office to harmonize S1000D with requirements of the Sharable Content Object Reference Model (SCORM) for computer-based training.

2005 - a MoU was signed between ASD, AIA, and ATA to promote common, interoperable, international technical publication data in the Aerospace and Defense Industries and to work in concert on the joint development and maintenance of S1000D.

2007 - the MoU between ASD, AIA, and ATA was renewed to enable the three organizations to jointly further develop, maintain, and promote S1000D in the international arena.

2008 - AIA submitted a recommendation to the DoD to declare the S1000D standard to be the preferred specification for technical documentation in all DoD acquisitions (AIA, 2008).

1.2 Current

The S1000D specification is now conveyed and maintained by three parties namely; ASD (AeroSpace and Defence Industries Association of Europe), AIA (Aerospace Industries Association) and ATA (Air Transport Association of America). S1000D defines both electronic technical manuals, print out types and multimedia technical manuals. According to the official website of S1000D, this specification was initially developed by the Aerospace and Defence Industries Association of Europe (ASD). Currently, S1000D is jointly produced by the following organizations, their members, and customers:

- AeroSpace and Defence Industries Association of Europe (ASD)
- Aerospace Industries Association of America (AIA)
- Air Transport Association of America (ATA) e-Business Program *International Specification for Technical Publications Utilizing a Common Source Database* (2008)

Current organization map of the committee is given in the Figure 1.1

These organizations form the S1000D Council and the S1000D Steering Committee. These groups are dedicated to establishing mutually agreed standards for the documentation methods used by the participating parties.

According to S. & N.. (2010), with Issue 2, the scope of S1000D was extended to include land and naval specific applications. Ericsson and Dupuy (2010) stated that the specification

S1000D International Organization

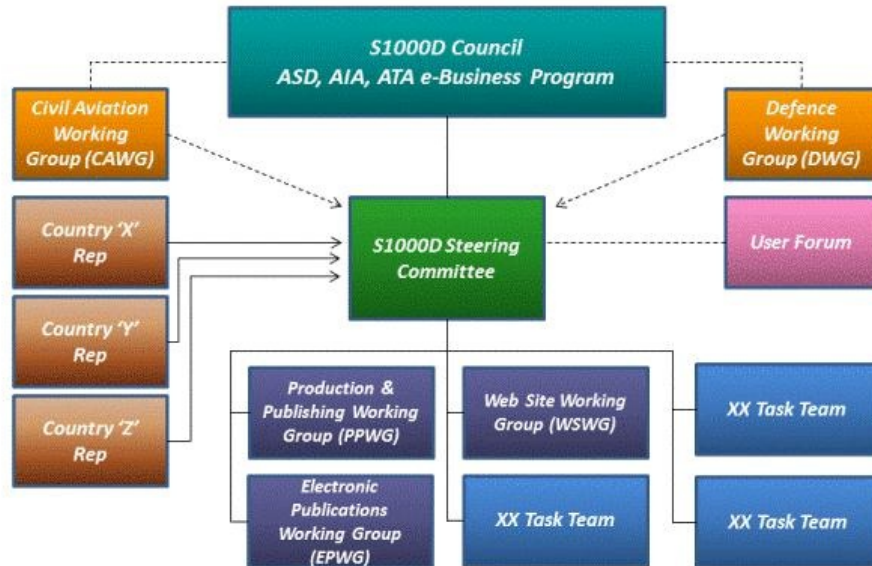


Figure 1.1: Organization of S1000D Steering Committee *Application of S1000D within the state-of-art Integrated Logistic Support environment (2010)*

continues to evolve and now supports:

- any type of equipment (including both military and civil products)
- publication
- construction
- policy procedures
- legal documentation
- organizational documentation
- and more...

Blais et al. (2010) stated that in US, S1000D is currently being employed by a number of US DoD projects, including: Air Force F-117A and Global Hawk unmanned vehicle programs, Naval Air Systems Command Joint Strike Fighter program, Army Future Combat System, and the Naval Sea Systems Littoral Combat Ship Mission Module Program (p. 2).

1.3 Purpose of the Study

Inter-organizational and intra-organizational S1000D dependent defense and aerospace projects are limited in Turkey. This thesis study will define a process while implementing S1000D

based technical publication creation project in a defense company and will also transfer the know-how and experience gained from the people we interviewed. S1000D is a new era in Turkey because the use of S1000D in the defense and aerospace projects begin to be mandatory in the project contracts. Therefore, defense and aerospace organizations in Turkey are required to meet the expectations about S1000D specification especially in inter-organizational projects. National Level S1000D implementation strategy is also required to be developed as it was in other European countries and US. This study can be a basis as it is analyzing the first multi-organizational implementation in Turkey.

With the lack of National Defense Organizations' published guidelines about the implementation of S1000D, companies are implementing this specification by the information taken from an experienced company in a different country. Most of the time this company is their co-partner in a project. Therefore, with the potential increase in usage of S1000D, Turkey need to define a National S1000D dependent Technical Publication Strategy in order to execute and guide the industry to use this specification.

In Turkey, there are very few knowledgeable people with awareness about S1000D in the industry. Some of them had worked or been working in S1000D dependent projects. In this thesis study, we found those experienced ones and interviewed with them about the gaps, process and critical issues while implementing S1000D in a project. We also collected information about inter and intra-organizational issues and lessons learned during the project.

In a technical publication development process, it is not only related with any specification but logistic support analysis approach is also critical because of the identification about which support level will be applied. In order to create technical documentation of a system or equipment, the level of the manual need to be clarified in terms of operator, maintenance, field or depot maintenance, training documents and part catalogue manuals. In addition, issue level of the specification is another point to take into consideration. By analyzing the requirements of the project and regarding the contractual obligations in the project, it needs to be decided that which issue level of S1000D will be implemented. Regarding those feasibility needs, there need to be guidelines published by a national defense organization in order to mentor the companies for all of these issues mentioned.

By ensuring the research questions, we will propose a new process work-flow required to be followed in a specific defense company when S1000D dependent technical publication creation process is the point in question. Although the specification itself has an outlined general process, industries need to conduct preliminary studies, tailoring processes and adopting mechanism for existing process to S1000D, so this study will take a step to S1000D dependent technical publication specification domain which is limited in Turkey and has global implementations and resources.

1.4 Significance of the Study

Regarding the privacy policies in defense industry both in Turkey and all over the world, it is very hard to collect data from specific projects when it is required to analyze the process of S1000D specification in a real life example. When reviewing the literature, S1000D specification dependent academic and industrial sources are limited and they are mostly product based white-papers because configuring an infrastructure which supports this specification

needs large amount of budget. Criticality of this thesis study also stands for lack of published guidelines in Turkey while it is critical to decide and implement that type of costly structure. In addition, this specification is accepted as the future of technical publications regarding all of the industry and global sector which Turkey is trying to catch up. Moreover, academic publications need to analyze and support the industrial needs and implementations when the point is this kind of costly infrastructure. Regarding the studies in all over the world, there are very few technical reports published by defense and aerospace companies and limited academic studies done by defense based institutions. This thesis work will be one of the first academic studies in Turkey which analyzes and supports the implementations from industry in terms of S1000D specification and technical publications.

1.5 Overview of S1000D

S1000D, International Specification for Technical Publications utilizing a Common Source Database, referred as S1000D, is a well build specification for developing and acquisition of Technical Publications which has a new perspective in terms of modular approach and use of Common Source Database. Specification compromises ISO and W3C standards. Information generated is in neutral format, which means it can be used on disparate IT systems and with the modular approach to data creation and storage that makes the specification so acceptable to the wider international community.

According to the presentation of Ericsson (2008), from Sörman Information and Media Company at S1000D User Forum (2008); S1000D is a technical publication (data) specification for standardized documentation of any civil or military vehicle or equipment in land, sea and air. Specification addresses the production, maintenance and presentation of technical publication processes, in a life cycle management approach. S1000D also defines a standardized transferring method for interchange of information between any parties. In addition, not only the process standardization, it also brings format, style and appearance standards namely layout for page oriented publications and presentation of IETPs.

The main goal of S1000D is Standardization of generation, management, use and exchange of technical publications data with maximum possible flexibility and number of functionality. As a result; it becomes an international standard and has flexibility for data use, functionality and interoperability of data.

1.6 What have we done / what will we do?

In Turkey Defense and Aerospace Industry, S1000D dependent technical publication projects are very limited. There is no such a considerable experience in terms of implementation of this specification. Therefore there is no process defined or rule sets described by Ministry of Defense, Turkey. Ministry of Defense and Undersecretariat for Defense Industries in Turkey does not have any guideline about how to implement S1000D to Technical Publications; companies are in a position to implement this specification while working with international multi-partner S1000D obliged projects. Until this time, there are 2 main projects in Turkey that S1000D based technical publications are mandatory, one of which was accomplished as a first phase. Those projects are:

- A specific Tank Project which is produced as a prototype and will go on with the serial production at the end of 2013.
- A Helicopter Project which has a process about completion of 1st phase.

These two projects technical publications are conveyed by using a consulting company in order to lead the publication team while producing the Technical Hand Books, Illustrated parts catalogue and other technical publications. Helicopter Project has passed the processes and gained the outputs because it is about to finish at 2013 and the first helicopter within the scope of the project will enter to the inventory of Turkish Armed Forces. On the other hand, the specific Tank Project has still no output and a progress because the Project will be accomplished by 2017.

With the increase in the S1000D mandatory in the projects in Turkey and lack of guidelines served from Undersecretariat for Defense Industries considering the specification; companies need to define a guideline or process work-flow in order to cope with the situation. AIA published a guideline as “A Recommendation to the Department of Defense to Adopt the S1000D - the International Specification for Technical Documentation” to direct and consult the users in America by stating that in USA, S1000D should be the specification for all technical publications that Department of Defense approved depending on an Industrial Consensus.

This guideline also consists that there is an industry consensus provided by Department of Defense which directs users to prefer S1000D as a specification for technical publications. The reason for this implementation is because S1000D brings solutions to the problems of technical data management and accordance between the training materials and the approved technical publications. By preventing the standalone technical publications and training materials, S1000D provides valid and accurate documentation and training materials throughout a database in a system life-cycle process. But, that guideline is specific for the needs of the USA Defense Industry.

Certainly, considering the Defense Industry in Turkey, a guideline can be also beneficial for most cases; however it cannot meet the requirements of the companies’ specific process management issues.

USA Department of Defense published a handbook MIL-HDBK-523 working with the standard MIL-STD-3031 - Army Business Rules for S1000D: International Specification for Technical Publications Utilizing a Common Source Data Base in 2011 in order to provide a guideline in terms of “Guide to The General Style and Format of S1000D Technical Manual Data Modules (2011) which has general and detailed definitions to follow while creating S1000D based Technical Publications. *Guide to the General Style and Format of S1000D Technical Manual Data Modules* (2011) stated as:

- General
- Data modules
- Warnings and cautions
- Publication structure
- Table of Contents

- Reuse
- Style sheets
- Graphics
- Business rules
- Schemas
- Information management
- Content matrices
- Display devices
- Compact Disk (CD) and Digital Video Disk (DVD) preparation
- Compact Disk/Digital Video Disk (CD/DVD) mailer data
- Jewel case flyleaf data

In addition, understanding the specification does not mean to implement it very well, so regarding the company needs and existing process between organizations in the company, there is a critical requirement to tailor and bound the specification to the existing working mechanism. In this study, we figure out the needs for a compatible process of S1000D specification regarding the needs of Technical Publications in a specific Defense Company by examining the existing know how from the projects experienced in terms of S1000D.

Throughout the experiences from the previous S1000D mandatory projects, we applied semi-structured interviews which are examining the process, progress and specific implementations to the different levels of personnel working at cooperative organizations in the project. Obtained data from the experienced users who are classified according to their hierarchical level in the organization they are working for critical points, gaps, deficiencies, inter and intra-organizational issues and practical suggestions are analyzed and tried to be integrated to the process definition study regarding the needs in a specific defense company taken a part in this previous experience. Detailed information about the interview is given in Chapter 4, analysis and results are reflected in Chapter 5.

The remainder of the thesis is organized as follows:

Chapter 2 - Background Information gives an overview of Technical Manual Types; provides detailed information about S1000D Specification and the components. Then related studies in literature and Common Source Database, Benefits of S1000D in the literature are described in detailed.

Chapter 3 - Our Approach and Single Case Study part presents our research details. In the Defense Company, we figured out the experiences from users having different roles during the S1000D dependent technical publication creation process. In order to analyze the deficiencies, problems and critical points regarding the implementation of the specification, we conveyed a semi-structured interview with the participants who were responsible for a part of the project while implementing S1000D specification.

Chapter 4- S1000D Implementations and Results includes the detailed information and interpretation of the analysis results. With the help of this study, we draw a map about the existing process with S1000D compatible process in terms of Technical Publication Creation progress in this chapter.

Chapter 5- Comparison, Conclusion and Future Work includes the concluding remarks, proposed process work-flow depending S1000D specification and states the future work.

1.7 List of Abbreviations

Here is the list of Abbreviations used in this thesis report:

Table 1.1: List of Abbreviations

ABBREVIATION	DEFINITION
ASD	AeroSpace and Defence Industries of Europe
AIA	Aerospace Industries Association of America
AECMA	The Aircraft European Contractors Manufacturers Association
BR	Business Rules
CSDB	Common Source Data Base
DM	Data Module
EPWG	Electronic Publications Working Group
HTML	Hyper Text Markup Language
IETM	Interactive Electronic Technical Manual
ISO	International Specification
LSA	Logistics Support Analysis
ILS	Integrated Logistics Support
MoD	British Ministry of Defense
PM	Publication Module
S1000D	International Specification for Technical Publications utilizing a Common Source Database
SNS	Standard Numbering System
TM	Technical Manual
W3C	World Wide Web Consortium

CHAPTER 2

BACKGROUND INFORMATION

In technical publications, S1000D is a new era although its beginning goes back to 1984. S1000D specification is recently supported by AECMA, the AeroSpace and Defence Industries of Europe (ASD), the Aerospace Industries Association of America (AIA) and the Air Transport Association (ATA) and controlled by the Technical Publications Specification Management Group (TPSMG). This group has full responsibility from the maintenance of the specification. ATA e-Business Steering Committee reviewed existing standards and then decided that next generation of technical publication standards for the civil aviation industry should be developed with S1000D in order to provide a single global standard for both civil and military applications. S1000D begins to be used as the international standard in technical publications for civil aviation, aircraft and defense equipment industry.

The specification is controlled by an international body, the S1000D Steering Committee (SC), which is responsible from maintenance of the specification. The SC includes members from both government agencies and industry. To address the rapid development of information technology, the SC is supported by a group of specialists known as TPSMG.

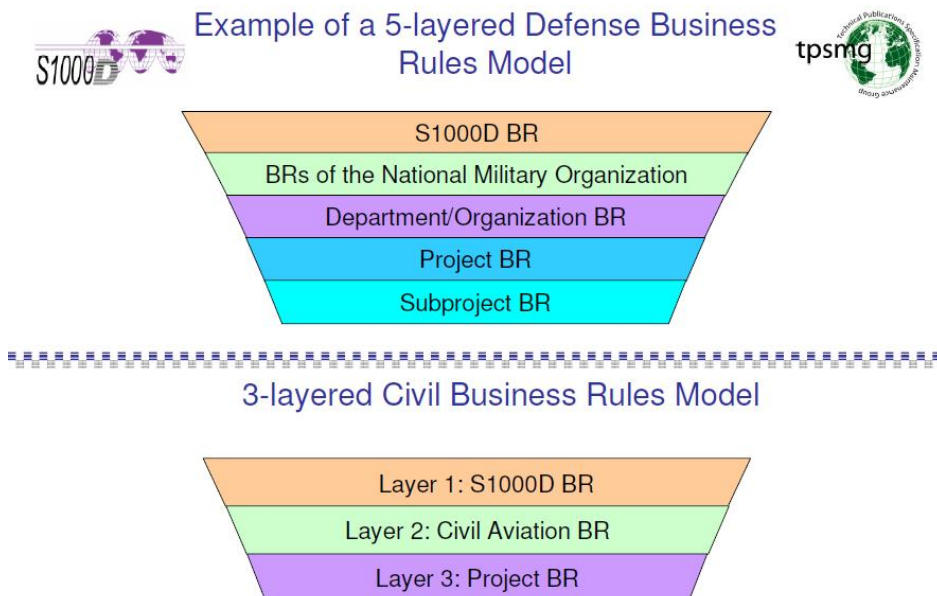


Figure 2.1: 5-Layered Defense Business Rules and 3-Layered Civil Business Rules (TPSMG and EPWG members (2008))

Ichizli-Bartels (2008) stated that, in S1000D based technical publication creation process; there need to be defined Business Rules on each layer of hierarchy. For example in defense industry, 5 layered Business Rules model is described in the Figure 2.1 by placing a National Military Organization BR in order to specify the S1000D BR in a manner that national ministry can approve. In terms of civil layered BR model, there exist not an organization inspecting the projects, so there is no need to define an organizational level BR.

Junod J. & J. (2011) conducted a study about Procedures for the Acquisition and Development of NAVSEA TMs/IETMs in accordance with International Specification S1000D. They defined a process work-flow depending on the US Army Naval Surface Warfare Center, Ship Systems Integration and Design Department’s needs regarding the comparison of S1000D layout and the NAVSEA Policy and Guidance which is a policy of a corporation where they are working for.

Within this technical report; S1000D specification is described chapter by chapter shown in the Table 2.1 as follows:

Table 2.1: Definitions of S1000D Chapters

Chapter Number	Chapter Name	Description
1	Introduction to the Specification	Includes general description and information about the specification and how a particular project or organization will use it, how to tailor it to demand changes in the specification and contains information useful for program managers.
2	Documentation Process	Gives information about the referenced standards in S1000D specification and the relation between them. The identification of the need for Business Rules to adopt specification.
3	Information Generation	Enables deeper information about how generated and structured documents created and provides detailed information about quality assurance issues included in S1000D as a modular approach in data module development procedure. In addition this chapter also includes rules and schemes for authoring and illustration techniques for each S1000D elements and attributes.
4	Information Management	Provides information about managerial issues about S1000D applications, data modules, DM Codes, other numbering systems and project development. This chapter also deals with optimization and reuse of data in order to provide consistency and prevent rework.
5	Information Sets and Publications	Defines rules for information sets and publication creation with concept description.

6	Information Use/Presentation	Deals with the appearance, page orientation and interactive electronic technical publications (IETPs).
7	Information Processing	Provides directives and suggestions about creation and maintenance of CSDB objects. This chapter also defines rules for publication generation techniques, technical requirements for display systems and information interchange issues.
8	Standard Numbering Systems, Information Codes, and Learn Codes	Describes Common Standard Numbering System (SNS) and the information architecture used in Data Module (DM) Code. Learn Codes are deals with the issues in the projects which are producing training data.
9	Terms and Data Dictionary	Includes the glossary information and list of acronyms for the specification S1000D.

2.1 Technical Publication Types

The new generation technical publications are based on interactively electronic technical manuals and interactive electronic technical publications instead of paper and print based manuals. According to the *How S1000D Works?* (2012) official website, technical documentations are classified in to 5 :

The first level of electronic technical manuals are also has a page oriented view similar as traditional manuals and styled as a book view by having chapters, sections with hyperlink properties. This kind of page-book oriented structured of IETMs are generally classified to I, II or III Classes according to their interactivity level and functionality.

Class IV type of manuals appearance are different from the page and book oriented view. Rather than traditional structure, level IV of publications has modular approach including technical content elements in terms of part lists, drawings, diagrams and other visual support required. This data-driven representation is electronic based and consists of linked data modules on an underlying database structure which provides a multiple usage of single item by different places in an IETM and between different IETMs. This brings a more dynamic approach with enabling cost and labor savings.

Class V level has the highest interactivity level which is integrated with a fully-constructed maintenance concept by providing simultaneous supportive information considering an on-going system. This level of interactive electronic technical publications are working with a trouble shooting mechanisms, depending on a system trouble cases by supporting the system via providing information synchronously. Interactivity levels and delivery channels of IETMs are presented in the Figure 2.2

Class IV and V types of IETPs are considered as the new generation modular and dynamic approach having benefits of both time and cost savings associated with reusing data rather than recreating it each time *IETMs/IETPs* (2012)

	Type I		Type II	
	Class 0	Class I, II, III	Class IV	Class V
Media Delivery Method	Paper	Electronic Technical Manual (ETM)	Interactive Electronic Technical Manuals (IETM)	Class IV IETM plus Electronic Infrastructure
Formatting/Presentation Methods	Multiple volumes	Electronic Emulation of Paper Manual	Fully Interactive IETM	IETM is linked to Maintenance Systems
Level of Integration Capabilities	Not linked or integrated at all	May include electronic page turner and hyperlink functionality	Includes functionality to automatically guide a maintainer through a maintenance troubleshooting process	Integrated with Intrusive Diagnostics Systems

Figure 2.2: Technical Publication Types (Continental Datagraphics (2013))

2.2 S1000D Specification

In this section, we tried to describe the S1000D specification by defining a methodology. S1000D has different issues that can be considered as versions and key components which are critical while implementation of the specification. In addition; as it is a database dependent system, we indicated the Common Source Database and Data Reuse in this section in detail. Lastly, the benefits and the challenges of implementing S1000D are discussed.

2.2.1 Methodology

“A Recommendation to the Department of Defense to Adopt the S1000D – the International Specification for Technical Documentation” (2008) explained that S1000D is an SGML (Standard Generalized Markup Language, XML (Extensible Markup Language) and CGM (Computer Graphics Meta-file) dependent specification to produce wide range of information types such as; descriptive, procedural, maintenance schedules, fault isolation, crew/operators, testing and training documents. Although its background leans on aviation industry, S1000D supports any type of land, air or sea system or machinery requiring maintenance, operation, configuration to parts and supplies.

S1000D has a new approach to the technical publications by changing the working principle of related divisions in a company or organization. Figures 2.3 and 2.4 represent the difference of data creation for technical publications by using traditional model and the new S1000D approach. Via this approach, engineering data is selected according to the usage area, for example operations, maintenance or parts catalogue. Document creations, publications and storage of the items are conveyed separately. Regarding the training documents, it's also a different job and process to create. There are so many duplicated parts in both operational,

maintenance catalogues and training materials which are created one by one.

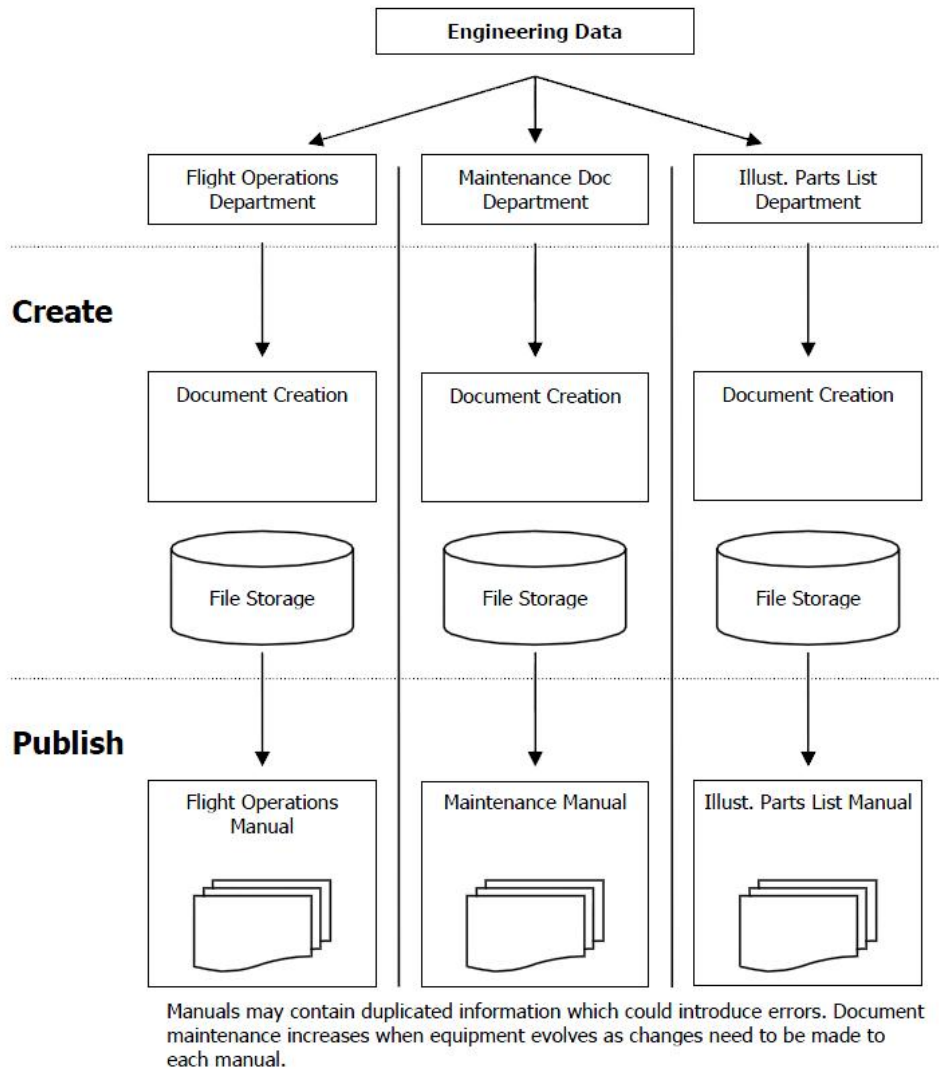


Figure 2.3: Traditional Data Creation Approach (Continental DataGraphics Ltd. 2010)

When considering S1000D Common Source Database approach, all of the data is created once and can be used for operator, maintenance, IPC documentation and also training materials. With the help of the new data module types in latest issues of S1000D, multimedia and e-learning objects can also be created via integration tools from CSDB. Throughout the CSDB, DMs can be transferred to a different project if that project has the same equipment, part or sub-part. In addition, DMRL can be transferred to a new project in order to use the same DM types and change them according to the new system.

2.2.2 Issues of S1000D

Junod J. & J. (2011) also describes the managerial process of S1000D specification and the version management by defining that major changes are reflected as Issues to the specification. However, change requests are collected throughout the Change Proposal Forms and evaluated

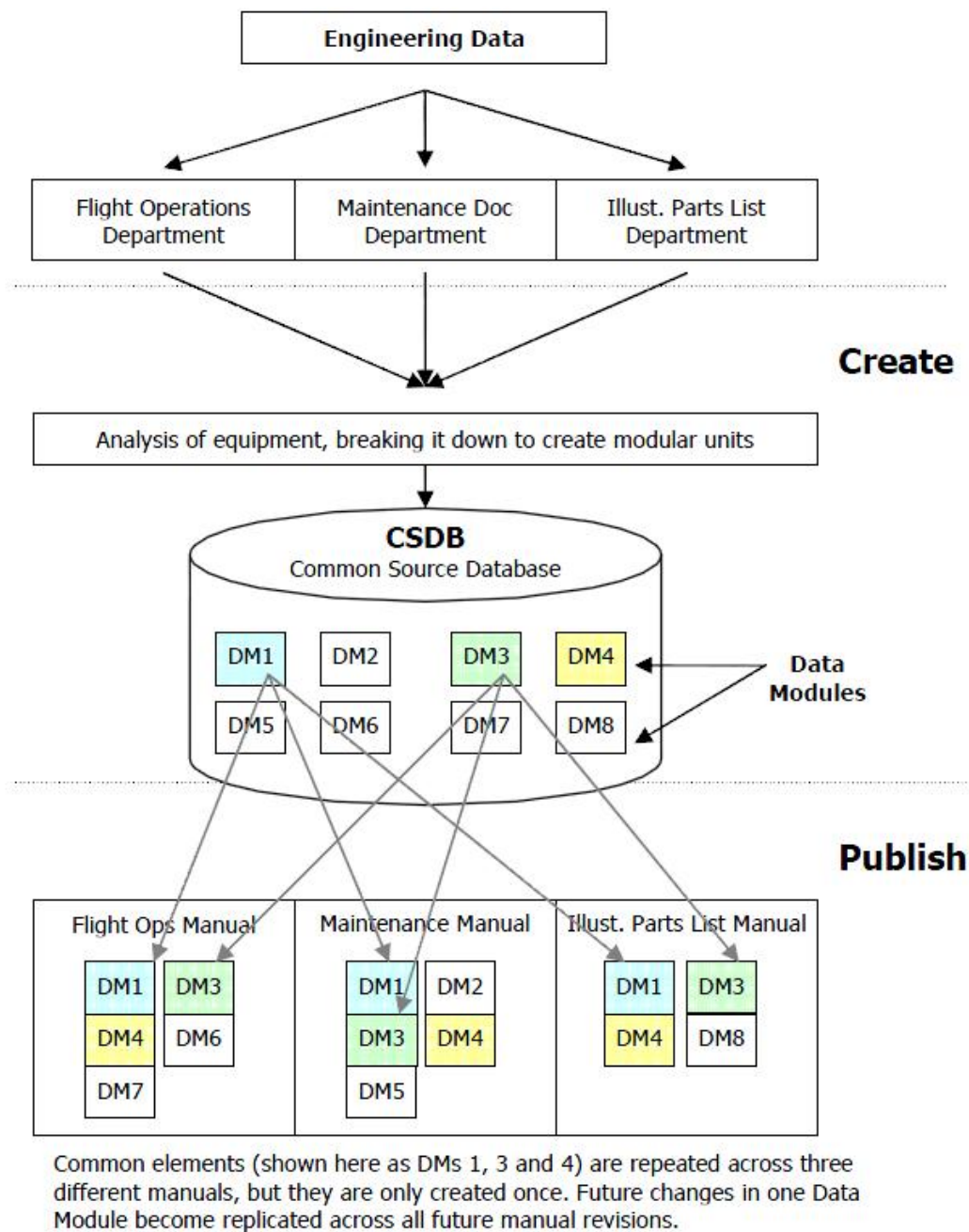


Figure 2.4: S1000D Data Creation Approach (Continental DataGraphics Ltd. 2010)

by a multinational team and a review process.

In S1000D depended projects, implementers prefer to use different versions of it according to their specified needs and minimum requirements. For example in Issue 2.0 which was released in 2003; supports Interactive Electronic Technical Manuals with the help of Process Data Module and the Publication Module. In 2007, Issue 2.3 was released with an additional functionality of introduced multimedia (3D and audio) and a technical repository to the specification. In addition, later release in 2007 July, Issue 3.0 meets the requirements of Air Transport Association which was added a new applicability model and changes demanded by

defense communities from various nations and provide support for 787 Dreamliner aircraft / Boeing.

In 2008, Issue 4.0 was released with 42 change proposal forms approved which are requested by US Army suggesting improved S1000D schema, some changes from aerospace and defense users and including SCORM compliant training modules.

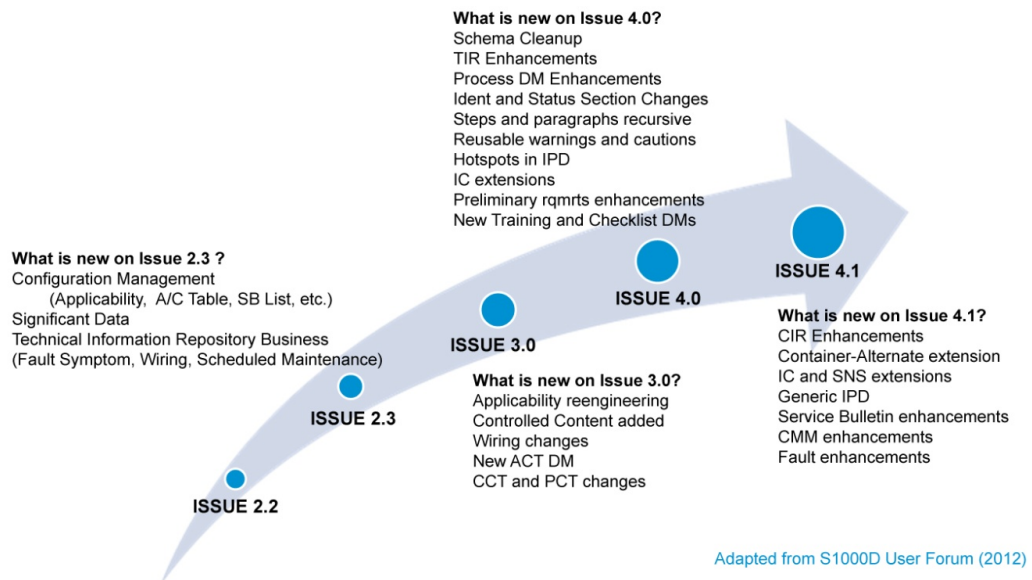


Figure 2.5: Evolution of S1000D

2.2.3 Key Components of S1000D

During the implementation phase of S1000D, Technical Report from Naval Surface Warfare Center Junod J. & J. (2011) stated that there are components that ought to take in to consideration during the process. S1000D has a Data Module based structure providing re-usability and divided in small information sets to address the technical data problems and required fulfillment. For a new or a conversion project; before the authoring process and any conversion, three main steps need to be taken:

- The business rules of the project,
- Data module Requirements List (DMRL) and
- The Standard Numbering System (SNS) selection.

Other key components can be considered during the project or conversion process but those 3 artifacts need to be clarified at the beginning.

2.2.3.1 Business Rules

Guide to the General Style and Format of S1000D Technical Manual Data Modules (2011) specified that Business Rules are very critical in the beginning phase because they are used to provide consistency by defining set of rules for creating data modules and graphics. Business Rules does not mean to change the schema property of S1000D, on the other hand it means to tailor the specification with the requirements of the project by preventing any contradiction to a mandatory rule in the specification. After the entrusting, prime contractor, sub-contractors and government need to collaborate with each other for the rule set by considering each item of S1000D Business Rules Set with the help of the standard MIL-STD-3031.

S1000D Business Rules Categories can be directly correlated with or obliquely relevant to the customer. From the Hoyland (2004), Table 2.2 shows the direct/indirect relations between each Business rules Categories and the Customer.

Table 2.2: Direct/Indirect relations between each Business rules Categories and the Customer

	Business Rules Categories	Relation With the Customer
1	General Business Rules : Rules that are not belong to other specific categories. Example: Defining which Issue of S1000D will be used for the Technical Publication of the project. Rules for the	Directly related with customer.
2	Business rules for Product Identification In accordance with engineering and design work breakdown structure : <ul style="list-style-type: none"> • Synopsis of Data Module Types • Definition of Product Breakdown Structure and Standard Numbering System (SNS) 	Indirectly related with the customer.
3	Business Rules for Maintenance and Operation of the Product Concept and Scope: <ul style="list-style-type: none"> • Determining the types of descriptive or procedural knowledge Example : Removal / installation procedure <ul style="list-style-type: none"> • Determining the levels of training and qualification for the maintenance personnel. 	Directly related with customer.
4	Security Business Rules <ul style="list-style-type: none"> • Defining the authorization of the Technical data access and modify the data. Example: Restricting each vendor / sub-contractor to be responsible only for the departments itself and the right to change the data access and its own.	Indirectly related with the customer.

5	<p>Business Process Oriented Business Rules:</p> <ul style="list-style-type: none"> • Determining working methods between manufacturers and sub-contractors and all the suppliers involved in the project, • Within the scope of quality processes, determining working principles of the division of labor between the author groups and the engineering and design groups, other disciplines of technical document and so on. 	Directly related with customer.
6	<p>Data Processing and Creation Related Business Rules:</p> <ul style="list-style-type: none"> • Defining spelling rules <ul style="list-style-type: none"> – Language, terminology, dictionary <p>Example: Using Simplified Technical English ASD-STE 100 and so on.</p> <ul style="list-style-type: none"> • Defining rules of Illustration and Multimedia <ul style="list-style-type: none"> – Graphic and style <p>Example: cgm. , Jpeg, etc..</p>	Directly related with customer.
7	<p>Data Exchange Related Business Rules:</p> <ul style="list-style-type: none"> • Creating the list of Data Module if it is used. • Throughout the Common Source Data Base, reporting of the status of business situation. • Determining the Data Exchange period. • Determining the criteria for acceptance and rejection of DM. <p>Example: The Unauthorized Data Exchange shall not be allowed.</p>	Directly related with customer.
8	<p>Data Integration and Administration Business Rules:</p> <ul style="list-style-type: none"> • Defining data management rules for both the manufacturer and customer. • Defining the rules for Business Work-flow • Determining the quality guidelines • Data is accepted only if they are prepared according to business work-flow and quality control criteria specified in the rules. 	Indirectly related with the customer.

9	<p>Generally in Modernization Projects/ Data Legacy Rules:</p> <ul style="list-style-type: none"> • Defining rules and strategies for converting the current data to new data structure (data modules) and data management. • Migrating a document prepared in the data format of ATA iSpec 2200 in to the appropriate Data Module structure in S1000D. 	Indirectly related with the customer.
10	<p>Technical Document Output Related Rules:</p> <ul style="list-style-type: none"> • Determining that which of the following formats is used while submitting technical publications to the customer. <ul style="list-style-type: none"> 1. Print out book 2. Electronic Copy 3. in Multimedia 	Directly related with customer.

To prevent the challenging situation while defining business rules at the beginning of a project, Business Rules categories and the flow of the timing about those categories are described as an example at the Figure 2.6. Regarding the specific conditions of the project, those categories and sequences can be modified.

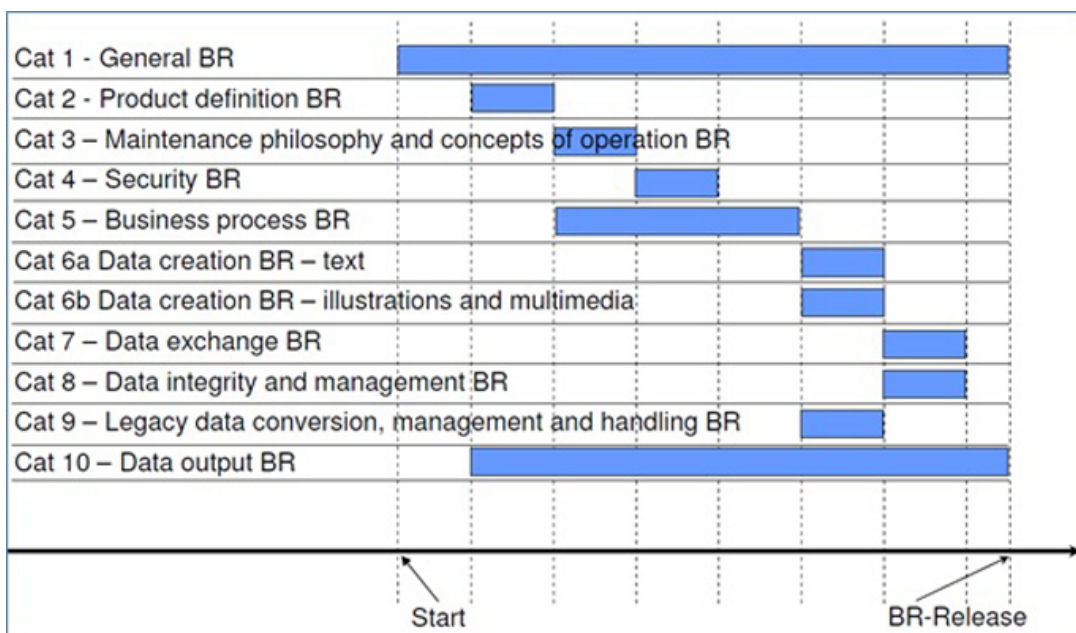


Figure 2.6: Sequence of Business Rules Production regarding the Business Rules Categories, Corena Group (2008).

2.2.3.2 Data Modules

Data Modules (DM's) are smallest, self-contained unity which consists of 2 parts in terms of, Management data and Content. The management data includes Identification and Status information via Data Module Code (DMC) whereas the content shows what the user sees regarding the types of the Data Module. DMC reflects the relation between DM and document components and equipment. Status information shows the security level, issue number and date.

The article Ichizli-Bartels (2008) describes that each Data Module is in the form of SGML or XML file by including one task or description on one object in one situation, addressed by a unique Data Module Code and Issue Number. Data Modules are created ones and then, can be used many times in many procedures and manuals. In order to prevent the duplication, DM should contain unique information and can be from 2-3 paragraphs to several pages of data including illustrations. According to the course notes from Jordan (2011), In Issue 1.6, there were two main types of data modules; Procedural and Descriptive. In Issue 4, there are 22 types of DMs namely;

- Descriptive
- Procedural
- Crew (includes descriptive flight reference cards as standard emergency procedures in Aircraft)
- Fault
- IPD
- Schedule
- Wiring Data
- Wiring Fields
- Process (designed for IETP)

On the other hand, with the developing issues, there appended also some management types of data modules as:

- Applicability Cross Reference (w/ Issue 4) - manages the origination of that part/item
- Business Rule Exchange -inter-organizational DM exchange management
- Comment - For descriptions
- Container - combining DMs to use as a whole
- Data Dispatch Note
- Data Module List - use for copying DM list to a new project to use all of those DMs
- Product Cross Reference (w/ Issue 2.3)

- Publication Module
- Technical Condition Cross Reference (w/ Issue 2.3)
- Technical Information Repository (w/ Issue 2.3)

S1000D defines different data module types and develops new ones to meet the requirements of improving needs in the projects via latest issues. Considering data types each DM should consist one of the data module types and have to include all of the identification and status information. This structure is shown in the Figure 2.7.

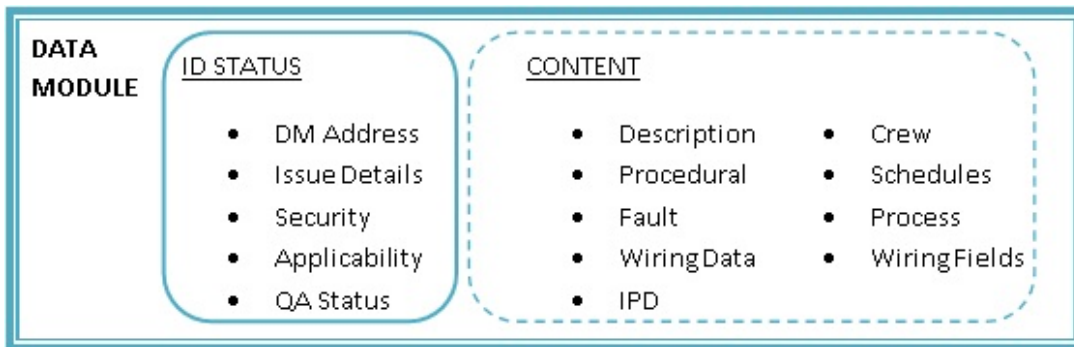


Figure 2.7: Data Module Structure

International Specification for Technical Publications Utilizing a Common Source Database (2008) specification defines a Data Module Code (DMC) as 17 to 37 character alphanumeric codes identifying the type and the applicability of the data in a data module and enabling it to be input into, and retrieved from, a database. While DMCs share a number of concepts similar to other numbering schemes (military, civil aviation), they incorporate additional features used to support modular documentation.

Regarding an air vehicle, engines and equipment; there is an example of a Data Module Code below in the Figure 2.8, with relations with the information that the code parts carry.

2.2.3.3 Data Module Codes

The Identification and Status section of every data module provides a unique definition which ties the data module to components and sub-components of the product and gives descriptive information about the contents of the Data Module. *S1000D Glossary* (2013) which is a products and services company that specializes in enterprise application development, content management systems and XML authoring, defined on its official website that each Data Module code consists of the following items as a determination to prevent duplication of data and facilities database control and managerial issues.

- **Model Identification Code** - Used to indicate the model/overall system to which the technical data is applicable.
- **System Difference Code** - Indicates alternative versions of the system and subsystem/sub-subsystem identified by the SNS without affecting the type, model or variant identity. Specifically, different codes are used to identify information that is specific to one unique configuration of a product.

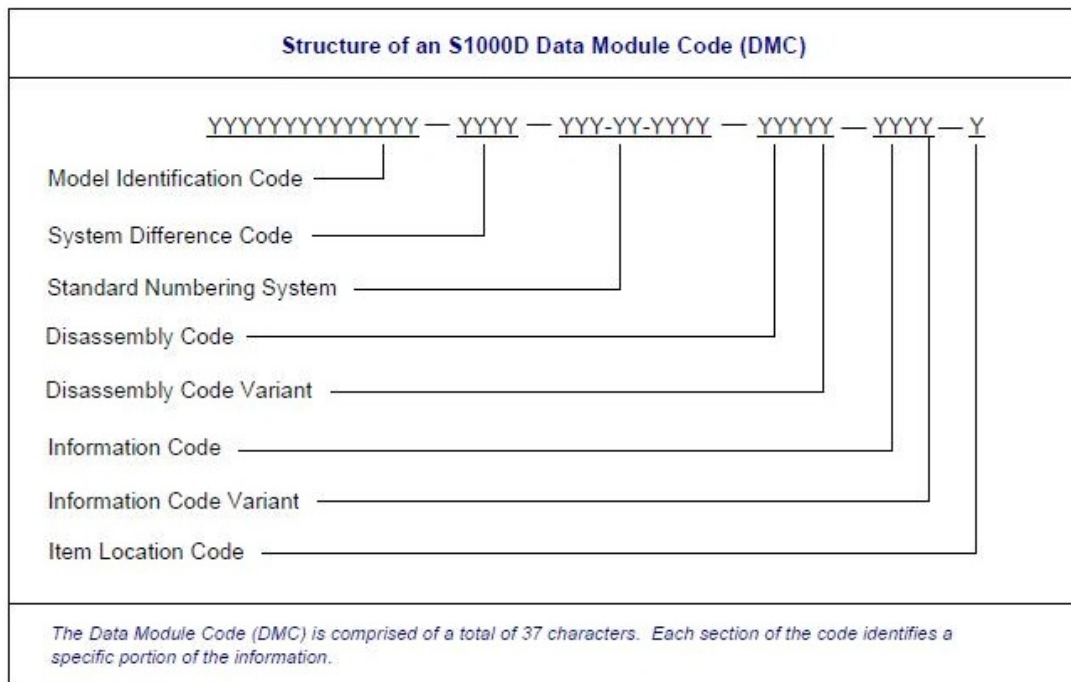


Figure 2.8: Data Module Code Contents *International Specification for Technical Publications Utilizing a Common Source Database* (2008)

- **System** - Contains a two digit number identifying the system that a data module is contained within.
- **System - Subsystem/Sub-subsystem** - Describes the further breakdown of system.
- **Unit/Assembly Code** - Refines the SNS beyond the System/Sub-system/Sub-Subsystem level. This field is a two digit identifier used to specify individual units or assemblies.
- **Dis-assembly Code** - Identifies the breakdown condition of an assembly to which maintenance information applies.
- **Dis-assembly Code Variant** - Disambiguate two or more data modules that share the same number and are for the same item at the same level of disassemble.
- **Information Code** - Used to identify the exact purpose of a DM. An information code is a three character code that is set to a value found in the vast predefined list of information codes defined in Chapter 8.4 of the S1000D specification.
- **Information Code Variant** - The Information Code Variant is used for disambiguating generic information codes to allow for more specificity.
- **Item Location** - Location Code indicates the location of the unit on which maintenance is being performed.

2.2.3.4 Data Module Requirements List

It is a list of Data Modules required for a project which will change through the life-cycle process of the project. As stated in *International Specification for Technical Publications*

Utilizing a Common Source Database (2008), Data Module Requirements List is providing the users to create data module templates in a Common Source Database (CSDB). DMRL supports planning, reporting, production and configuration control, especially in a work share environment. Regarding the existing process and technical manuals, DMRL is similar to the Document/Book Plans which are defining the types of the content of the book in an operators' manual or maintenance manuals. A data module requirement list can be generated in parts (e.g. by partner companies for later merging) or in a complete form and have to be ensure that only needed and desired data modules providing the desired information are produced. A DMRL contains the following elements:

- identification and status section
- data module requirement list content

General content, functions and information sets identifies the depth and the range of TM such as which weapon system are subject to what actions and other requirements scoping the developed content.

2.2.3.5 Metadata

S1000D Configuration Metadata relates all technical content which is supporting a Common System to the system, assemblies and sub-assemblies. With the help of relationships between assemblies and parts to data; Technical Report from Junod J. & J. (2011) explained that by assigning logistical control number in the status component of the data to a DM, a data manager can check out accurately that which of the contents will be affected from a system design change. In addition, Metadata requirements specified in S1000D refers to identification and status section of a DM that describes the information in order to address and manage the DM. Identification section consists of DMC, Title, Issue Number and Date and Language. On the other hand, status section of metadata includes Security Classification, Responsible Partner Company and the Originator, Applicability, Technical Standard, Quality Assurance status, Skill level and Reason for Update of DM.

By consisting Identification and Status of the extensive Metadata, it can be used for:

- DM management in the CSDB
- Use of Applicability and Quality Assurance Management
- Control and Retrieval Function Management
- Compilation of Sets and Subsets of Information Automation
- General Information about CSDB and Implementation of Export Controls Management

Table 2.3: Common information sets defined in S1000D Issue 4.0

Crew/Operator information	Storage	Equipment information
Description and operation	Wiring data	Weapon loading information
Maintenance procedures	Illustrated parts data	Cargo loading information
Fault isolation	Maintenance planning information	Stores loading information
Non-destructive testing	Mass and balance information	Role change information
Corrosion control	Recovery information	Battle damage assessment and repair information
Illustrated tool and support equipment information	Service bulletins	Material data
Common information and data	Training	List of applicable publications
Maintenance checklists and inspections	Training aid Booklet	Commercial Off the Shelf

2.2.3.6 Information Sets

Information Set is an S1000D concept which refers to a collection of required documentation of a certain Scope and Depth of the technical information that is to be produced for operation and maintenance of the Product and subsequently establishing the basic data module requirement list which are in the form of Data Modules and can be managed in CSDB.

International Specification for Technical Publications Utilizing a Common Source Database (2008) states that:

Since the range of the Product within land/sea systems is so varied, it is impracticable to define one suite of information sets that is appropriate to all land/sea systems. Therefore, for land/sea systems, the project or the organization must define the information sets that are appropriate to their projects. However, to assist with this, a suite of information sets has been provided which can be used. In either case, the project specific information sets must be agreed between the customer and the contractor.(Chapter 3.3, p.3)

Although S1000D defines most common information sets for TMs, they can be defined accurately in the project contract in terms of the scope and depth to meet the requirements. Table 2.3 shows the common information sets defined in S1000D Issue 4.0.

Whereas S1000D defined the common Information Sets in the Table 2.3, there is also context specific information sets described in the specification for air, land and sea systems. In order to form a complete set of information about the project specific manner, organizations need to tailor those common information sets and select air, land or sea specific ones to put together

and provide a wide range of technical manual and training document strategy.

2.2.3.7 Publication Module

As described in *International Specification for Technical Publications Utilizing a Common Source Database* (2008), The publication module describes both the content and the structure of a publication. DMs even front matter DM and illustration DMs, Publication Modules and legacy technical publications are combined by a Publication Module to create the final deliverable in the type of defined publication format. S1000D provides support for wide range of different types of publication in a various media formats from IETPs to print out paper based and page oriented publications.

Similar to Data Module, Publication Module also includes an Identification and Status and Content sections and aims to compile a set of DMs to create a publication such as a checklist, guide, catalogue or another document on a particular subject depending on a paper or screen based media.

The publication module Schema is defined in the Figure 2.9:

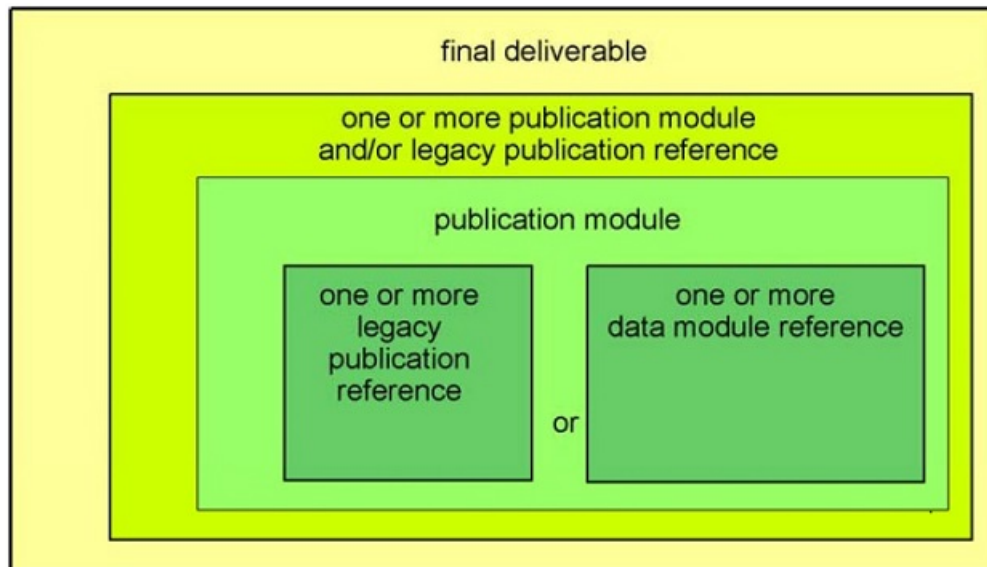


Figure 2.9: Publication module concept (S1000D Specification, Issue 4.0, Chap 4.9.1)

2.2.3.8 Publication Module Code

Publication Module Code is a part of Identification and status section of Publication Module. It is unique structured identifiers of the final deliverable to enable CSDB manage this publication and provides DMs and IETMs to refer, retrieve and access the publication module. The structure of Publication Module Code is defined in S1000D as stated in Table 2.4.

Table 2.4: Publication module and SCORM content package code, S1000D Issue 4.0(2008)

Publication module code and SCORM module code breakdown	Length
Model identification code	2 thru 14 alphanumeric characters
Issuing authority (eg CAGE)	alphanumeric characters
Number of the publication or SCO	5 alphanumeric characters
Volume number	2 numeric characters

2.3 Common Source Database

CSDB is specified in the S1000D specification as the key element of information management by supporting a storage and management function for all items required to produce the technical publication. DMs are the smaller unit of Technical Manuals which are stored and managed by a Common Source Database (CSDB). Not only those DMs but also all information objects required to be stored in order to manage and retrieve the data.

In *International Specification for Technical Publications Utilizing a Common Source Database* (2008), main goals of Common Source Database is stated as:

- optimizing the technical publication process
- providing the control mechanism while authoring
- enabling quality assurance process
- regulating data exchange with collaborator organizations, sub- contractors and customers
- providing various media based delivery of technical publications independent from the source storage format.

The main point of Common Source Database is that it is the smallest container in the CSDB which can contain and refer to any text, illustration, exploded visuals and any kind of multi-media not in an embedded form, but referenced to the item in a Data Module.

Systematic definition of system breakdown structure is critical in terms of establishing technical information as a Data Module which is used scores of times efficiently in the CSDB.

2.4 Data Reuse

Considering the serial production of technical publication development projects, Data Module approach provides reuse of data which is preventing re-authoring, management and update complexity especially in different types of delivery is considered.

In Figure 2.4 S1000D Data Creation Approach, Data Reuse is also presented in the relation of CSDB and Publish phases, so S1000D Data Modules are smallest information units having

a meaningful information and any supporting data such as graphics. For example, if there is a Data Module describing the installation of a back up system for a specific software in a project, this procedure may also valid for another project which is using the same software or same back up utility. With the help of data base structure and the managerial information in DMs, data reuse can be provided. Managerial metadata associated with Publication Modules, Data Modules, and graphics/multimedia in a S1000D development approach provides searchable material for locating potential reusable data modules.

Junod J. & J. (2011) stated that Preliminary studies before a project can provide searching reusable metadata and figure out the capabilities to select required modules use available metadata and search capabilities to locate useful modules and determine the content to be reused or to be tailored. With the help of this preliminary study, schedule management can be done more accurately and recreation costs of DMs can be reduced. Acquiring activities, program managers, and project managers should anticipate and plan for data module reuse both within the current project and across previous and future projects. Developers can use the Common Source Database, metadata, and search capabilities to locate reusable modules.

2.5 Benefits

Most of the large-scale, multi-developing project plans stated that technical publications of the system will be produced depending on the S1000D specification because the greatest benefit provided by S1000D is Information Reuse. The structure described in S1000D is creating Data Modules containing text, graphics or procedural information and references and with a managerial type of content, those DMs are stored in CSDB. This structure facilitates time saving and consistency between each individual publication by preventing to recreate the same information over and over again.

“A Recommendation to the Department of Defense to Adopt the S1000D – the International Specification for Technical Documentation” (2008) stated that with the help of modular approach to data management procedure, S1000D brings a re-usability capability by specific data modules stored in CSDB. On the other hand, S1000D addresses existing problems and tries to solve them by specifying those items in the various issues of the specification.

This guideline claims that existing Technical Publications does not carry metadata to enable life cycle management information. Most of the time especially regarding a specific defense company, Maintenance Plans are in the Word format, Manuals and Illustrated Parts Catalogues are in the form of PDF, training documents are brought in Flash or PowerPoint form. This is a problem for both revision control and data consistency. S1000D brings life-cycle management of data in the form of the same type for both training materials, manuals and maintenance, training and document plans.

Even if you have a system for those documents contain metadata for the life-cycle management, this information does not reflect the process work-flow for the integrated logistics practices. There should be a relation between processes and logistical metadata of the content. For this lack of application, S1000D ties the technical publication content with the assemblies in a system. Therefore, all of the changes and modifications or related decisions can be followed by technical authors.

Without S1000D, there is no chance to follow the Engineering Change Proposal affects on

technical publications. However, S1000D provides the analysis of a potential effect of any engineering change on all of the system documentation with tracking logistical control numbers which are addressing a specific assembly in the system. If there is no specified Logistical Control Number in the system, the training specialists in the system are aware of the changes after the technical publications have been updated. Training production is generally scheduled after deployment of the system and this will cause serious lag time. However, S1000D keeps both technical data and training material in a same CSDB by managing the relation between those records and the assemblies and configurations of the system.

As a deduction, the mentioned guideline insists that S1000D addresses those defined problems by implementing a fundamental concept: data interoperability enabled by data standardization. S1000D is accepted as the beneficial solution form technical publication preparation and management process. The features which make this specification bringing advantage to the organizations are:

- The specification is internationally accepted and has a developing life-cycle.
- Various type of media deliver (data output) is supported by the specification from a single different type of source which prevents inconsistencies between different outputs.
- Facilitating the reuse of data provides cost savings
- With the existence of common source database, configuring data and management is functional.
- Considering the overall life-cycle of the technical publications, maintenance costs of the information decreases
- With the help of modular approach, information is recorded as sub parts of content in order to meet the specific user needs.
- Data exchange and technical publication transformation as an electronic output from one system to another becomes practical between different organizations, sub-contractors and collaborators.
- The Data Module concept of the specification can also be implemented to legacy data.
- Not being a proprietary type of specification, S1000D provides neutral delivery and data management.
- Data storage of the publications supports electronic format while the output can be in both paper, XML or web based technologies like IETPs and IETMs. This depends on the customer requirements.
- In a specific project, *How S1000D Works?* (2012) states that S1000D specification brings a standard way to enable communication and data exchange between all of the contributors.
- Data Exchange structure of the specification provides future developments of the same DM within the same project or related with other one.
- S1000D rules Simplified English as an obligatory which brings consistency in all of the content developed in the project.

In a specific defense company mentioned in this study, there are existing processes and mechanisms to create technical documentation by integrating different divisions and departments to provide sources, controls, standards and templates for the customer documentation. During this process, Figure 2.10 reflects that the existing mechanism works as creating the technical manuals and training documents and requirements are the separate processes conveyed by the same people or different ones in the team as an independent process. Moreover, there are same contents on those two processes and joint procedure defined both in technical manuals and training materials. Most of the time, maintenance and operational contents have similar parts and procedures on different documents. This existing approach defends the rework and duplications during the creation of those different types of materials and does not have any managerial and revision information except for the content in the process.

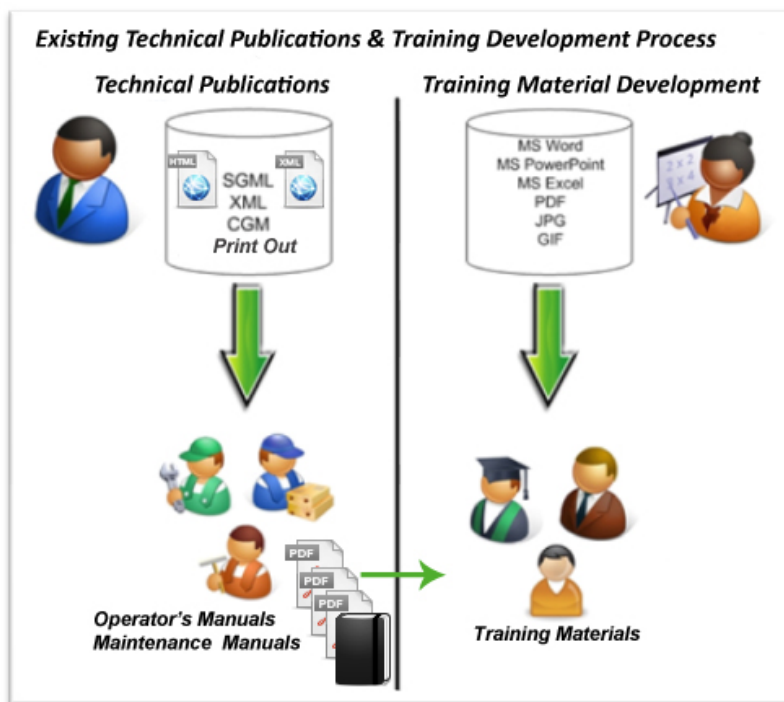


Figure 2.10: Existing Process

On the other hand, S1000D dependent process shows in the Figure 2.11 that all of the related material about the specific project/system is stored as small units and with a managerial approach by the responsible members in the team. Whenever there is a creation of any type of document, the small units come together and form a relevant content with the help of describing one item at once and use it whenever needed. This approach prevents duplication and modification requirements of all of the same data in different documents. When there is a change or modification, there is only one item to update and use the updated one where it was referred.

With the help of this new S1000D approach, data management on technical publication creation process becomes earlier and meaningful when regarding both multi-organizational projects and companies which are producing a similar type of systems.



Figure 2.11: S1000D Process

2.6 Challenges

In a multi-organizational large scale projects, S1000D dependent Technical Publication creation process is accepted by the authorities to be challenging. In a presentation about Business Rules- essential step towards a successful S1000D implementation by Ichizli-Bartels (2008) indicated that even if there is standardization about how all of the documentation is stored, used and created, it is hard to collect from the contractors and sub contractors and combine design documents, logistic support analysis records, maintenance plans and related documents, configuration management documents and manage the throughout an infrastructure. S1000D requires a fundamental change in the traditional process of developing information. There need to be some documentation support in order to pass those challenging issues:

- Style guide document which defines the authors and publication rules can be a support for contributors in the project. This document is generally written at organization/department level but can also be at National Military Organization level.
- Guidance document which defines project business rules and prepared at project level. This document describes the File Names, Quality Assurance related information, SNS and Information sets that the specification is not clearly defined.

With the update of S1000D Issue 4.0, definition of business Rules and Business Rules Categories and BR-Layer Concept is defined in order to guide the users for this challenging implementations.

Most important key point of the specification is Business Rules which is hard to pre-realize the requirements and create them by the authorized people in the team and also challenging to obey those rules for the authoring and controlling team. Therefore, at this position a Business Rules Checker mechanism can be developed. Considering the customer's Requirements Specification and Business rules documents, we need to suggest them to structure their BR's in the S1000D Chapter format which will prevent the confusion. In order to eliminate another challenge, at the very beginning of the project, arranging a practice exchange using a Data dispatch Note (DDN) and selected XML and CGM files will enable to see if there is any irrelevancy in the BR or in the implementation. In addition making sure of the DM import and export to the CSDB will also prevent an incorrect implementation and a problem later. During the data exchange, file name conventions, delivering data in a correct form and final manual adjustments need to be tested to be sure about the flow of your business rules.

Regarding the article *Understanding S1000D Business Rules!* (2010), there are three common mistakes that organizations are implementing S1000D and developing the business rules during the process; lack of giving prioritization to Business Rules development, not appropriately focusing on BR development activity and uncertainty about S1000D Business Rules project team compromise on the specification.

The article also analyzes why S1000D Business Rules Projects fail in detail and argues that the organizations are not assigning reasonable amount of staff and time to the Business Rules development activity and they are regarding this schedule without daily or weekly concern. They mostly dedicate people who are already working on a customer documentation and expect them to create Business Rules during their break of the routines. Therefore, key members in the team cannot give all of their attention to this important activity and this situation results in an inconsistent data and missed deadlines.

In addition; Business Rules creation process also requires a pro-active approach by all of the team members to focus on the project and giving a high priority, otherwise the focus and the momentum of the project can be lost, so long periods and inactive time spent can be cause to the need of preparation and rework which are already covered before, when there will be a meeting or active working time.

When considering the Business Rules development process in the specification, most of the time organization or managers can be fall in to a mistake to think that this process can be done during a few weeks. However, the items need to be decided during this creation process is defined, most of the time the decision on a single specific item may spent e few weeks because team members may not agree on an item or some pre-work is required to clarify the rule especially in conversion or exchange related items. Some rules can be left as open item or defined later, but this implementation may bring rework about the undefined rules considering sub-contractors and inter-organizational structures who does not have any information about the rule and behave just the opposite. Therefore the article suggests that the average amount of time required to develop S1000D Business Rules should be between 4-8 months regarding the activities specific to your project. S1000D familiarity is also critical for the team members as defining the first milestone rules by preventing the redundant time spent.

The last unclarified issue about the S1000D specification is that in most of the organizations, BR Project teams consider that S1000D is just a guidance or publishing style document and they take in to this specification after the existing production process to create the documentation. Whereas this implementation may be objectionable because S1000D requires a radical

change which affects the rooted existing processes of the organization by requiring a considerable budget to settle down the infrastructure that the project managers even not estimated at the beginning of the project.

As an advice for the organizations; Jeff Deskins, Manager of Consultancy, *Understanding S1000D Business Rules!* (2010) stated that Business Rules project team need to be read and internalize the specification before beginning to create the rules. Especially in critical and inter-organizational projects or first experiences, it will be better to get consultancy from industry experts who are familiar with the similar systems or platforms you are about to create. S1000D specification especially the Business Rules component is one of the key feature which should not been underestimated.

CHAPTER 3

METHODOLOGY OF THE THESIS - CASE STUDY

Chapter 3 explains our research approach, case study methodology, qualitative data collection and data analysis process from which we benefited during this thesis study deeply. Data was collected by semi-structured interviews with the experienced participants from a specific S1000D dependent Technical Publication creation project.

3.1 Approach

At the beginning of our thesis study, we searched for an implementation of S1000D specification especially in Turkey and tried to find out academic or industrial publications about S1000D. Unfortunately there is not any academic publication related with this specification. Also there are limited industrial implementations in Turkey. Considering the international studies, there are some guidelines, academical journals and industrial white papers. Therefore, this thesis study aims to reflect and improve the situation for a specific defense company in Turkey where only two projects are implementing this specification into their technical publication creation process.

Therefore, we tried to get in to contact with the people from Aerospace and Defense Industry in order to share their experiences about this project. In this process, the researcher's manager (from a specific defense company) has supported the study via communicating with the people involved in the S1000D project and talked with their managers in order to facilitate them to participate into researcher's semi-structured interviews.

Currently, S1000D based technical publication obligation is only for a collaboration project between an aerospace company, a defense company and an international helicopter company. Only the international company has a previous experience about S1000D. When we reached those people from the S1000D based working team, we comprehended that those people are assigned to different levels of roles at the project according to their positions in their company. In addition, there are some sub-contractors contributing in this project from all partners. As authorities are not approving to share those contributors name due to the privacy policies, we will call out them with definitions described below:

- Aerospace Company in Turkey (Main Contractor in Turkey) will be mentioned as Organization 1,
- Defense Company in Turkey (Collaborative Partner) will be mentioned as Organization

2,

- International Helicopter Company (International Partner) will be mentioned as Organization 3,

In addition, there are some subcontractors working with both Aerospace Company in Turkey (Organization 1) and Defense Company in Turkey (Organization 2) also has different groups in the same company working as a subcontractor. During the analysis in Chapter 4, we will indicate those companies by using their Organization numbers that we defined and mentioned about the subcontractors via organizational definitions.

We conducted a single case study in order to get data from experienced users in a sample project and figure out the gaps, positive and negative implementation experiences and the relations between both organizations and internal divisions in the companies. This single case study is very critical regarding this thesis study because this know-how transfer is very valuable especially there is no other experience in Turkey about military domain. I want to give some information about what is a case study and the benefits of case studies while defining a new process utilizing a common specification in a worldwide perspective.

3.1.1 What is Single Case Study?

Case Study is an ongoing approach which has been used for researches for a long time. In order to collect qualitative data and conduct analysis methodologies, case study approach of qualitative research suited our conditions. (As we have a case to get benefited from.) This study is trying to draw a work flow about a specification oriented approach, Merriam (1998) stated that case study method of qualitative research is suitable for such study.

Merriam (1998) also stated that in order to comprehend and analyze a situation and its in-depth meaning, you can reach this purpose by a case study design (Cited in Cagiltay (2002)). To collect data, analyze and interpret a sample in terms of start, progress and final phases; we required to get as much experience as we can reach with the purpose of suggesting a process work flow to a previously experienced progress about a very specific domain. In this study, I collected data from seven participants in one case as a project, therefore my method for this research would be a single case study. Rather than collecting data from both military and civil S1000D specification based technical publication creation projects from all over the world, I preferred to use one real life case from Turkey because the aim of this study is to suggest a process work flow to a military oriented project in conjunction with an existing process in a military organization. Therefore, irrelevant data or experiences far from the target industry can rout up the study from the intended target. In addition, cases in Turkey is also very limited. To be a subject of this thesis study, except for our case, there is only one other case which is a civil project that does not reflect the military domain requirements. Due to the fact that we are constrained in a single case in Turkey and other world wide and military irrelevant projects can confuse the aim of the study, we conducted a single case study to analyze.

While creating the semi structured interview questions, we covered the key components and critical issues that might have been a problem or gap during the first phase of the project. When making a research on international sources, there are some articles and sources that states the critical and key issues of implementing S1000D or some case studies in international ones. The sources and the relation with the studies are described below:

- Technical Report from Naval Surface Warfare Center Carderock Division, 2011, Procedures for the Acquisition and Development Of NAVSEA TMs/IETMs in Accordance with International Specification S1000D - This technical report indicated some critical items while implementing S1000D in US. Although Turkey has different standards and mechanisms in terms of technical documentation and our case is not relevant with the naval systems. Apart from this report; we evaluated that the critical issues mentioned in this technical report can also be an issue for our Turkey case, so we took in to consideration about the issues mentioned in this report.
- AIA Product Support Technical Publications Sub-Committee Aerospace Industries Association, Inc., 2008, A Recommendation to the Department of Defense to Adopt the S1000D - the International Specification for Technical Documentation - As there is not such a guidance case in Turkey, I needed to investigate about which concerns are required by US Defense industry to be guided while implementing the specification.
- A Case Study, ONEIL, 2010, S1000D IETP Oshkosh Truck and UK Ministry of Defence - This case study gave information about UK Ministry of Defense oriented standards referring S1000D, XML support for DMs and the major advantages to using such an international standard.
- Course Notes from MEKON, 2010 that I participated at 2011 in London, Introduction to S1000D Training- MEKON Course notes also provided me the main concepts and critical issues about the S1000D specification and with the help of those notes, I benefited from the notes to classify the main items to ask in the semi-structured interviews.
- White paper from HEBCO, 2010, Publishing Aerospace and Defense Content Using the S1000D Specification - This white paper mentions about the Business Rules layers according to the organizational hierarchical rule set between layer 1 to 5. In addition, there is a representation of desired S1000D organization regarding DoD and commercial projects.
- Technical Report, 2011, Procedures for the Acquisition and Development of NAVSEA TMs/IETMs in accordance with International Specification S1000D - This technical report analyzes the S1000D based Technical Manual Development phase in Ship Systems Integration and Design Department in US Naval Surface Warfare Center Carderock Division. We benefited from this report to identify the basic concepts of S1000D and define the critical points while implementing the suggested S1000D work-flow during the TM development.
- Academic Report, 2010, Should S1000D be Required by the Department of Defense? - The purpose of this academic work is to determine whether S1000D, an international specification for technical publications, should be required in Department of Defense (DoD) acquisitions. This report provided us the participants' angle of vision for the mandatory use of S1000D supported by DoD in US. With the help of this study, we will be able to compare and contrast our results in terms of the benefits of S1000D usage with the findings reported by Naval Postgraduate School researchers.

After bringing those issues together as a critical components in S1000D and trying to generate some questions, I requested one of the employees in my company who worked on this mentioned project to pass through the questions together. During this meeting, I realized some of the other issues, gaps, critical situations while talking with an experienced colleague and asking him drilling questions in order to get the main points of the process.

By passing over and reviewing the draft questions with one of my colleagues who have experience about S1000D process, we clarified the questions with both considering the industrial and technical resources in the literature and experiences from the true life example. With the help of this experienced user, we decided to add some inquiring questions in order to get eligible and qualitative answers from the target group. After this study, we went through the both personal and domain related questions with my supervisor and shaped the final version.

After-wards, to apply this semi-structured interview to the people working in different departments and companies in aerospace and defense industry, we have to get permission from Ethics Committee from Graduate School of Social Science. After our application to the ethics committee is approved, we conveyed our research with seven people involved in the S1000D based project. Five of them are working for a defense company in Turkey but at different divisions and their responsibilities in the project are different. Two of them are from an aerospace company which is the main contractor of this S1000D dependent project. In addition, we also tried to make the interview with the company originating from abroad, but the main contractor of the project did not found our request appropriate.

The main constraints of this study is that all of the issues related with the project is confidential as this is a military project. If we are working on a civil industry and have a chance to analyze the implementations on civil industry products for example automobiles, there are some companies in Turkey creating S1000D compatible documentation. In addition, there were also a contribution from Turkey to Airbus cargo flight production project and the documentation was created S1000D compliant but as I indicated at Chapter 2, Background Information part of this thesis study, civil and defense business rules structures are very different and their implementations also differ.

We have to take this project as a sample because it is the first and the only one in military industry to conduct a study and get concrete answers. During the industry research, there are so many different industries using S1000D dependent technical publication creation process namely, automobile, truck and various civil equipment producing industries all of which are originated from abroad. Therefore, the technical documentation processes of those industries are completed during the production life cycle, regarding their sales in Turkey, they just translate their documentation and serve to the regional markets as in this situation.

Due to the confidentiality issues and the nature of defense industry; defining any project name, company name and giving real life examples in the thesis study is impossible. Therefore, we tried to generalize the definitions about both projects and related companies. Our resource project is also have a critical mission for Turkish Armed Forces, so the companies avoid helping my study about the problems they had between them, internal and intra-organizational issues they experienced. In addition, there is no intermediate stage as a team in Undersecretariat for Defense Industry organization between companies and the customers about this S1000D related issues, we could not get accurate information about the inter-organizational related issues and customers side. Therefore, we are limited to the interview conversations in terms of gaps, critical issues and the problems experienced.

As suggestions to the future researchers about S1000D dependent Technical Publication creation process, this kind of information collection study is better to convey with the people from all of the contributors in a project with the inclusion of customer, sub-contractor, main contractor and international partner.

3.2 Interview with the experienced users about S1000D

INTERVIEW FORM: This interview aims to collect your experiences about S1000D implementation process in a project you contributed depending on the questions below. Please do not give your name during this Interview. Your personal information, the project name and features that you may mention in the following questions will remain confidential.

- What is your Position/ responsibility in your company?
- How long have you been working in this company? / Industry experience?
- What is your age and educational status?
- What was your role and responsibility while working on S1000D specification based Technical Manual Creation?

Table 3.1 shows the summary of participants' personal information about their professional career.

Table 3.1: Summary of Participants' Professional Career Information

Part. No	Position/ Title	Company and Professional experience?	Age and Educational status?	Responsibility on S1000D
1	Technical Publications and Training Chief Engineer	15 Years / 20 Years	42, Graduate	Coordination with the project partners, Super User
2	Technical Publications and Training Senior Expert Engineer	14 Years / 14 Years	40, Undergraduate	Admin/ Reviewer
3	LSA Engineer	2 Years / 2 Years	27, Undergraduate	Author
4	Technical Publications and Training Senior Expert Engineer	12 Years / 12 Years	36, Undergraduate	Author
5	Engineer	4 Years / 4 Years	28, Undergraduate	Admin/ Reviewer
6	Assistant LSA Engineer	2 Years / 2 Years	26, Undergraduate	Author
7	LSA Leader	5 Years / 8 Years	32, Undergraduate	Super User, Project Manager

CHAPTER 4

S1000D IMPLEMENTATIONS AND RESULTS

In chapter 4, results of S1000D Case Study is presented. This is a single case study which is the only military based technical publication creation project having a completed phase. By conducting semi-structured interviews; we asked critical points, gaps and experiences of the participants.

Regarding the answers and thoughts taken from the participants for each interview question, we combined their opinions according to 3 main categories in terms of administrative, business rules and technical issues. When we reviewed all of the answers roughly, the mentioned issues, gaps, critical points and problems are whether about administrative, technical domain or related with business rules which is a specific process for S1000D.

In this analysis, we tried to figure out the findings about critical points, gaps, conflicts and other potential issues during the experienced process which may affect our work flow definition regarding the needs in a defense company. Therefore, we combined those answers to 3 main category in order to get benefit from during the process definition phase in Chapter 5.

4.1 Interview Questions and Answers

IQ 1. Considering the S1000D specification-based technical publications production Project; before the project, how did you define a process work flow? Can you share what you did as a preliminary study? Did you take any training? Did you give any? What about time, place and the participants of the training?

With this question, we tried to figure out whether the trainings and pre-studies are sufficient and qualified, or not. We also tried to differentiate the training types and variations by collecting information from the participants. During the initial phase of the projects; trainings are taken by the team members regarding their roles. Therefore, we asked participants for quality, adequacy of the training and preliminary study, then group their answers according to Administrative, Technical and Business Rules issues and according to the super user, admin and author roles of the team members.

As a preliminary study, they created a list of documents in accordance with the level of maintenance which was required in the project contract. They discussed how to do the business

with companies and involved in the project decision-making. Then the decision about the software and its installation process occurred. Those are very similar to begin any logistical support - technical documentation creation phase of a project. On the other hand, this single case study also has a training preparation phase.

According to the specific needs of S1000D, the team members required to join some training and business rules preparation work. Super user role of the participants had joined Business Rules preparation training, S1000D and independent software training and project specific software on the job trainings. Trainings were very comprehensive regarding the super users' needs regarding their opinions. Admin users also participated S1000D and independent software training and project specific software on the job trainings. They did not participated Business Rules preparation work. While author from Subcontractor (Organization 2) and author (Organization 1) just joined 3 days orientation training, another author working as a subcontractor had joined admin level trainings. While implementation of the project, planned resource in terms of personnel was changed because two team members in the project who had joined super user level trainings had promoted to managerial level and did not contributed to the project because of their concentrated workload. Therefore, the members who planned to work as in an author role whose admin level will be those 2 members, had to work also as an admin role which brought an unexpected work load for those users. Detailed information from the participants' opinions is given in the Table 4.1 and the summary of the findings for this question are stated below:

Table 4.1: Participants' Training Information

Administrative Issues	Super Users and Admin users joined to a project specific on the job training for 4 weeks. Authors joined to an orientation training about the project.
Business Rules Issues	Super Users joined to a business rules definition workshop. Admin Users joined to a Business Rules training whereas two of the Authors did not participate any stage of Business Rules Definition.
Technical Issues	Super Users and Admin users joined to an independent S1000D software training for 1 week. Authors joined to a S1000D software training for 3 days. One of the authors (from the subcontractor division of Organization 2) evaluated this training phase as: <i>We participated approximately 1 month training in Italy...for the technical illustrations, the technicians could not be able to participate the trainings, so we provided the required training to them.</i>

Inferences:

All of the author group of users did not take the same training, while two of them joined S1000D orientation training, one of them participated a platform, S1000D on the job and software training and business rules training. This brings inconsistency and authors trainings are not comprehensive enough in terms of business rules and administrative issues.

Suggestions:

- All of the participants from all of the roles need to be informed about the Business

Rules, how to follow those rules and get the updated rules during the process, this was a drawback about the trainings.

- Super Users, Admin users and one of the Author user had participated BR workshop. But BR description training does not arranged for the author and technician groups. All of the roles need to take the relevant training before the project. Author and lower level team members need to be informed about the BR definitions related with their jobs.
- In spite of the fact that team members may have lack of technical knowledge about XML/SGML or software used for S1000D dependent TM creation, those requirements should be detected and eliminated by training supports or role replacements before the project.

IQ 2. As an inter-organizational S1000D dependent project, what are your thoughts about the process, are there any problems and the challenges during the integration? How can you define a solution if there is an inter-organizational conflict?

As this case has an inter-organizational formation, we tried to address the conflicts and challenges between organizations in the project. Therefore, we directed this questions to the participants. Subcontractor Author group did not experience any integration situation, so they are not aware of the integration challenges. On the other hand, super user and admin group took part in integration process as expected; they had challenges with the Data Module Coding mechanism and as a major challenge during the integration, super users and admin group agreed on not defining the whole project life-cycle management process according to S1000D.

Super User (Organization 2) summarized the process as: deciding on approved document list, obtaining CAD data, ATA numbering, preparing DMRL, Content creation and DM approval and delivery. In this process they had problems with equipment changes and numbering standardization. Detailed opinions are mentioned in the Table 4.2 depending on 3 main categories that we indicated and the findings are located below.

Table 4.2: Problems and Challenges during Integration and Inter-Organizational Conflicts

Administrative Issues	Super Users stated that incompatibility on data module numbering, data flow deficiency from the design, disharmony of current processes with S1000D are the challenges. Admin users indicated that lack of experience and lack of well defined business work flow can be diagnosed as problems.
Business Rules Issues	Super Users explained that problems(inconsistency) in ATA numbering defined in BR between organizations as a conflict. Author from subcontractor of Organization 2 said, S1000D assumes that every required item in process work flow is ready. It does not allow manual addition and forces to obtain items according to that assumption.

<p>Technical Issues</p>	<p>Super Users specifies that the change in equipments during the design process created extra work load.</p> <p>Admin users (Organization2) defined that lack of experience because of being the first project in Turkey and inadequate definitions during the processes cause problems and challenges in this project. In addition, the related software we are using is also new and nobody had experienced before, so our IT department cannot manage this software configuration issues, the consultant company has the responsibility and this made us dependent to that company in terms of both tangible and intangible issues. We could not solve our problems internally, this caused to loose time during the process.</p> <p>Authors indicated that they had problems about not accessing the models of the equipments in the system and system design documents are not very qualified. In addition, in most cases system documentation is not sufficient and the products obtained as pre-made may have no models or required documentation with itself. On the other hand, S1000D assumes that all of the required material is ready to use, so we had problems about with the restrictions of the specification while trying to attempt manually insertions.</p>
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Inferences:

DMC numbering was a challenge during the integration. Equipment changes during the progress is also a challenge to regenerate the related Data Module. As a technical issue, S1000D dependent software support from an outsource consultation company brought challenges while there is a problem inside the company. Solution process lasted longer than expected. Procuring 3D Model files from design departments or system design definition documents' being inadequate caused problems while preparing Data Modules. In S1000D; Design, system integration and production departments need to be work parallel with each other. However in real life implementation, this ideal case is challenging to occur.

Suggestions:

- Working in collaboration with design department need to be provided to obtain complete and workable models. Therefore, processes should be defined and working principle documents need to be updated regarding S1000D requirements in both design and customer documentation management.
- Consultant company dealing with both about technical issues and software or BR consultants need to assign an employee to be trained about these supporting issues.
- ATA numbering and DMC strategy should be defined and shared with each of the team members with BR trainings at the beginning. A platform can also be beneficial to announce updates etc.
- Periodic meetings about BR need to be organized in order to share detailed definitions about existing items or new required BR.

IQ 3.What are the Challenges, Critical Issues and Experiences during the implementation and adaptation of S1000D Specification in a Defense Company depending on your experiences in the S1000D contractual obligation project ?

The main point of this question is time loss because of the project's being the first experience that all of the participants agreed on this critical point. Especially, Super User (Organization 2) stated that the decided numbering system in Business Rules are not fully implemented. Subcontractors are inclined to deviate from the decided DMC numbering style. The contributors used their own numbering strategy in some cases, so during the integration this brings a challenge and a new work load. The adaptation for Author group is also took some time to became familiar with the structure of S1000D. Detailed information about the participants' answers are categorized and given in the Table 4.3 and the findings are stated below.

Table 4.3: Challenges, Critical Issues and Experiences during the implementation and adaptation of S1000D

Administrative Issues	Super Users accepted that deviations from the decided numbering standards and engineering changes when creating the documentation somehow caused problems in defense company side. Design changes and additions of equipments or removals made us confuse about the specification because we did not have any experience before. Super User (Organization 1) stated that with the help of Engineering Review Board, minor problems and challenges or instabilities skipped ahead. Authors stated that incompatibility on configuration and numbering between firms/parts created challenges.
Business Rules Issues	Super Users indicated that DM Code numbering is very critical at the beginning between the organizations, Problems with this standard numbering system may cause serious problems in the ongoing process. Admin Users stated that adopting to this new implementation and process needed some time and due to the lack of experience, while implementing DM contents and BR documentation, there are some errors occurred which caused some loss of workforce. All of the participants claimed that they did not have any internal conflict during the process.
Technical Issues	Authors claimed that new software and database infrastructure, constraints of this software and the specification brought some problems to them. There are no defined process work flow or if any, it did not reflected to us. Admin User (Organization 2) quoted that <i>...being the first S1000D dependent project in our organization, we had lack of experience. Because of this deficiencies and mistakes while applying BR document and DM contents, we had some loss of labor.</i> Depending on the consultant company, in terms of all of the issues they experienced is also exhausted and there are no routine meetings or rules defined between organizations and departments. In some cases, because of this disconnection, they lost some labor. With the help of engineering studies, problems and challenges are disappeared.

Inferences:

Equipment changes, additions and deletions in terms of design environment should be con-

sidered. DM Content structures and comprehending Business Rules document is critical at the beginning since loss of workforce. Defining a detailed process, shaping the work flow and announcing all about this strategy to all of the team members is also very important because S1000D has some limitations because of using a common source database and a DM management system, therefore all of the infrastructure should be reviewed before to adopt the specification. Required changes need to be done.

Suggestions:

- Mechanisms similar as ERB need to be provided to both contributors which includes all of the changes and updates in all contributors' side. SNS should be clarified in detail at the business rule definition phase and tailoring/matching between companies need to be tried on small units before the main integration.
- They would not have any departmental level intra-organizational conflict, but the answers are indicating that there are some gaps between departments. This also means that relevant understanding about the use of specification need to be provided inside the company.

IQ 3.1 Are there any intra-organizational conflicts during the integrations? Do you have any process work flow defined to solve those conflicts?

While Organization 1 used Engineering Review Board for the intra-organizational conflicts, Organization 2 had no mechanism similar to this board. One of the Authors from Subcontractor (Organization 2) defined this situation as; since they are not accredited to decide on any conflict, they are in subjection to Organization 2 to solve their problems and proceed in the project. This situation causes time losses and re-work in some cases. On the other hand, if all of the detailed decisions were figured out during the Business Rules phase and shared with all of the contributors not in theory but in practices in the project, those impediments could be avoided from the beginning. Participants' opinions are stated in the Table 4.4 in terms of administrative, technical and Business Rules issues point of view.

Table 4.4: Intra-organizational Conflicts and Solution Work-flow

Administrative Issues	<p>Super User (Organization 1) stated that the work flow on such (disagreement and conflicting) cases were missing. Therefore an Engineering Review Board meeting is scheduled to solve such cases with the goal of project success.</p> <p>Super User (Organization 2), on the other hand, stated that <i>...there is not any work flow defined for this case, but sharing the same purpose, the maximum performance to target for the sake of the success of the project took place.</i></p> <p>Authors indicated that missing of work flow for solving disagreement and conflicting cases made us dependent to the main contractor (Defense Industry side) on all subjects. They were also responsible from development of some Data Modules throughout the process, so some communication problems and delays are faced.</p>
Business Rules Issues	<p>All of the Super User and Admin groups stated that they did not live any problem or conflict as intra-organizational level in terms of Business Rules. On the other hand, authors stated about this issue that <i>... we had no Business Rules defined or process work flow to follow when needed, so they are very dependent to a specific division in the defense company. Because of the workload, this division both had to give support to us and also required to complete their own DMs at the same time.</i></p>
Technical Issues	<p>One of the Authors (Organization 1) stated that such cases are solved with some additional engineering studies, while others indicated that they do not know any work flow or conflict situations during the project.</p>

Inferences:

Organization 1 and 2 has different approaches and mechanisms for intra-organizational conflicts which are not communicating with each other. Whereas this kind of partner organizations is better to share the experienced conflicts in order to record them for the future potential projects and help one another to avoid the same conflict or problem to occur for the success of the project. Engineering Review Board is recording the updated changes to announce all of the related departments about the new situation, but the work flow or process related experiences were not recorded to help the coming personnel or the future projects. Process related conflicts, problems or suggested ways also need to be kept in record to benefit from later.

Suggestions:

- Irrelevant sharing mechanisms between companies need to be minimized in terms of Engineering Review Board (ERB).
- Business Rules need to be transferred to all of the subcontractors even if they are inside the company as different divisions. This will decrease the control periods of the DMs by the main contractor and will prevent re-work which may be needed when subcontractors did not informed about the details of BRs.

IQ 3.2 Regarding the trainings, coding standard conflicts or organizational hierarchy, is there any disagreement happened? How did you solve?

Super User participants accepted that there were disagreements happened. Some of the team members who had taken a comprehensive training could not work for the project later. Their colleagues need to load up the two roles' responsibilities. Participants' thoughts are indicated in the Table 4.5 and findings inference from the answers are stated below.

Table 4.5: Disagreements and Solutions in terms of Trainings, Coding Standard Conflicts and Organizational Hierarchy

Administrative Issues	<p>Super User (Organization 2) stated that the experienced Data Module Coding conflicts with the main contractor (Organization 1) in this project. Even if they are the main contractor, they did not reflect any coding standard to their partners. In addition, they designed the equipments according to their own standard and than Organization 1 informed them about the coding strategy. Super User (Organization 2) explained their experience as follows:</p> <p><i>During the project, we had numbering problems. The other companies had a tendency of numbering their equipments and DM codes breakdown structures different from the ATA style and informed us about this later. Although BR document is defining this coding style in details, they did not obey the rule, so this caused problem. There were 2 ways to solve this problem;</i></p> <ul style="list-style-type: none"> • we would assign DM codes according to the ATA standards and they will change those codes with their newly defined ones, • we would replace our codes according to their numbering style and send them <p>in this project, both of these methods are used. Authors also pointed out that they had problems about the coding strategy and solved those issues via meetings, but if they had informed before those meetings, they would not use the incorrect DM codes.</p>
Business Rules Issues	<p>Authors (Organization 2) claimed that they are included in the process later and could not have a chance to give feedback at the beginning of the project about both the coding strategy and business rules. Therefore, although there was a Business Rules document shared with us later, it was a very long document and they had a trouble with labor-force to analyze this long document. They tried to find our way by consulting to the main contractor in our project about the operations.</p>
Technical Issues	<p>Super User (Organization 2) stated as a solving to the problem provided in Administrative issues part, the solution can be both changing the coding standard according to the main contractors specifications or sending the Data Modules to the main contractor as they are, and the main contractor can turn them in to their coding strategy. In this project both 2 techniques is implemented.</p> <p>In addition, author (subcontractor of Organization 2) defined as a technical issue that <i>...due to workload; during the delivery periods when all of the users required to use the software, because we are more than the amount of licenses, we needed to use the program in a rotative way.</i></p>

Inferences:

There were coding conflicts and integration problems and irrelevant trainings for author users occurred. When we look at the big picture, there had been serious work overload happened. Although participants did not declare this issue as a reply to this question, we can state that two of the trained team member had to work as a manager because of their promotion and could not have time to meet their responsibilities regarding the project, so their roles need to be covered by the other team members and this lack of trained high level role owner members caused work overload for their team and deficiencies in controls of DMs.

Suggestions:

- Trainings need to be recursively repeated in order to fill the gaps after the first general training phase.
- Team member replacements and separations need to be get in to consideration during the project in terms of work load. Precautions should be planned at the beginning for this situations.
- There might be training needs at later stages or on the job implementations need to be organized to cover the updated business rules or high level decisions need to be transferred to the author group in order to provide consistent working strategy and prevent labor loss.
- Subcontractors or different divisions in the same company may not have any information about the experienced challenges. There need to be a intra-organizational platform for the problems and the solutions where the suggestions for the problems can be discussed or shared.

IQ 4. What are the related Inter-organizational Issues regarding the subcontractors and contributors during the project integration and data exchange process? Is there any defective and inadequate issue during the project?

In order to get the opinions of the participants, we firstly directed the 4th question to draw a general concept about inter-organizational running mechanism. With the help of probing questions under this one, participants indicated the specified situations under this general inter-organizational relation based question. Therefore, the opinions of the participants are stated under the probing questions by analysis of categorization in terms of administrative, technical and business case issues.

IQ 4.1 Because of being an inter organizational and international S1000D based project, what are the problems and conflicts you experienced with the other contributors? How did you solve them? Is there any pre-defined process for those conflicts?

Regarding multi-contributed projects, integration issue is always an handicap for the process. In most cases those potential integration problems are predicted at the beginning and tried to be avoid by describing a process to handle them. Participants indicated that they had problems with the integration because both lack of a process definition about the integration problems

and not detailing the contractual issues, business specifications in Business rules document. Therefore sub contractors who did not have any responsibility for integration did not aware of the solution process also. Organization 1 and 2 had business meetings to solve this problems. In spite of arranging meetings during the process when having a problem, organizations would be better to assume that there would be a problem while integration phase and define a process to solve this at the beginning. In this case, we collected the experiences of the participants about this integration case in this process and categorized the answers according to the administrative, technical and business case issues extent in Table 4.6.

Table 4.6: Inter-organizational Issues regarding the subcontractors and contributors during the project integration and data exchange process

Administrative Issues	<p>Super Users stated that there are so many equipments from various organizations and companies in the project, so the business share is mixed together within the contractors. This caused to create nested procedures for both operational, maintenance and trouble shooting processes between organizations. Meetings with both international contractors and inter-organizations in Turkey are done till the beginning and going on to solve those process related problems for the coming phases.</p> <p>One of the authors from a sub-contractor division in Organization 1 claimed that if there is a process defined for Data Module exchange and review operations, their department was not aware of this process. They also added that they know the main contractor has a plan for the project, but we are not informed about the process.</p>
Business Rules Issues	<p>Super User (Organization 1) stated that...<i>by not exactly implementing the data exchange procedures described in Business Rules (BREX), some problems occurred and via workshops and business meetings, inter-company solutions are founded. These pathways described previously in certain areas and were defined by the contract and job description, but more elaborate problems are disabled via double-triple negotiations.</i></p> <p>Author (Organization 1), on the other hand defined that they had problems with system breakdown structures. During the process, organizations realized this problem, came together and agreed on a common breakdown structure. It would be better if they did this agreement at the beginning. Another author (subcontractor of Organization 2) defined as ...<i>if there is a process work flow about the review, we don't know this rule. We sent the DMs that we prepared and Organization 1 reply back to us about their opinions and required changes. We communicated through Organization 2 during the whole process.</i></p>

<p>Technical Issues</p>	<p>One of the admin users denoted that as they do not have any responsibility about the integration, they did not been experienced about the issue. Author (subcontractor of Organization 2) explained that <i>...because I am an author, whether there exist problems, or not between the contributor companies are not reflected to me.</i></p> <p>Other admin user stated that not clarifying a professional process at the beginning about Data Modules caused updates and labor force loss. Defense company in this project was not responsible for the integration, so they did not experience intra- organizational conflicts, but the main contractor from Turkey has this responsibility. Therefore due to the problems during the integration, such data required to be pulled from the database system again.</p>
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Inferences:

In this case, integration process is challenging because it is the first project and team members are inexperienced about what to do. In addition, there were some irrelevancies between organizations due to the communication gaps.

Suggestions:

- System breakdown structure need to be defined considering all of the configurations and announced to all of the team members in different roles. This brings increasing the control mechanism.
- Data exchange procedure need to be described in BR document at the beginning and should be implemented in a pilot DM for figuring out the challenges at the beginning.

IQ 5. Are there any lessons learned mechanism generated during/after the project?

Especially in first time projects, lessons learned mechanism is critical for the future developments. Participants approved that there is no lessons learned mechanism for this first phase. As one of the Super User (Organization 1) stated that they are planning to define a lessons learned mechanism at the end of the project, but it is not beneficial for the ongoing project. The participants have inconsistencies about their answers because Admin user (Organization 2) indicated that they have a lessons learned mechanism created in the database. They are following the experiences via this mechanism. This situation shows that one of the contributors had stated a lessons learned mechanism while others and the sub-contractors did not have any idea about this situation. Therefore, this system only collects the experiences and lessons learned from only Organization 2. In addition, only team members from organization 2 can access this information. Due to this disconnection, contributor organizations may have the same mistake and make a time and labor loss because of not knowing about this mechanism. Participants' answers are categorized in 3 main domains and given in the Table 4.7 and the findings are stated below.

Table 4.7: Lessons learned mechanism generated during/after the project

Administrative Issues	<p>Super User (Organization 2) indicated that they did not have any mechanism during the whole process, but they have a high level of information and communication between the team. Necessity information is shared via meetings by taking the records. Super User (Organization 1) stated that <i>...the first phase is finished and this Lessons Learned mechanism is planning to be implemented in ongoing phases. Project is still continuing.</i></p> <p>While Super Users did not give a positive reply to this question, One of the admin users (Organization 2) stated that they have a common area where encountered problems are kept in the database. In addition, he added that this is the way to monitor how similar cases can be accessed from the database as an information. The other subcontractor Admin User (Organization 2) said they did not have any mechanism similar as Super Users.</p>
Business Rules Issues	<p>Authors also stated that they did not have any document for lessons learned and if there is, it will be very beneficial and need to be defined in Business Rules for example as a “how to solve a problem” case. One of the authors also stated that it will be planning for the next phases of the project.</p>
Technical Issues	<p>Authors claimed that by encountering problems and errors, lessons learned mechanism was directly generated, but it is not a written document. It is now a know-how that the team members had experienced.</p>

Inferences:

By not defining a lessons learned mechanism at the beginning of the project, know-how loss during the project was occurred and time and labor loss because of challenging with the same problems in different contributors sides. One of the contributors stated a lessons learned system in the database but this is a close-group sharing and caused the real need owners’ cannot benefited from the recorded experiences.

Suggestions:

- Lessons learned mechanism is better to be a contributor’s sharing platform which is improved by the real challenges’ solutions approved by the admin or super user level roles. This platform should also be shared by the sub-contractors and provide them not to live the experienced problems again till the beginning of the project.
- Regarding the opinions of the participants, Lessons learned improvements and decisions should be updated in periodical meetings during the project development process.

IQ 6. Depending on your experiences, how can you define a suggestive S1000D process work flow or critical steps in a defense systems project?

Participants like-minded on Business Rules is the most critical issue in an S1000D project. Project planning, DMRL and customer requirements are also indicated as very important during the process. Detailed information from the participants are grouped in to 3 categories in the Table 4.8 and stated with the findings below.

Table 4.8: Suggestive S1000D process work flow and critical steps in a defense systems project

Administrative Issues	<p>Super User (Organization 2) described that project structure is very critical to decide to use which version of S1000D. In addition he emphasized that Business rules creation, document requirements, DMRL, Data Module creation and delivery should be the process roughly.</p> <p>Author (subcontractor of Organization 2) stated that <i>...based on our experiences, high level usage of S1000D and division of labor should be made professionally. This helps to increase the speed while preparing DMs.</i></p>
Business Rules Issues	<p>About Business Rules issues, Admin users stated that preparing a Business Rules document according to the specific needs of a project will prevent a lot of misunderstandings at the beginning. Despite those rules, if there is also complexities in detail, contributors should come to gather immediately and set a rule for that complexity in a practice.</p> <p>Authors who are mostly affected from the use of Business Rules defined that <i>...everything was well-defined in theory by assuming that information or knowledge already exists to use, but actually we're having problems to collect resources and S1000D does not have any flexibility or work flow for this process is included in the specification.</i></p>
Technical Issues	<p>Super User (Organization 1) indicated that engineering interfaces, customer requirements and technological applications are very critical to manage an S1000D dependent project.</p> <p>Authors claimed that S1000D seems to have planned and defined a lot of things in theory, but Simplified English obligation is very exhausting. Defining only one word can be beneficial for multi-national projects but in practice, it causes waste of time.</p>

Inferences:

Since author group of the participants did not have any reasonable reply to this question because they are not informed about any process or they did not have any operational critics because of not being aware of the Business Rules defined at the beginning of the project. They thought that all of the deficiencies are because of the limitations of the specification, but in some cases they are because of the lack of detailed business rules definition.

Suggestions:

- S1000D issue need to be selected according to the requirements and the foresight about the project by the managerial level.
- Theoretical business rules need to be practically experienced at the beginning in pilot implementations to see if it is working, or not.
- Reaching the resources that S1000D requires in the project should also be defined as a process and related departments/companies need to agree on that process.
- Engineering interfaces, customer requirements and technological applications are critical and need to be defined in detail as a rule in BR document which will be shared and agreed with all of the contributors.

IQ 7. Do you have any other opinions about the critical issues stated in S1000D which are listed below? In what extent did you consider those issues during your project life-cycle in terms of Technical Publication creation?

With the help of this question, we tried to motivate participants to think about the different aspects of the process they experienced by asking the probing sub-questions stated below.

IQ 7.1 Content development in Technical Manuals (TMs) usually starts prior to the final release of engineering documents. Do you have problem like that? How did you solve?

During the interview, participants generally complained about the changing equipments and model files during the process. In order to figure out their preferred solutions or implementation to this problem, we asked for their experiences. They mostly preferred to begin with the pre-work directly unrelated to the model file which has a potential to change. The other strategy is working in parallel with the design department to track the required incomplete models to use them after completed. Participants have different experiences about this challenge which are stated in the Table 4.9 with the findings below.

Table 4.9: Content development in Technical Manuals (TMs) starting prior to the final release of engineering documents

Administrative Issues	<p>Super User (Organization 2) stated that it may be not appropriate to begin creating technical publications before the project reaches a certain maturity level. Beginning with database design, visual library etc. are suitable to begin with.</p> <p>Super User (Organization 1) added that similar to engineering documents, technical publications are living documents which need to be updated during the time spent.</p> <p>Admin users defined that by tracking the unterminated documents and working in collaboration with design and production departments, this issue can be controlled.</p>
Business Rules Issues	<p>Admin user (Organization 2) stated that <i>...we did not have any problem about this issue because the equipments we are responsible for are created before for some other projects and the documentation is mostly available.</i> Therefore they did not have to wait for any information to be created and documented.</p> <p>The other admin user (Organization 2) indicated even if they do not have such a case, but it can be very troublesome to work parallel with production process.</p>
Technical Issues	<p>While two of the authors from both Organizations 1 and 2 stated not having any problem about this case, one of the Author (Organization 1) described as a problem that Data Module updates and information tracking requires more labor.</p>

Inferences:

Authors (Organization 2) are working manually on DMs and directed by the admin level users, so they did not have any responsibility to track engineering documents. Organization 1 had worked in the same database with the design department of the same organization. There-

fore most of the model files or the information documents about the equipments had already located in the database. They had the ability to create DMs throughout the same database with the designed models and if there is a change or update, the database had warned the author of the publication about this change. On the other hand, Organization 2 had lots of subcontractors who cannot access the database, so they need to follow the revision updates and manually apply the changes to the documents. At this case, rework is required and at each time, design information need to be transfer to technical publication process.

Suggestions:

- Database system need to cover all of the contributors to prevent manual work. Due to privacy issues, this sharing can be settled by depending on a procedure.
- Before creating the main content, engineering documents and the infrastructure need to be accomplished and ready for accurate work.
- All of the documents related with the system need to be tracked throughout a revision based PLM.

IQ 7.2 Data Modules can be added or removed in the process. Did you experience such a process?

All of the participants answered that during the process, DMs were added, changed and removed. In addition, the Table 4.10 shows the specific answers according to both the roles of the participants and the classifying the answers in terms of Administrative, Technical or Business rules categories.

Table 4.10: Data Module Addition and Removal

Administrative Issues	Super Users defined that due to the nature of S1000D, DMs can be added or removed. We also made a lot of correction, addition and removal during the process.
Business Rules Issues	Super User (Organization 1) stated that relying on the configuration changes, additions and removals were done in terms of Data Modules.
Technical Issues	Authors replied this question similarly as other roles. One of the authors (Organization 2) indicated about this issue: <i>...putting up an existing item is easy but adding something new is difficult because the software requires to define everything in detail in order not to miss out something. Therefore all of the content and visuals in a Data Module is creating via assigning a code. When you're creating something new, you should control each item not to duplicate or give the same code with a previous one. It is tiring to ensure this process.</i>

Inferences:

As S1000D based technical publication creation process covers a life cycle management of a manual, data module addition, removal and modification is normal and inevitable.

Suggestion:

- The important point is that defining a suitable numbering and management strategy for Data Modules in order to be flexible for this kind of changes.

IQ 7.3 Content has to be evolved to be compliant with Simplified English requirements of S1000D. What are your thoughts about this issue?

In order to analyse in what extend, users get benefit from S1000D Simplified Technical English, we directed this question and get their thoughts by combining the answers in 3 categories; Administrative, Business Rules and Technical issues which are indicated in the Table 4.11.

Table 4.11: Simplified English requirements of S1000D

Administrative Issues	Super User (Organization 2) stated that habits of people can take some time to shift the direction to STE and when the system safety is the issue, forcing STE creates annoyance. Authors, on the other hand indicated that STE is necessary and should be used because complex sentences causes ambiguity for the person who will use the document.
Business Rules Issues	Admin user (Organization 2) stated that the potential removal and installation procedures sentence patterns are included in BR document, so they did not live any difficulty on those DMs. However, if the system features etc. are not included in BR sections, it can be difficult to find the right words to express. In addition, she described that <i>If there are so many contractors and sub-contractors in a project similar to this one, in order to provide consistency throughout DMs, this kind of standard is very useful.</i>
Technical Issues	Admin users indicated that STE dependent authoring or translation process took time only at the beginning. Then the author get used to it and use with ease. Authors also accepted that creating content with STE is quite coincide with S1000D usage logic. Only sometimes with STE expression, it is a little difficult to fully reflect the information they wanted to express.

Inferences:

In STE, participants claimed that authoring takes more time. In addition, for the installation and removal procedures, STE is defined in the Business Rules document, but regarding the system features STE is not defined in Business Rules document. Therefore, providing consistency in those parts would be difficult.

Suggestion:

- S1000D is meaningful with STE, therefore in BR creation phase STE terminology for both types of Data Modules are need to be also defined.

IQ 7.4 When traditional data is available, it becomes more of a data migration task than

content authoring task.

All of the users stated that this is a new project and they did not required to migrate data. All of the content is created from the rough, as a new beginning. In addition, Super User (Organization 2) explained as an additional information that, *...if data migration will be done, old data obliged to be transferred to STE as “procedural” or “descriptive” structure. Those are the major challenges.*

Suggestion:

- At the beginning of the Data Module creation, if there is any data migration required need to be defined.

IQ 7.5 Processing of the CAD data for illustration development is mostly troublesome. What about your project?

There are no problems reflected to super users from Organization 1 and 2. On the other hand, subcontractor author from Organization 2 stated that they had problems with the models. According to S1000D, they need to create isometric views, but they have some older explosion view files. Therefore, they could not use the old visuals because of isometric requirements. They formed the visuals from the original solid models again by regarding isometric view. Opinions of the participants are stated in the Table 4.12 and the findings are below.

Table 4.12: CAD data for illustration

Administrative Issues	Super Users stated that if the solid models are available, problems can be minimized as new drawings can be produced in the worst case. Authors indicated that in some cases model files had shortcomings and some models were not updated, so they had problems with model files.
Business Rules Issues	Some of the participants stated that Business Rules for model identification is not sufficient.
Technical Issues	Especially authors said they had problems in finding ready-made items' solid models. Author (Organization 2) stated their experience as: <i>...we are purchasing some of the equipments or components as a package from abroad, so we did not have any chance to take the solid models for these items.</i>

Inferences:

CAD Model requirements need to be defined in the Business Rules in detail in order to give information to all of the contributors and design subcontractors to provide full-functional solid models.

Suggestion:

- Criticality of the CAD models in the project need to be described to the design department. Regarding the rules in S1000D, to provide a full functional CAD models for each component. a checklist can be implemented to the design department to approve the models for Technical Publications.

IQ 7.6 It is critical that the team should be familiar with what are S1000D and SGML/XML structures. How did you select employee? Did they get training about these issues?

There is no employee selection regarding the XML/SGML structures. Required training is provided to the assigned team members to be aware of this issue. Participants' answers are located in the Table 4.13 and the findings are stated below.

Table 4.13: SGML/XML structure training

Administrative Issues	Super User (Organization 2) stated that by providing a training to the currently working users, we've made them using, authoring, illustrating according to the S1000D specification, but this requires a long process. Admin users (Organization 2) claimed there is no such a new recruitment process for an employee have a background about SGML/XML structures, but all of the existing personnel who will be working for the project had participated a training about those issues. Authors indicated that all of the staff responsible for the project had taken a training about what is S1000D and SGML/XML structures.
Business Rules Issues	Participants did not share any information or opinion about Business Rules category.
Technical Issues	Super User (Organization 1) stated that <i>...training had been taken about XML/SGML structures, but it should be considered that there has been lack of well qualified staff in the project process.</i> Admin users stated that lack of training is happened, because the staff working for the project had been responsible for the SGML/XML structures, so they had some difficulties to solve the deficiencies that they are very unfamiliar with. Authors, on the other hand indicated that the previously trained staff had given them a training about XML/SGML structures to the author groups.

Inferences:

Because of assigning the project to the existing workers in any company, SGML/XML based trainings need to be provided because of the structure of S1000D Data Modules.

Suggestion:

- Required training about XML/SGML should be provided for the team members who will work for those issues.

IQ 7.7 Trainings are required for the team members according to their roles in the project. Are you happy with the training you got? Is that suitable for you?

While Super User and Admin level trainings are efficient, authors stated that trainings can be more comprehended. In addition, all of the author users did not take the same training. Because of unexpected situations, some of the participants of the training could not work for the project and some of the team members are joined to the team later. They only took an orientation training and learned to create DMs and authoring via previously trained personnel as indicated in the Table 4.14 below.

Table 4.14: Training for the roles of the project

Administrative Issues	<p>Super User (Organization 2) stated that standard trainings are not well-suitable in this kind of multi-organizational projects. The main contractor should organize a project-specific training. We participated a project specific training before starting.</p> <p>Admin users (Organization 2) claimed that they had taken a project specific training. There is no role based training concept, but they admitted that in general the training was enough.</p> <p>Two of the authors (Organization2) stated that the training was enough and sufficient, on the other hand, author (Organization 1) claimed that more role based specific training could be taken.</p>
Business Rules Issues	There is no role based Business Rules training taken.
Technical Issues	All of the participants stated that there is no role based technical training taken during the progress.

Inferences:

Software and S1000D specific trainings are comprehended enough although they are not planned for the different roles. BR trainings for the author level or some admin level users are not efficient at the beginning of the project.

Suggestion:

- Trainings need to be planned not only just at the beginning, but then due to unexpected conditions, additional trainings can be organized regarding the new requirements.

IQ 7.8 There should be established a team consisting of team leader, project manager, technical authors and technical publication specialists. Do you have such a team as S1000D Working group?

All of the participants from Organization 1 and 2 indicated that there is a team but regarding subcontractor level, they replied as no. In addition they did not have any technical publication specialist. If there was a consultancy required, the Super Users from both Organization 1 and 2 undertook this task. Participants’ answers for this question is given in the Table 4.15 and the findings are given below.

Table 4.15: S1000D Working group

Administrative Issues	<p>Super User (Organization 2) stated that in the case of when other disciplines of the project is functioning properly; project outputs, meetings and any kind of requests and supports are sufficient, in our case our technical publication team was always intertwined and worked with the project manager.</p> <p>Super User (Organization 1) also stated they have an internal structure to lead the project.</p> <p>While Admin user (Organization 2) stated that they have a structure as in the question, other admin(Organization 2) replied as no because they did not have any technical publication specialist.</p>
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Business Rules Issues	All of the participants stated that they do not have any Business Rule defining a team and the responsibilities.
Technical Issues	All of the authors indicated that <i>...despite our project does not have any well-defined and assigned team, we were getting the support and working according to the assigned responsibilities.</i>

Inferences:

Defining a project team and assigning the responsibilities fairly provides each team member who to ask, who to work with and etc., so all of the team members should be informed about the “team” and the responsibilities.

Suggestion:

- Clear assignments of responsibilities need to be defined and announced.

IQ 7.9 Business Rules definition is critical. This step consists of which issue will be used and why, DM Codes, DM types and product breakdown structure tree. Did you work on such a definition process?

Business Rules is an obligation in S1000D, but it is critical to prepare a well-defined Business rules document since most of the problems and gaps occurs because of not clarified rules or “will be defined later” items. Participants agreed on having a BR document but efficiency of this document is suspended. their detailed opinions are located in the Table 4.16 and the critical points are stated below.

Table 4.16: Business Rules definition

Administrative Issues	Super User (Organization 2) indicated that Business Rules document is a condition of S1000D. Therefore, if Business Rules study had not done, the process breaked down. We worked on this Business Rules definition process at the beginning. We defined issue number, DM codes, types and the breakdown structure in general manner. Authors stated that, they have not been in a team to define the business rules but the defines rules have been came to them to follow during the content development process.
Business Rules Issues	All of the participants stated that there are Business Rules according to the needs of the project even if some of the participants (author group) did not joined this definition phase. They just implemented those rules during the technical publication creation process.
Technical Issues	Super users described the BR definition phase as follows: <i>...they formed those rules by taking the example of a previous study in the aerospace indusrty. They re-defined the rules by differentiating the previous rules according to new needs and adopting the new project specific requirements. With maintaining the integrity of know-how transfer, this case also brings some gaps that we could not be aware of at the beginning. Thereore, if there is any deficit that we have noticed during the process, we created Business Rules at that time or revised the rules that we defined inproperly at early stages.</i>

Inferences:

Some of the participants joined to definition phase of the Business Rules while the others are not included or reviewed this process. For an effective rule definition, the members who will apply those rules in the project is better to review or give an opinion to these rules. In addition, BR document is very long to be covered by the whole team members but with regular meetings or shares, related parts with specific level of members need to be compromised during the beginning of this phase.

Suggestions:

- Super Users and Admin level of users need to review and contribute with their opinions to the BR Document.
- BR document need to be covered periodically during the appropriate phases in order to clarify the general rules or (will be defined later) items.

IQ 7.10 Defining the authentications, privileges and describing project and operation procedures in Common Source Database.

Participants stated that authorization is done by super users at the beginning, then they settled a process proper to their organization as indicated in the Table 4.17 below.

Table 4.17: Defining the authentications, privileges in CSDB

Administrative Issues	<p>Super User (Organization 2) indicated that <i>...during the authentication process, Super User creates the project description and makes the role assignments, Admin users creates Data Modules according to the Business Rules and the Author generates the contents in these DMs. This process had been exactly implemented.</i></p> <p>Admin users (Organization 2) claimed that <i>...the role assignment had been done properly, but because of the intensive work schedule, we had to take role both as an author and as an admin user for reviews in most cases.</i></p>
Business Rules Issues	<p>Participants stated that procedures which are required to be followed while working with the database are defined in the Business Rules document.</p>
Technical Issues	<p>At the beginning of the project, those authentications and privileges assigned to the roles in database had been done by the previously S1000D user organization in the project. Admin User (Organization 2) stated that <i>... trainings are provided by an experienced company which is working as an international partner in the project.</i> After the trainings, other organizations gained competence to use the database.</p>

Inferences:

In this case, some of the authors need to perform the jobs assigned to admin users. It was critical that the same person both created the DM and reviewed it, however, even if there is a lack of employee, the reviewer should not review his/her own DM. There can be able to set a cross review procedure between subcontractor organizations.

Suggestions:

- Workload need to take in to consideration while assigning roles and role-gaps should be replaced or re-defined when separations or changes in members had occurred.
- BR definitions while using the CSDB need to be accurate because all of the participants complained about this subject.

IQ 7.11 Defining in which way or method DMs will be transferred to CSDB and how to set a review process. How did you define this?

Transfer protocol need to be defined to record Data on CSDB. Participants replied to this question according to their different methods as indicated in the Table 4.18 and the findings are located below.

Table 4.18: Defining a method for DMs transferred to CSDB

Administrative Issues	Super User (Organization 2) explained that <i>...the author role is the first auditor. Software also provides the ability to control, then the admin and the super-user has to make last control. We always used an approved document to transfer to the CSDB.</i> Super User (Organization 1) stated that they did not have any duty as transferring data to database because they are working via connecting to the CSDB in order to prepare DMs. <i>Related engineers who are involved in the projects are informed via sending the pdf formats of the DMs and receiving their opinions and implementing the opinions to the DMs.</i>
Business Rules Issues	While Super Users and admin users are stating that the transferring policy is defined in Business Rules, authors indicated that <i>...we did not have any idea about this question.</i>
Technical Issues	Admin user (Organization 2) indicated that roles are defined separately in Business Rules but in practice, both authoring and admin user roles are done by one person.

Inferences:

During the transfers to the CSDB, all of the roles related with the project need to take their responsibility which are defined in Business Rules document and all of them should be informed about the process. In this case; although rules are defined about the use of CSDB and review strategy, in implementation there were some exceptions happened.

Suggestion:

- Business Rules need to be defined clearly about how to transfer DMs to CSDB by considering both team members, subcontractors responsible for DM preparation who are not working with direct database connection.

IQ 7.12 Deciding whether Data Modules will have the entire complete procedure or solutions DM will be given a different set of results. How did you decide on this?

Participants tried to define a way to form DM structures while S1000D defines some of them

already. At this point users need to create the project specific type of data modules such as general description of the system and sub components descriptions. Participants indicated that they defined this content structure during the BR preparation phase as stated below.

Table 4.19: DM Content Structure

Administrative Issues	<p>Super User (Organization 1) stated that ... <i>requirements of the project had been taken in to consideration while deciding on the procedures in compatible with the procedures defined in S1000D already in terms of installation, removal, description, IPC DMs.</i> Super User (Organization 2) indicated that all stakeholders co-project managers agreed with the decisions of this question. In general, every action which need to be taken is given separately in DMs.</p> <p>All of the admin and author group users stated that this decision is given during the Business Rules creation phase, we have not been included in the decision phase, decisions were transferred to us.</p>
Business Rules Issues	<p>Two of the authors from both Organization 1 and 2 stated that they did not have any idea about how and who had defined DMs. They did not informed about DM related Business Rules. On the other hand, author from (Organization 2) stated ...<i>we are given a set of example DMs from another project and according to this samples, we prepared our own DMs. In DM structures we firstly define what to do and then what to see about the component or equipment. If there is any test procedure in an Installation DM, we referred it to a new test DM in existing DM.</i></p>
Technical Issues	<p>As a technical approach, DM structures are listed in Chapter 2.2.3.2 Data Module part which are mentioned in S1000D. Therefore, projects need to consider those procedures and need to tailor those DM types to their requirements. In some cases, some procedures can be duplicated in different DMs. Those implementations need to be controlled and all of the content should be organized regarding the DM types.</p>

Inferences:

According to the specific needs of the project. DM content need to be defined for example if the DM will fully covers the changing a specific equipment or one DM will describe the removal information of that specific equipment and another DM will mention installation of the equipment to the system.

Suggestion:

- DM content for the procedures need to be defined in BR document in terms of in what extent it will cover procedures. One DM may contain the whole procedure or multiple DMs may include the same procedure by dividing it.

IQ 7.13 Defining an approval mechanism for DMs by deciding that DMs will be transferred to CSDB after or before the approval. If DMs are transferred before the approval, what will be the process for the confirmation? Therefore, depending on this decision, did you identify a revision strategy?

Revising the Data Modules in CSDB is a flow process for the authors, admin and super users.

As indicated in the Table 4.20 below, the Business Rules also stated a method for the revision of the DMs.

Table 4.20: Approval Mechanism for DMs transfer to CSDB

Administrative Issues	Super User (Organization 2) stated that the approval process was used after being transferred to Database in order to keep the whole revisions related with a publication. Admin users (Organization 2) indicated that <i>...in order to prevent any DMs' revision not getting delivered to the customer, the DMs were decided to be approved just prior to the delivery phase. Thus, any revision of the DM change is done on the revision delivered to the customer.</i>
Business Rules Issues	According to the responses of the participants, revision strategy need to be defined in Business Rules document.
Technical Issues	In the technical aspect, approval mechanism for revisions of a publication need to be set and authorized according to the roles in the application level. Not only defining a method for revision of DMs and approvals, but also operating this technique in implementation is very critical.

Inferences:

Regarding the main contractors business rules about revision strategy, contractor may decide on increasing the revision of the publication for each customer delivery. On the other hand, subcontractors may use a different strategy while delivering DM packages to the main contractor. This depends on the project structure and decisions.

Suggestions:

- For a reliable revision record strategy, all of the DMs which are approved by the related roles need to be transferred to CSDB but the revision strategy of the company may differ from subcontractor to subcontractor or main contractor.
- The point is that, all of the major changes need to be recorded differently as a new revision in the database. There should not be any local copies of DMs.

IQ 7.14 The project group will need to meet at regular intervals to discuss problems and progress. This is important as this is where everyone will learn what mistakes to avoid for the next project. Did you have any sharing platform or mechanism for the lessons learned?

While some of the participants indicated that there was a lessons learned mechanism available during the first phase of the project, some of them answered as no. This is because of assuming the lessons learned mechanism as a brainstorming or experience sharing meetings. However, we are asking for a recorded and announced lessons learned sharing which has an official platform. Therefore, the detailed answers and thoughts from the interviews are indicated in the Table 4.21 and related inferences and suggestions about the question are stated below.

Table 4.21: Sharing Mechanism for Lessons Learned

Administrative Issues	Super User (Organization 2) stated that entire Technical Publication team took part in this meeting process till at the beginning. Super User (Organization 1) admitted that <i>...we have no such a sharing platform officially.</i>
Business Rules Issues	Super User (Organization 2) mentioned that Business Rules were carried by the support of admin and with management of Super User. Author (Organization 2) stated that <i>...there is no mechanism to define lessons learned. They were attending all of the meetings till the beginning in order to solve the problems experienced during the project and define a way to follow, but those meetings were random sessions and there is no lessons learned mechanism to collect those experiences for the future projects.</i>
Technical Issues	When analyzing the project process, there is no technical infrastructure, official lessons learned mechanism or platform exist.

Inferences:

Super user thought that this process is an unofficial sharing in the meetings about the usage of BR, but the point is that the experiences need to be recorded officially and creating a mechanism for the project team to share and record all of the positive and negative experiences especially implementing Business Rules.

Suggestion:

- Lessons learned mechanism for both experienced issues and practical ways on how to do a specific item need to be recorded and transferred to both the team members, all of the contributors of the project and the upcoming projects later.

IQ 7.15 Throughout the whole process, decisions taken should be announced to the whole team, everyone should know about the operation. Project team should know who to ask for support, this mechanism need to be also defined. How was the support, process work flow and decision sharing?

Table 4.22: Decision Announcement and Support

Administrative Issues	Super User (Organization 2) indicated that <i>...this process was conducted through official project meetings, department meetings and in-person meetings.</i> Admin users (Organization 2) stated that admin and other officials are transferring the relevant information on recent developments to all project staff. Author (Organization 2) indicated that <i>...the required support is only the main contractor department in the defense company. We did not have any decision authority.</i>
Business Rules Issues	All of the Authors indicated that they did not have any information about this issue. It is obvious that there is no announcing mechanism and defined professional support roles or competent authority in the project, so the support is limited with the BR transfers during the meetings.

Technical Issues	In Interview Question 2, admin user from subcontractor role of Organization 2 stated that <i>...at the beginning of the project, we did not know who to go for support although we joined a comprehensive training and we are in subjection to the main contractor of the defense company side of the project. After living license and software related problems, neither this defense company nor the company we got training did not aware of our problems, finally a distributor of the software infrastructure of our S1000D tool had tried to solve the problems. During this process, we had a lot of timing problems and disconnections with this third party company. I think that it would be better to work with our IT department to get support. For this project, some officers from IT department of the defense company can be assigned for S1000D specific support mechanism and can be trained on their jobs while we are getting the training.</i>
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Inferences:

For technical support concept, only the main contractors became the consulted corporations and for the software issues, the distributor company of the software is responsible for the support. But there was no information given to all of the contributors in the company about the support authority. Most of the different departments tried to solve their problems by themselves or asking to the main contractor.

Suggestion:

- Support mechanism need to be defined and assigned to a specific groups or companies at the beginning by announcing this information to all of the project contributors. In addition, it is also beneficial for large-scale and privacy critical companies to create their own consultant groups in the company to get immediate support when required.

IQ 7.16 Business Rules should be transferred to subcontractors and expected content or structure need to be defined. Is there any sub contractors in the Project? Did you share BR?

Table 4.23: BR transfer to Sub-Contractors

Administrative Issues	Super User (Organization 2) stated that everyone involved in the project need to have the BR document and it is inevitable to use this document as a guide. Admin users and authors indicated that BR document is shared with all of the stakeholders.
Business Rules Issues	All of the participants approved that BR transfer to sub-contractors is done in the project.
Technical Issues	BR definitions limited some of the existing infrastructure and some of sub-contractors needed to adopt S1000D BRs to their jobs.

Inferences:

BR transfer between all of the sub-contractors had been done via meetings. By this irregular meetings, some of the unclarified issues became clear. At that point, in some cases some of labor loss occurred because of late clarifications of the issues. Regarding the professional

support, role identifications and support authorities were not clear and people did not know who to go when having any problem. Taking support from an outside consultant company need to be evaluated in terms of efficiency.

Suggestions:

- While transferring BR document to sub-contractor companies or divisions in the same company, the main contractor need to define the support mechanism in terms of technical infrastructure, software problems or detailed know how in implementation of S1000D.
- At the beginning of the project, selected team members need to be assigned to those required support roles and need to be trained according to their specialized field to prevent time loss and security gaps.

IQ 8. Do you have any other experience or critical situation which makes sense in terms of S1000D dependent process improvement?

Table 4.24: Experience or critical situation for S1000D dependent process improvement

Administrative Issues	<p>Super User (Organization 2) stated that, according to his experiences S1000D Specification itself is already a general process itself; but only by preparing a project specific BR Document indicates the full rules to create a technical publication. Defining an additional process will be just the summary, detail of the work is project specific, so it cannot be defined as a general process. In addition, he continued ... <i>during this project, our international partner had an experience about creating a BR document, so we based our rules on this previous example and change the rules according to our project.</i></p> <p>Admin user (Organization 2) indicated as a critical issue that ...<i>the BR Document and the Tasks required to be well-defined at the beginning. In addition, practical training is important for everyone who will take part in the process.</i></p> <p>Authors stated that they experienced some difficulties due to limitations in the use of S1000D. After passing these kind of difficulties, by providing the flow of information to all project team, they can be prevented from spending time with the same problems. It must be said that they were using this technique and this facilitates their work.</p>
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Business Rules Issues	<p>Super User (Organization 1) indicated that <i>...it is very critical that the internal company processes and engineering documents should be defined according to those requirements stated in S1000D.</i></p> <p>Admin Users stated that Business Rule identification document in accordance with the project is very important, need to be sufficiently detailed at the beginning of the project. This document is to be well prepared, especially for multiple projects, the contractor's labor losses in future periods, and therefore greatly reduce the problems.</p> <p>Authors stated that <i>...after experiencing on a project, some of the issues become more clear. In the first project as we were amateurs therefore we had problems. Details are thought out well, but in order not to perform error, the software used for the CSDB connection and management has a very low usability. Performing an error in the name of the program used a very thought-out details, but there are not enough of much use.</i></p>
Technical Issues	<p>Author (Organization 1) gave importance to the point that <i>...at the beginning of the project, engineering, design and technical publication work group should be participate a project and S1000D specific training as a joint group and how to work with each other should be explained.</i></p>

Inferences:

Project specific Business Rules and practical training is critical. Information flow about implementation of S1000D throughout team members and lessons learned mechanism is critical to share. In addition, engineering documents and working principles between design, project, engineering, production and technical publication work groups are not compatible with S1000D in this case.

Suggestions:

- Project specific BR document and S1000D dependent process work flow need to be defined and reviewed by all of the project working groups as design, engineering, technical publications, project management and support departments and also subcontractor companies.
- Regarding the international implementations of S1000D, large-scale companies had a strategy about S1000D usage and documented their rules as; for example X Company Business Rules in order to share those rules with the potential sub-contractors. While deciding on a project sub-contractor, those companies evaluated the potentials according to their ability to adopt the defined BRs to their own processes. Therefore in Turkey, our case has two main industries and two large-scale companies which need to have a S1000D strategy and company specific Business Rules.
- Another option to lead the defense and aerospace industries in this kind of military projects, Undersecretariat of Defense need to work on and define National Military Organization level Business Rules. With the help of those general concepts, organizations should also create their own Organizational Level BRs. Having a common strategy as a nation brings consistency between different industries in this country. Moreover, adoptive and guidance resources can be constituted and inspections can be conducted via related main organization.

IQ 9. Do you believe that using S1000D as a specification in your TM creation project is necessary or beneficial? How this specification is implemented, whether as an obligation or not? What do you think about the fact that S1000D is the internationally accepted specification for technical publications?

Table 4.25: S1000D is necessary or beneficial?

Administrative Issues	<p>Super User (Organization 2) commended on this issue as dependent on the intended use, this specification can be better to use, but its not very practical. It is very difficult to conduct a project only with correspondence process especially in international projects with different countries. All stakeholders should work very close, but Turkish language is not supported by the specification. <i>...It would be better to take S1000D as reference and use Standard Numbering System and the structure of the specification.</i> He also indicated that <i>...if the same equipment is used both in one project and another, the documents created once can be used multiple times. On the other hand, if the equipments are produced in the process of integration for different contexts and purposes, then again re-effort needs to be spent to re-use them. Everything is not practical as it was said, processes may take time for many years and project schedules should be considered.</i> In addition, he indicated that there need to be so many citations in documents and references, so IETP output makes sense, but it is not useful in case of a hard copy. S1000D is more suitable for the production of interactive document. Regarding printed copies of the documents to be used; as labor, restrictions and other reasons, it is not eligible. S1000D practice is helpful. However, there are some limitations. Applications can be used if it has more advanced structure. Because S1000D makes creating technical publications more easier, so it is acceptable for this kind of work all over the world, but the standard can also be developed.</p>
Business Rules Issues	<p>Super user (Organization 1) stated that <i>... S1000D is beneficial and necessary for this kind of multi-nations projects. I thought it should not be mandatory. In the light of the technological developments, it can be accepted as the default standard for technical publications in the future.</i> Admin user (Subcontractor of Organization 2) stated that <i>...regarding the multi-national or partner and large scale projects, S1000D is necessary for the management of Data and integrity of the documents.</i></p>
Technical Issues	<p>Admin user (Organization 2) indicated that <i>...it is suitable for interactive technical manuals; but the focus is print out materials, labor loss and limitations prevents the specification being an effective solution. Author users are also agreed on that the specification is beneficial for collaborative and large-scale projects, however, they indicated that the worldwide accepted specification may be the improved version of S1000D in the future because some limitations and modifications need to be arranged in the specifications' current version.</i></p>

Inferences:

Participants evaluated the S1000D specification as beneficial in general in terms of the data reuse, data exchange, sharing and management features. They indicated that there are so

many S1000D dependent tools for creation technical publications according to the selected versions. Technological improvements and specifications' being a developing structure which has a serious support mechanism at the background makes S1000D a well-known and world-wide accepted specification for technical publications utilizing a common source database. On the other hand, there are some limitations exist in current and previous versions that may be minimized or modified in later versions. Those challenges are stated as tools' and documents' integration with other formats and contexts, change in the standard in short terms, IETP friendly structure and technical limitations.

Suggestions:

- S1000D need to be improved according to the limitations that participants mentioned in the answers in interview question 9.
- All of the participants stated that S1000D is beneficial and can be suggested as a technical publication standard regarding multi-national, cooperative and large-scale projects, but it cannot be stated as mandatory because in some cases, using S1000D may not be beneficial and meaningful.
- Cost-benefit analysis and feasibility studies can be conveyed before deciding to implement S1000D in a project if there is no contractual obligation.

4.2 Summary of the Findings

According to the interviews, we had summarized the participants' replies as inferences depending on each question and listed some suggestions for those inferences. In this part, we collected all of the suggestions and listed them in this part of the chapter. For some of the interview questions, participants replied in the same manner or may make the same suggestion for different issues. Therefore, we eliminated all of the suggestions and inferences to take core concepts and critical points to criticize via comparing previous studies in Chapter 5. The core concepts and suggestions gained from the replies of the participants from semi-structured interview are indicated according to the categorization below. Those findings are also reflecting the discoveries and answers of the research questions that we indicated in Chapter 1. Findings, suggested work-flow and future work topics are providing the arguments about research questions in a wide-ranging manner.

Business Rules Definition:

- S1000D issue needs to be selected according to the requirements and the foresight about the project by the managerial level.
- Business Rules, how to implement those rules and get the update rules during the process need to be informed to all of the project team members by giving importance to the issues according to their roles. A general S1000D BR training is stated as not efficient for the later stages. BR Trainings and periodical meetings need to be organized to discuss unclarified issues and announced at the beginning of the project.

- For the BR support, project management need to assign this BR support task to the selected team members in each department or subcontractor as a contact point. In most cases, this task remains to the main contractor or consultant company and this may bring time loss, accessibility and privacy issues. Therefore, depending on an external company cannot solve the problems every time and companies need to have possession of BR Support representatives in each organization. Training requirements of this BR Support Representatives is mentioned in Training part. Support issue is discussed in Chapter 5, in terms of comparing challenges with the previous study.
- Support mechanism need to be defined and assigned to a specific groups or companies at the beginning by announcing this information to all of the project contributors. In addition, it is also beneficial for large-scale and privacy critical companies to create their own consultant groups in the company to get immediate support when required.
- ATA numbering and DMC strategy should be defined and shared with each of the team members with BR trainings at the beginning. A platform can also be beneficial to announce BR and ATA numbering updates etc. The important point is that a suitable numbering and management strategy for Data Modules brings flexibility for later changes. This suggestion is also considered as Sharing Issue and mentioned also under that topic.
- Data exchange procedure need to be described in BR document at the beginning and should be implemented in a pilot DM for figuring out the challenges at the beginning.
- System breakdown structure need to be defined considering all of the configuration in order to related to a Data Module Code and announced to all of the team members in different roles. This brings increasing the control mechanism.
- S1000D is meaningful with Simplified Technical English (STE), therefore in BR creation phase STE terminology for both types of Data Modules are need to be also defined.
- Criticality of the CAD models in the project need to be described to the Design Department. Regarding the rules in S1000D, to provide a full functional CAD models for each component. A checklist can be implemented to the design department to approve the models in compatible with S1000D for Technical Publications.
- Business Rules need to be defined clearly about how to transfer DMs to CSDB by considering both team members, subcontractors responsible for DM preparation who are not working with direct database connection. DM content extension is also clarified if any procedure is given by a one DM or multiple DMs by dividing the steps.
- Regarding the international implementations of S1000D, large-scale companies had a strategy about S1000D usage and documented their rules as; for example X Company Business Rules in order to share those rules with the potential sub-contractors. While deciding on a project sub-contractor, those companies evaluated the potentials according to their ability to adopt the defined BRs to their own processes. Therefore in Turkey, our case has two main industries and two large-scale companies which need to have a S1000D strategy and company specific Business Rules.
- Another option to lead the defense and aerospace industries in these kind of military projects, Undersecretariat of Defense needs to work on and define National Military Organization level Business Rules. With the help of those general concepts, organizations

should also create their own Organizational Level BRs. Having a common strategy as a nation brings consistency between different industries in this country. Moreover, adoptive and guidance resources can be constituted and inspections can be conducted via related main organization.

Business Rules Implementation Process:

- Working in collaboration with design and other related department need to be provided to obtain complete and workable models. Therefore, processes should be defined and working principle documents need to be updated regarding S1000D requirements in both design and customer documentation managements. Reaching the resources that S1000D requires in the project should also be defined as a process and related departments/companies need to agree on that process.
- The use of S1000D Specification need to be comprehended at the same manner in a department or company, so in order to eliminate the gaps, processes need to be defined by complementing each other from the System Requirement Analysis phase to Customer Documentation and Technical Publications.
- Team member replacements and separations need to get in to consideration during the project in terms of work load. Precautions should be planned at the beginning for these situations.
- All of the documents related with the project is better to be tracked throughout a revision based PLM.
- S1000D need to be improved according to the limitations that participants mentioned in the interviews.
- All of the participants stated that S1000D is beneficial and can be suggested as a technical publication standard regarding multi-national, cooperative and large-scale projects, but it cannot be stated as mandatory because in some cases, using S1000D may not be beneficial and meaningful.
- Cost-benefit analysis and feasibility studies can be conveyed before deciding to implement S1000D in a project if there is no contractual obligation.

Training:

- In our case study, Super Users, Admin Users and one of the Author users had participated BR workshop. But BR description training does not arranged for the author and technician groups. All of the roles need to take the relevant training before the project. Author and lower level team members need to be informed about the BR definitions related with their jobs.
- Trainings need to be recursively repeated in order to fill the gaps after the first general training phase.

- There might be training needs at later stages or on the job implementations need to be organized to cover the updated business rules or high level decisions need to be transferred to the author group in order to provide consistent working strategy and prevent labor loss.
- Required training about XML/SGML should be provided for the team members who will work for those issues.
- Trainings need to be planned not only just at the beginning, but then due to unexpected conditions, additional trainings can be organized regarding the new requirements.

XML / SGML:

- In spite of the fact that team members may have lack of technical knowledge about XML/SGML or software used for S1000D dependent TM creation, those requirements should be detected and eliminated by training supports or role replacements before the project starts.

Common Source Database:

- Database system need to cover all of the contributors to prevent manual work. Due to privacy issues, this sharing can be settled by depending on a procedure and role authorizations.
- At the beginning of the Data Module creation, if there is any data migration from a previous or current another project available need to be defined.
- All of the major changes need to be recorded differently as a new revision in the database. There should not be any local copies of DMs, interoperability on DMs between departments or companies may split at this situation.

Lessons Learned / Sharing:

- Mechanisms similar as Engineering Review Board (ERB) need to be provided to both contributors which includes all of the changes and updates in all contributors' side. SNS should be clarified in detail at the business rule definition phase and tailoring/matching between companies need to be tried on small units before the main integration.
- In some cases, different companies or departments may have sharing platforms separate from each other which causes irrelevant processing, so for all of the contributors in a project, there need to be a major sharing platform for all of the discussions, experienced problems, solutions and lessons learned in a project. In addition, there can be any intra-organizational level sharing either to discuss internal issues.
- Lessons learned mechanism is better to be a contributor's sharing platform which is improved by the real challenges' solutions approved by the admin or super user level roles. This platform should also be shared by the sub-contractors and provide them not to live the experienced problems again till the beginning of the project.

- Regarding the opinions of the participants, Lessons learned improvements and BR decisions should be updated in periodical meetings during the project development process, changing, improved implementations or innovations can occur during the progress because the project life-cycles' have very long term.
- Lessons learned mechanism for both experienced issues and practical ways on how to do a specific item need to be recorded and transferred to both the team members, all of the contributors of the project and the upcoming projects later.

CHAPTER 5

COMPARISON, CONCLUSION and FUTURE WORK

In this chapter, findings are analyzed and compared with semi-structured interviews and previous related studies in Section 5.1. In Section 5.2, with the help of this comparison and contrasting issues process work-flow was suggested regarding the needs in a specific defense company depending on S1000D.

5.1 Comparison of Findings with Previous Studies

According to Blais et al. (2010); their structured interview results in "Should S1000D be Required by the Department of Defense?" study showed that there are some benefits and challenges that the interviewees mentioned. They grouped the opinions of the interviewees under 4 main categories, namely:

(1) benefits experienced from using S1000D; (2) challenges or issues experienced in the use of S1000D; (3) whether DoD should require the use of S1000D and (4) actions DoD must be prepared to take if the decision is made to require the use of S1000D. (p.19)

In this study, the interview questions are more specific regarding the S1000D process experienced in single case study when comparing with the previous study. We had directed 9 main questions and 19 probing questions to collect experiences and thoughts of the participants. We summarized the findings by categorizing them into main issues mentioned in Chapter 4.2.

Considering that previous study, our semi-structured interview results are parallel to some of the previous findings. In addition there are also some contrasting issues between our study and the previous one. In this part, we stated those issues by depending on those semi-structured interview inferences.

Firstly, Blais et al. (2010) indicated that the primary gain experienced from using S1000D is Data Reuse. They stated the following:

...the pieces of information that you create in S1000D are very small pieces of information that are referred to as data modules. What this means is that these small pieces of information can be reused in multiple contexts, multiple scenarios throughout a range of systems, platforms, or weapons systems. (p.19)

In our study, participants also admitted that reuse of Data Modules was very critical in the process (Inferences from Interview Question 9). In order to provide Data Reuse benefit in S1000D, Data Module Codes need to be given according to the Standard Numbering System structure and System Breakdown Structure. Data Module content management is also very critical to reuse it. Depending on the results, Data Module content clarification is very important to decide while Business Rules definitions and sharing the information with contributors and sub-contractors at the beginning of the project. This strategy increases or decreases the Data Module reuse percentage both in the same system project or in another one which uses the same equipments or parts.

In addition, results from Blais et al. (2010) denoted that data exchange and data sharing are also benefits of using S1000D in technical publication creation process. Similarly, S1000D indicates that Data Exchange is one of the important features of the specification, on the other hand; in our case study, by not exactly implementing the data exchange procedures described in Business Rules (BREX), some problems occurred during the integration. As stated in Interview Question 4. Via workshops and business meetings, solutions are founded between the companies. These pathways described previously in certain areas and were defined by the contract and job description, but more elaborate problems are disabled via double-triple negotiations in the project team members. Therefore, Data Exchange is one of the benefits of S1000D while it was defined in compatible with the specification at the Data Exchange related BR definition and sharing Data Exchange rules to all of the contributors by implementing the rules consistently.

Both the previous study and our case study show that Data Sharing is very effective when using S1000D in between companies, organizations sub-contractors and customers. XML and SGML structures also help Data Transfer to different tools, use attributes and share between various level of maintenance easier and sharing with multiple vendors if you are using the S1000D consistently.

Another issue, accepted as a benefit regarding the previous study is the Cost Savings. Despite Blais et al. (2010) stated that potential and real cost savings are also benefits of using S1000D, in our case study, none of the participants directly mentioned about the cost savings through S1000D. Because the project is the first one in Turkey, has the obligation to use S1000D and only the first phase of the project had been completed, so the cost-benefit analysis may not be conducted yet. Nevertheless, if there is no contractual mandatory about using S1000D, depending on the project scale and requirements, potential situation of the project helps to decide whether using S1000D will be beneficial or not.

According to Blais et al. (2010) “The availability and capabilities of tools operating on S1000D data were highlighted by a number of interviewees, as well as the openness of the standard” (p.22) This emphasizes that the XML structure allows the tool work in compatible with other interfaces and this neutral infrastructure allows different viewers, software systems, databases and platforms to work together with the S1000D supported tool. It was stated in the study (2010) that:

...there is no other specification that exists that’s as well developed to talk about how to construct data to produce technical publications. I believe the U.S. civil aviation industry has said that now with the incorporation of changes for Issue 4.1 that they were ready to say that they could use that S1000D specification for all makes and models of civil aviation. (p.22)

Considering the benefits coming from the XML/SGML structure and the software used for S1000D, our case study inferences also mention about the XML structure that is forming the Data Modules in the CSDB. In order to create IETP format or web based technical publications, tools for S1000D and XML structure is very beneficial and inevitable to use; but in our case the required output need to be printed out pages. Therefore, to convert the XML structure to a page layout format, there needs to be an add-in software to handle the limitations of the S1000D dependent tool and create the page layout templates according to the contract.

Training benefit of S1000D is mentioned in the previous study because of the new feature of S1000D Issue 4.0 which provides creating training materials via Data Modules. On the other hand, in our case study Issue 2.3 is used and this version is not supporting training data modules. Inferences from the interviews also show that some of the participants stated S1000D need to be improved in some aspects in terms of training and multimedia support and can be used as an international specification after meeting all of the requirements that a technical publication creation process needs.

According to Blais et al. (2010), "Use of S1000D brings a number of technical and programmatic challenges. Several interviewees commented on the need for leadership, policy, transition support, and comprehensive vision."(p.24). They claimed that training issues are not taken into consideration in army and even if it requires less effort to standardize trainings similar as technical publications, there is a big gap between the manually created training materials and S1000D dependent technical publications. S1000D tool is also needs support and there needs to be a group to consult the project team in terms of using Business Rules and technical support. In our case study, technical support and the external consultant company became an issue as a challenge. For immediate support and BR management support, our case study suggests that in each department/ company or sub-contractor who are contributing to the project, a group need to be formed by representatives from each organization and trained as S1000D working group. This group will be trained specifically on about BR implementations, technical issues and software related updates and problems. Therefore, if there is an immediate need to support, firstly this group will be aware of the issue. An external consultant company can be considered for support but, especially in Turkey those companies are working as a distributor of an international one. Therefore, problems may spend days or months to solve because they are sending the issues to the central support mechanism to their international partner. The cost of support staff, maintenance of the tool and trainings are also indicated as challenges in the previous study which our case study also shows parallel findings in terms of diverse training requirements, required add in software for the existing tool to customize according to the contractual obligations and separation of the staff issues.

Rapid change in the S1000D specification in a short term is considered as a challenge in the Blais et al. (2010) study. Interviewees claimed that to keep up with the specification is very hard (2010, p.24). On the other hand, in our case study, participants mentioned about this rapid change by suggesting that S1000D issue need to be selected according to the requirements and the foresight about the project by the managerial level because different issues consist of different features and different level of workloads. At the beginning of the project, if there is no obligation about the version, a feasibility study needs to be conducted and issue number need to be optimized.

As the last item, Blais et al. (2010) described that there are some limitations in the standard considering the version they use or work of the standard. Some of the elements have very short abbreviations and data naming is not clear which makes intelligibility of XML schemes very

hard. In addition, STE brings loss of the meaning in the vocabulary and this causes uniform and unclear content. In parallel; considering our case study, participants complained about the use of STE which makes creating content more difficult and prevent author to transfer what he wants exactly to the content.

In Chapter 4, we asked to the participants for their opinions about how this specification need to be implemented, whether as an obligation or not. Moreover, their thoughts about the fact that S1000D is the internationally accepted specification for technical publications were also asked. Similarly, Blais et al. (2010) also asked that "Should S1000D be a DoD requirement?"(p.27) in their study. The answers of the interviewees from that study differ. While some of them supported to use S1000D because of the benefits it brings, others concerned about a mandated standard which would be implemented also in existing systems and costs, software and infrastructure requirements of the specification. In addition, some other opinions show that it is the inevitable end for the technical publications, so establishing an enterprise wide approach to the technical data management will be beneficial that will already begin to occur simultaneously. In our case study, participants agreed on the fact that if we consider multi-organizational and international projects, S1000D should be used; but the point is national projects, using the specification can be beneficial but need to be analyzed and evaluated to use or not.

Lastly, the critical point to compare the previous study with our case study is that; interviewees suggested some actions to DoD to promote successful implementations of S1000D whereas in Turkey, there is no organization or initiative addressed to get support or guidance about S1000D yet.

Blais et al. (2010) stated that interviewees thought making S1000D a mandatory standard would not result in a successful implementation. Guidelines need to be updated according to the needs of diverse project categories, funding need to be provided for transition and it was stated by an interviewee that "[DoD should] institute some kind of training course, maybe through the Defense Acquisition University. If a standard is going to be required and its use is going to be far-reaching within the DoD and have implications for the next 20 or 30 years,I believe that good training on the use of that standard [is essential]." (p.31). In addition, existing projects and new ones have different requirements for implementing or migrating to S1000D. Therefore, DoD needs to distinguish the guidance for both new S1000D project, migration to S1000D from an existing project. In our case study, in addition to the points mentioned, tailoring issues in a project is also considered by an authorized organization for guidance.

Similar to our case study, in the previous study Blais et al. (2010) listed as the key activity for top-level coordination of organization-wide business rules. We also mentioned about the Organization and company level BR as a suggestion in terms of Business Rules Definition part in Chapter 4. Moreover, in S1000D working groups and government bodies who are maintaining, improving and supporting S1000D; DoD suggested to take place as a leadership because changing proposals are evaluated in the committee and taking part in decision processes brings more effective use of S1000D. In Turkey case, there is no organization officially working with S1000D committee. There needs to be a high level organization rather than companies from aerospace and defense to represent the implementations in Turkey and adopt and participate to improve the specification for the benefit of the industrial needs in Turkey.

5.2 Suggested S1000D Process Work-flow

Regarding the existing process in a defense company and general definitions of S1000D process described in Issue 4.0, we defined a work-flow for S1000D use and explain the steps by relating the new process with the existing technical manual creation mechanism. While S1000D Issue 4.0 is suggesting a general map for the technical publication creation process; regarding the implementation of the specification in a real life project, findings of this study shaped and detailed the general map by providing critical points and in process activities during each step. In addition we also benefited from a study which explains the NAVSEA Technical Manual Management Life-Cycle process as a specific implementation. International USSMG S1000D Sea Working Group is supporting this department for S1000D Sea oriented implementations by requesting changes or modifications in the S1000D process according to their specific needs. Although there exist no initiative similar to USSMG in Turkey, we defined a work-flow by tailoring those previous techniques and general S1000D process definitions.

While suggesting a process work-flow, we divided the whole process in to 3 main phases. First 10 steps are stages of the Planning Phase, from step 11 to 27 are belong to the Creation Phase and 28 to 34 steps are belong to the Review Phase.

5.2.1 Planning Phase

Planning Phase of suggested process is given in Figure 5.1.

Step 1. S1000D - Contractual Obligation or Project Decision

S1000D is very new in Turkey and also in the Defense Industry. The experiences are depending on the mandatory use of S1000D because of the contractual obligations in related projects. Therefore, if there is an obligation to use S1000D, there is nothing to decide on. The Issue number of S1000D can also be mandatory. At that point, the project would be created according to the contractual constraints and requirements.

1.1 Feasibility Study of S1000D if not mandatory

When S1000D is not mandatory, projects may decide on to use this specification if there is a considerable background information available which were created before by using S1000D in a different project. In this situation, project managers need to analyze the common equipments, parts, systems and DMs related with those items to use S1000D or not. In some cases; the project may have a potential to go on with an international partner or will be applied on a large-scale platform based project, at that point authorities need to make a feasibility, cost benefit analysis study in order to use the specification or not. It is very important having a foresight to decide the future requirements of a project in terms of technical manuals, training materials, format and diversity issues. In the light of the case studies, some sample same-scale projects all over the world can be analyzed in terms of which of them used S1000D and which did not. Therefore budgets of those projects can be compared to see the relation of the size of the project and investment tendency to the specification. In order to keep the track of the

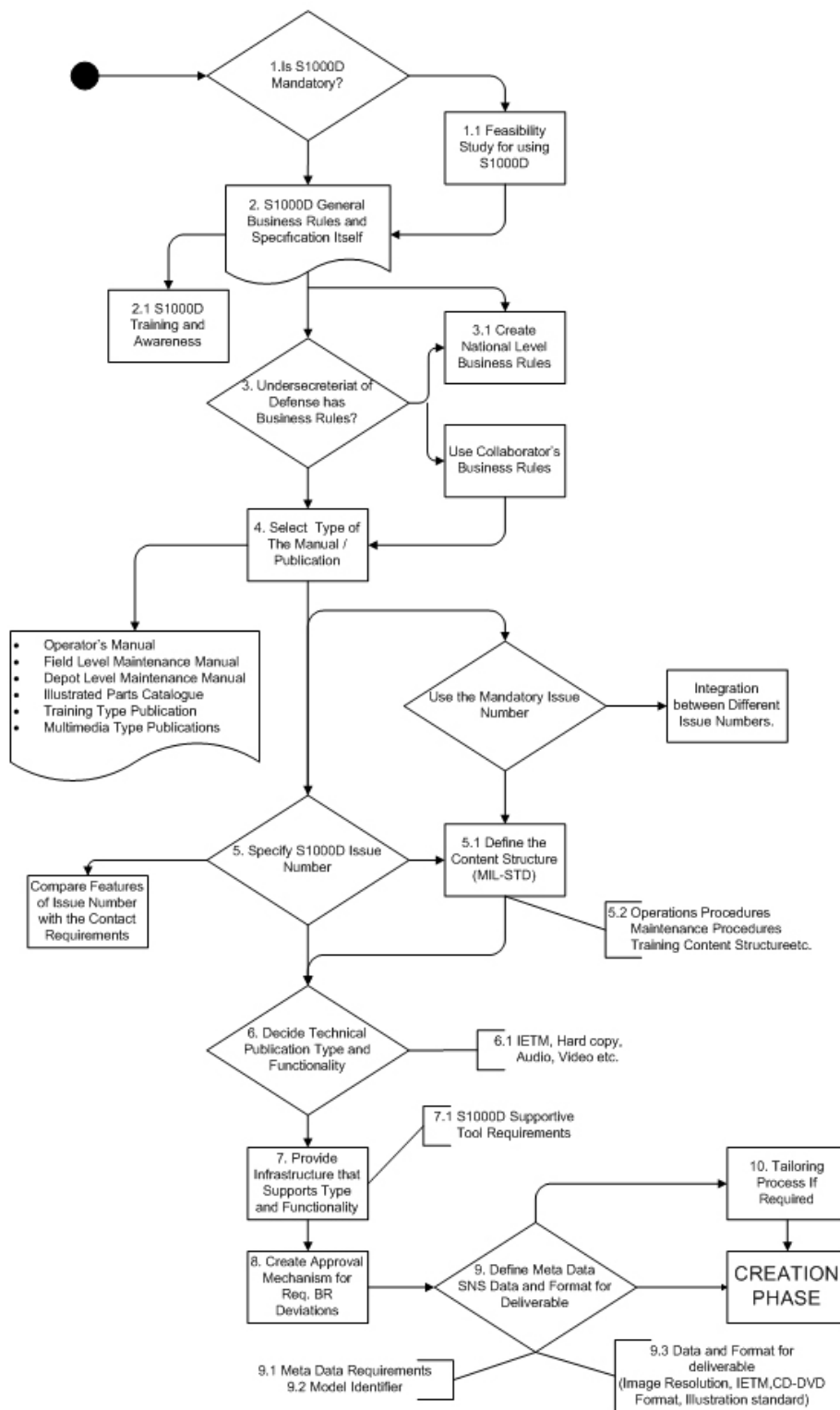


Figure 5.1: Suggested Process Work-Flow, Planning Phase

agenda, defense companies may follow up the international conferences and S1000D user forum meetings.

Step 2. S1000D General Business rules and Specification itself

In this step, decision makers need to be well-equipped about what the specification is. S1000D has a rule set which was named as Business Rules (BR) and those high level rules need to be considered in all of the projects which are using S1000D. Regarding the defense industry, in US, UK and some other European countries there are representatives in S1000D community to improve the specification and setting Business Rules for specific need of the countries' defense system projects. In Turkey, we have new constructions both in industry and in the government about logistics planning and coordination. It will be better for government in Turkey to have a representative in S1000D Steering Committee in order to contribute to the specification via change proposals and suggestions. It is critical to have a role in deciding committee to expand the use of S1000D both in Turkey and international partners.

Step 2.1 S1000D Training and Awareness

At this phase of the process, project managers and BR makers need to take a general understanding about S1000D. For this requirement, General S1000D training and high level issues can be provided to them. Regarding the findings, Super Users, Admin Users and one of the Author user had participated BR workshop. But BR description training does not arranged for the author and technician groups. All of the roles need to take the relevant training before the project. For the long terms projects, trainings can be repeated or rearranged for the changed BR and personnel situations. Regarding the training related findings in the Chapter 4, they need to be covered and decided at this step.

Step 3. Undersecretariat for Defense Industry Business Rules (Turkey)

While all of the developed countries has a national level business rules in order to define S1000D General BR one step in detail, Turkey does not have any rules and awareness about this issue. Therefore, after getting the general S1000D training, Undersecretariat for Defense Industries should define national or industry level BR. For this inexperienced process, the government may get support from the industry leaders or collaboratively work with them who had experienced or had been a part of S1000D technical publication creation project. If the National level Business Rules cannot be formed and the project has the obligation of using S1000D, the main contractors's or international partner's Business Rules can be accepted in that case.

Step 3.1 Create National and Industry Level Business Rules

At this step, authorities may cover and distinguish the differing platforms as Land, Naval and Air Platforms business Rules. In addition there can be some other BRs to cover the needs for Defense Electronics, Rocket-Missile and Ammunition systems. Findings of this study emphasized the Business Rules Definitions as a category which needs to be taken in to consideration while developing BRs in this step.

Step 4. Deciding the Type of the Manual/ Publication

At this phase, the type of the manual need to be defined which will be developed in the extent of part, system, equipment or platform dependent manuals. In addition general purpose and the scope of the publication is also defined at this process step. The categories of the manuals and publications produced by the specific defense company are stated below.

- Operators Manual
- Field Maintenance Manual
- Depot Level Maintenance Manual
- Illustrated Parts Catalogue
- Training Type Publication
- Multimedia Type Publication

As a process document, Integrated Support Plan is prepared and shared with project management team and customer for approval. The decisions about the manual type and other issues need to be take place in this Plan. In addition, the delivery schedule, quantity and approval mechanism before delivery to customer of those manuals should also be defined in Integrated Support Plan.

Step 5. Specify S1000D Issue Number / Use the Mandatory Issue Number

If the project decided to use S1000D, according to the steps followed, the requirements about the technical publication would be clear, so the issue of S1000D which covers the requirements but not brings extra work load and functionality can be selected via evaluating the future implementations. If the project is a S1000D mandatory one and the contractor company had decided on the Issue number, then the other subcontractors and partners need to use that Issue for the smooth integration of the content.

Step 5.1 Define the Content Structure

For technical Publication's content structure, defense company's standard templates which are created depending on military standards (Mil-STD) the content outline need to be considered. If required, the outlined content in the template documents can be evaluated and modified according to specific implementations. As a preliminary study, the defense company will better to define and announce "Specific Defense Company Information Sets" which are including the existing procedures outlined in manual templates or tailor a matching table for the sections, subsections and modules in the manual by matching each part with an information set defined in S1000D. Business Rules document need to include all of those decisions related with S1000D.

Step 5.2 MIL-STD (Operation Procedures, Maintenance Procedures etc.)

At this step, defense company has a MIL-STD dependent content structure which is describing

the general Description, Instructions for operation, instructions for maintenance, fault location and troubleshooting, interoperability testing etc. in both operators and field level maintenance manuals. On the other hand, S1000D has Information sets depending on equipments which are described in Chapter 2 Background Information, Section 2.2.3.6 Information Sets part of this thesis. If the publishing of technical manuals will be conducted according to the existing templates, the information sets and template outlines need to be matched and tailored. While publishing, which information sets will be included in which part of the manual outline required to be analyzed. If there is a modification need about the manual formats, it should be implemented regarding the potential information sets in S1000D dependent project and the project contract.

Step 6. Decide Technical Publication Type and Functionality

Decision makers also need to discuss about the functionality level and minimum requirements of the manuals and publications. In order to select the issue number of S1000D, the feature and functionality requirements need to be defined. This step will provide to define the infrastructure in order to create TMs and the support for those TMs after delivering to the customer/main contractor. How the updates will be applied and changes will be informed to the customer/main contractor is also discussed and defined at this step. The other issues need to be clarified at this step are:

- Connection to the other chapters of TMs in terms of content and cross reference.
- Navigation of the TM in order to inform the user in which part of the manual especially in IETMs.
- Usage and display of the graphics
- Fault Diagnostics and Troubleshooting processes
- Interaction with external processes
- Usage of multiple media content (animation, audio, video explosions etc.)

Step 6.1 Level of TM (IETM, Hard Copy, Audio, Video, Animation etc.)

At this step, the format and the interaction level of the TMs need to be clarified because print out outputs needs special templates and infrastructures while module based interactive IETMs have other requirements while creation. In defense company case, most of the time level of TMs are defined in the project contracts attachments in integrated logistics support related issues. Meanwhile, in some cases the project has a potential to have different requests from different customers. At that point, preparing the TMs according to the potential modifications in terms of a modular approach. Customer may demand training materials as an interactive multimedia publications in some cases at later time after the project is completed, so when defining the level of TMs, the potential applications need to be considered or may be suggested to the customer at the beginning. All of those definitions need to be stated in Integrated Support Plan.

Step 7. Provide Infrastructure that supports Type and Functionality

This step includes software selection about S1000D and the integration of this software with related other existing information systems in the defense company. After deciding on the type and functionality features of the TMs, this software and relational integration is critical to meet the needs of the decided functionality.

Step 7.1 Software Selection

At this stage, testing and certification issues also need to be considered. Patching programs or software can be provided for integration, but firstly the process for the interaction of systems need to be defined. Considering the internal structure of the defense company, there are modeling systems (MCAD Software), enterprise resource planning system, documentation and purchasing systems in general. In addition, there are logistics specific software or databases which keeps the records of logistics support analysis studies. All of those systems need to be connected while creating the technical manuals. This integration needs effort and time to define and deploy. All of the decisions need to be written and announced as Business Rules about the use of S1000D.

Step 8. Create Approval Mechanism for Required BR Deviations

Technical Publications are prepared via collection of information from Modeling systems (MCAD Software), enterprise resource planning system, documentation system, purchasing systems and logistics support analysis records in the specific defense company. All of those systems has their own processes and process managers and responsible personnel. Therefore; when a project begins, Business Rules document defines the method on how to interact with all of those independent information systems and how will the approval mechanism regarding the managers and responsible employees. When Business Rules change, deletion or addition is an issue, how this will effect all of those systems need to be analyzed and clarified at this stage. A work-flow may be created on Business Intelligence system which is accessible on intranet portal for the approval and announcement of BR changes etc.

Step 9. Define MetaData, Model Identifier and Format for Deliverables

At that point, model identifier need to be registered to NAMSA, which the defense company uses for certification. Metadata and format of the deliverables are clarified. Each of the DMs are addressing a specific part of a specific equipment or a specific system which can be considered as a configuration item. Model identification need to be registered for the not previously registered ones. Format for deliverables are also critical because in some cases customer may want to transfer all of the DMs to their CSDB, or they may want to take all of the DMs as information sets in a specific technical handbook.

Step 9.1 Meta Data Requirements

Meta Data of the Data Modules provide management of the DMs in the Common Source Database system. This issue is explained in Chapter 2 Background Information, 2.2.3.5. Identification and status section of the DM need to be defined in order to management of DM within CSDB, use of applicability, quality assurance process, control of retrieval functions and automatic compilation of sets and subsets of information. If there is any national or organizational level Business Rules about the meta data usage, definitions need to be done regarding this Business Rules by eliminating contradictions.

Step 9.2 Model Identifier

This number is located as a prefix for all DMs in order to define the DM uniquely. In the defense company, model identifier registry supported by NATO Maintenance and Agency (NAMSA) is used, so in ideal case model identifier need to be used similar as NAMSA identification numbers if there is no any project decision in opposite way.

Step 9.3 Data and Format for deliverable

Both the source and publication of data in terms of visuals, animations or content need to be defined at this phase. Integrated Support plan and Project Management Plan or attachments may contain those format standards. The resolution of photographs, the perspective of the 3D models, illustrated visuals' stroke sizes and videos' bandwidth or screen resolutions used in TMs may be standardized by both customer in project plan or, project management in integrated support plan. Those issues need to be clarified and stated in both integrated support plan and Business Rules of the project.

Step 10. Tailoring Process

If there is any National and Organizational Level Business Rules, in some cases those rules may have a deviation. Therefore, tailoring can be conducted on the project specific Business Rules and the approval for this tailoring process need to be defined.

5.2.2 Creation Phase

Creation Phase of suggested process is given in Figure 5.2.

Step 11. Define Required Data Module List

For each required Technical Publication, Data Module List need to be defined in order to form information sets for equipments, systems or platforms. Exact definitions of DMRL will result in defining the required TMs about a system, equipment etc. in a correct range. If the DMRL is prepared and send to the project responsible team members as project management, system integration, logistic support, production and mechanical and platform design departments; with the help of the reviews gained from those people, the DMRL will be clarified and required TM types can be increased or changed. For example, regarding the defense company, when a DMRL about a project is send for review; product support engineers may foresee to use a security checklist to use during the repair or may suggest training aid booklet for the customer trainings. On the other hand, system integration department may suggest to prepare a transportation and packaging instruction cards to provide customer a safe usage of the system. Therefore, all of those issues need to be clarified and stated in the Integrated Support Plan and Business Rules Document.

Step 12. Determine Level of DM Reuse

For large-scale companies, the equipments or systems on any platform may have similar items or equipments. At that point, if there is previously created DMs related with those equipments, they can be transferred to the new S1000D project CSDB. During this step, both Data Reuse for the previous projects and the future potential projects need to be take in to consideration.

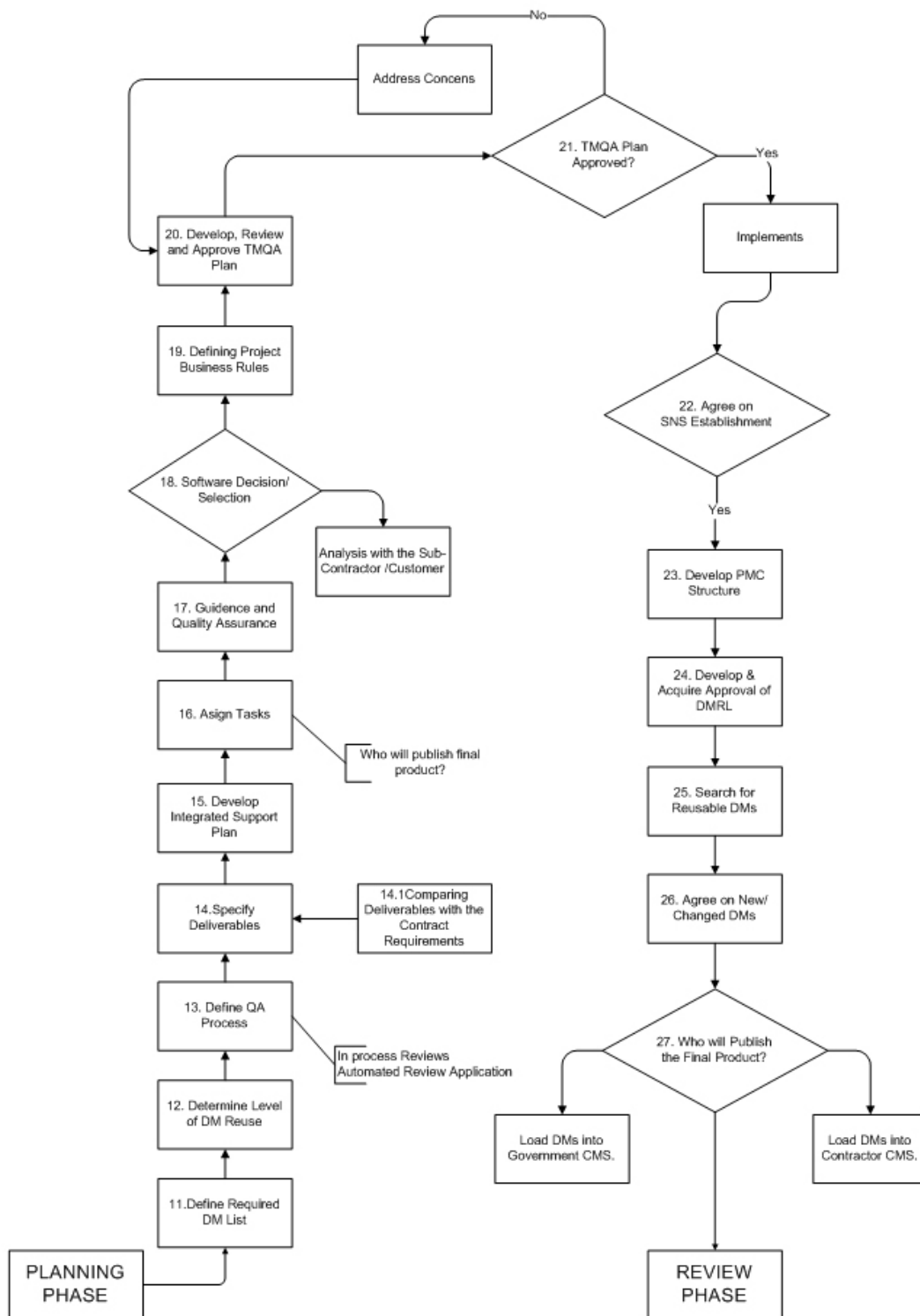


Figure 5.2: Suggested Process Work-Flow, Creation Phase

Step 13. Define Quality Assurance Process

Quality Assurance of TMs need to be specified according to type and extend to verify the manuals. At that point, defense company has an application of automation for review which can be accessed throughout the intranet portal. Related team members and managers reviews the related document, DM or etc. and inserts their thoughts and suggestions in to the system. After all of the authorized members review the document, the responsible member performs the required changes, deletions or additions and then with a review record, the document is transferred to documentation system with an appropriate revision number. If there exist any conflicts between the opinions of different reviewers, a meeting is arranged to clarify the issues. Sub-Contractors may also need to contribute to this process; so defense company has a “Sub-Contractor Software, Hardware Design Acquisition Process”, there are control lists and Acquisition Definition Form in order to check the submitted work packages whether they are appropriate, validated and verified via in process reviews and acceptance tests.

Regarding S1000D case, it should be clarified that DMs, TMs or Information set level of content is supposed to come out to the team members. Business Rules and Technical Manual Preparation Plan or Integrated Support Plan needs to define QA program in what extend the content will be reviewed and who will conduct this process. In Defense Company case, quality assurance consisting of subcontractors and partners is conducted via defined processes and related forms. S1000D dependent QA requirements need to be implemented this existing work-flow.

Step 14. Specify Deliverables

Depending on the contract document, required Data Modules and Publication Modules need to be defined and if the defense company publishes the final product, related presentation platform and formats are also need to be defined. According to S1000D, DMRL, DDN and List of Publication Modules need to be delivered during the submit. In addition, a list of Business Rules also needs to be delivered.

Step 14.1 Compare the Deliverables with the Contract Requirements

At this stage PMs, DMs, DDN, DMRL, BR deliverables are checked according to the contractual document by matching the delivery items. In some cases, graphics and diagrams and illustrations should be prepared depending on some standards, media files are required to be submitted in some special formats. If the publication will be delivered on print out materials, style sheets are also need to be delivered to the main contractor or to the customer.

Step 15. Develop Integrated Support Plan

In order to develop a general logistics support approach, there needs to be some issues to be clarified; firstly logistics requirements of the project need to be classified and analyzed, then maintenance and operations tasks need to be classified, then logistics support analysis plan need to be developed if this project will have a study about LSA. This Integrated Support Plan generally explains all of the main tasks which will be done by Product Support Directorate, Integrated Logistics Support Planning and Analysis Directorate or any other directorates in the defense company. This plan is prepared and reviewed by all of the contributors related with the project from various departments in the company. Then the plan will be send to the customer to get an approval. When approved, the progress will go beyond these decisions.

Step 16. Assign Tasks

Depending on the existing process and project management plan, task assignments are done in the defense company in terms of directorates affiliated with groups in the defense company. Technical manuals are prepared by integrated logistics support directorates in different groups in the company. The task assignments are done according to the system or equipment level development responsibilities of the groups. For example; if the stabilized machine gun platform is developed by a specific group, the TM creation responsibility belongs to the same group. If there are specific equipments or components on that system which is developed by any other group in the same company, the Technical Data related with those equipments are prepared by that group's integrated logistics support directorate and send to the main responsible. All of those data is integrated in to the Technical Manuals developed for the system. Therefore, tasks need to be assigned according to the system, equipment and component level of responsibilities in the company depending on Data Module Requirement List and any other issues project management have mentioned if any.

Step 17. Guidance and Quality Assurance

At this phase, project management directorate and the contributor departments need to develop guidance and quality assurance plans for the S1000D dependent TM creation project. This study need to be done to clarify that the applicable specification is comprehended by all of the contributors in the project. In defense industry, a Start of Work Meeting is done with all of the contractors by the organization of the main contractor. At this S1000D case, this meeting need to be contain a representative from Undersecretariat for Defense Industry related with the S1000D dependent project, technical design and production representative about the system or platform, Technical Publications Manager, Project and Quality Assurance Manager, Integrated Logistics Support Planning and Analysis Manager, writers, editors, key production personnel, government engineering (if it is a government project) or technical representatives.

During this phase, discussions about the issues in Integrated Logistics Support Plan, Technical Manuals Preparation Plan, Training Plan, specifications and standards need to be conducted. In addition, if any tailoring or DM reuse is estimated, this will be discussed and defined. Submitting deliverables, review strategy of the deliverables and BR, milestones of S1000D need to be discussed. Intra and inter organizational conflicts need to be addressed in order to define a process about how to be solved. Moreover, scheduling and verification/validation processes need to be discussed and clarified.

Step 18. Software Decision/Selection

Software selection need to be done by market research and requirement analysis at this phase. Although the software search studies to implement S1000D may begin parallel with the project decision to use S1000D and decide issue number, the decision need to be taken in this stage at latest. If there is any S1000D implementation software exist (this is the case in some groups of the defense industry), upgrades or patch programs can be used and developed to meet the new requirements. Software selection can also be done according to the main-contractor's software and infrastructure.

Step 19. Defining Project Business Rules

Technical Publications Management level (Super User) and admin level of the team members

need to decide the milestones and project Business Rules by getting benefited from a similar project case and deciding on new BR if required. Considering the Chapter 2, Section 2.2.3.1 in the thesis, Business Rules are defined according to the categories mentioned. If there are any national level BR Definition guidelines or high level BR definitions, authorities need to consider those resources during this process. In addition there is also a figure in Chapter 2, Figure 2.6 presenting the sequence of Business Rules production regarding the Business Rules Categories which helps BR definition team to schedule the time in terms of categories.

Findings stated that a general S1000D BR training is stated as not efficient for the later stages. BR Trainings and periodical meetings need to be organized to discuss unclarified issues and announced at the beginning of the project. For the BR support, project management level need to assign this BR support task to the selected team members in each department or sub-contractor as a contact point. BR document has a life-cycle, findings suggest that a platform can also be beneficial to announce BR and ATA numbering updates defined in BR. The important point is that a suitable numbering and management strategy for Data Modules brings flexibility for later changes.

During the project level BR definition, system or equipment breakdown structure need to be considered with all of the configuration in order to relate the potential Data Module Code and announce this strategy to all of the team members responsible or related with that component by documenting in BR document.

Business Rules Implementation Process findings need to be covered during this step and decisions should be reflected to the TM Quality Assurance Plan as a guide.

Step 20. Develop, Review and Approve TM Quality Assurance Plan

In the step 17, Technical Manuals Preparation Plan is discussed, at this phase regarding the software selection and Project Business Rules, the TMPP need to be developed, reviewed and approved. Schedule of the Technical Manual Preparation, methods, procedures, control mechanisms and resources are defined in this plan.

Step 21. TM Quality Assurance Plan Approval

If the plan meets the contractual requirements and the discussed issues in the phases before this phase, the approval is done by technical manual management level which need to be defined in Integrated Logistics Support Plan and Technical Manuals Preparation Plan. If there is any conflict for the approval, authoring team and the managerial level comes together to solve the addressed conflict.

Step 22. Agreement on SNS Establishment

SNS refers to the part of Data Module Code which identifies each DM uniquely. Both the authoring team and the Technical Manual Management level need to clarify the SNS numbering which will be used in the S1000D dependent TM creation project. The National Level Business Rules and Organization Level Business Rules may guide to define the standard numbering. S1000D specification also defined SNS in most of the issues, this can be take in to consideration as a reference. In addition, work breakdown structure of the system can be used to define SNS. The SNS need to be approved by National Department of Defense and NATO Stock Number if the project is a NATO Project.

Step 23. Develop DMC Structure

Data Module Code which identifies each DM uniquely need to be developed because this code refers to the DM and component and sub-components of the equipment or system. This code also tracks descriptive information about the content and the relation between other DMs and CSDB.

Step 24. Develop and Acquire DMRL

During this phase, after specifying and comparing the deliverables with the Contract Requirements, approved DMRL need to be developed and approved by the government or the customer. The definition of DMRL is conducted by the Technical Manual Management level, but the development of DMRL is done by the authoring team. According to Junod J. & J. (2011), this process may need some modifications in terms of cost and budget because the final DMRL may be very different from the initial list. They also suggested that the acquired DMRL should be tracked and supported during the whole project as a management mechanism to provide the required DMs to produce the desired solution as a product.

Step 25. Search for Reusable DMs

The authoring team or an authorized personnel tries to figure out whether there is any previously developed publication module or data module in the database. If any, the required modifications and re-coding need to be developed for the current project.

Step 26. Agree on New and Changed DMs

As mentioned in the interviews and suggestions in Chapter 4, DMs has a potential to be expanded, deleted or changes during the progress. All of the team members need to be agreed on the change, deletion or addition during the process. In addition, interviewees also suggest to announce those changes about DMs and DMRL to all of the contributors and team members. This will prevent sub-contractors and team members from working independent with one another while relating the DMs with the changed, deleted or added one.

Step 27. Decide on Publishing Side

In the previous studies and S1000D specification; this step is mostly recommended for the systems which has a Government Common Source Database as the final database to publish. In our case, we do not have any government database to compile the publications. In the defense company, the case is that one of the groups has the database as a main contractor. The other groups or subcontractors need to transfer DMs and PMs to this database to finalize the product. Loading the DMs from different contributors and publishing the final product throughout this database can be the case or each contributor published the deliverables via their own database. This strategy need to be defined and the integration process and tests should be conducted at this phase.

5.2.3 Review Phase

Review Phase of suggested process is given in Figure 5.3.

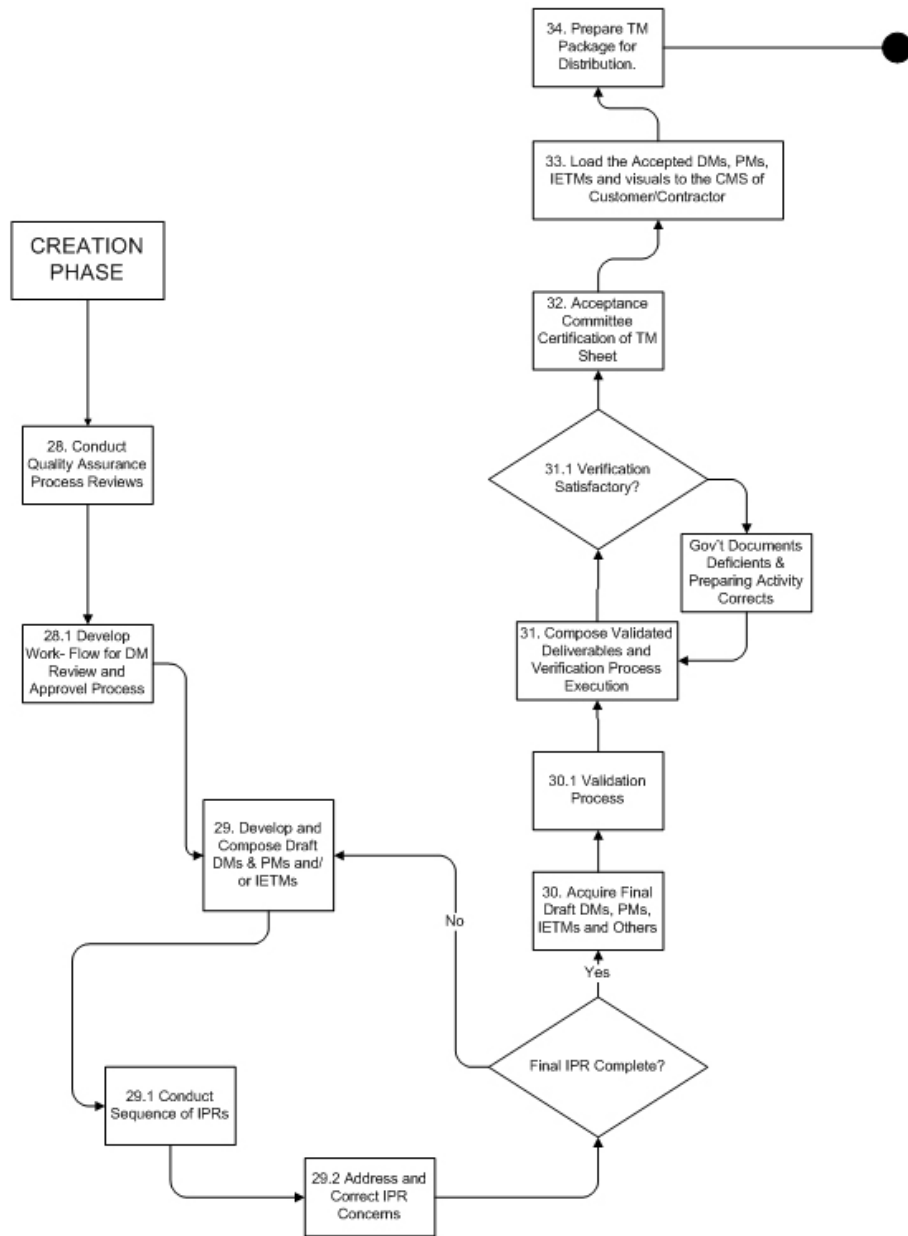


Figure 5.3: Suggested Process Work-Flow, Review Phase

Step 28. Conduct Quality Assurance Process Reviews

At this step, with a government or a customer representative a work flow for DM Review and Approval is stated. How to approve the DMs in terms of quality and operational issues are represented by developing checklists, matching tables and Quality Assurance Plan reviews. DM review mechanism and authorized approval system is very important at this point. DMs

are prepared separately from one another, but they have identification and status section which has the code to locate the DM in the appropriate place in the CSDB. This process is a kind of draft DMs' and PMs' validation. The main review process of the DMs will be conducted after DMs are completed in the following process.

Regarding the defense company; this process step can be helpful for indicating that if any corrective and preventive actions required, this can be discussed and implemented by creating a CPA form.

Step 28.1 Develop Work-flow for DM Review and Approval Process

Considering the approval mechanism and authorities in the company, a DM review and approval mechanism need to be defined and announced to the related team. This definitions may take part in Integrated Support Plan or other related plans.

Step 29. Develop and Compose Draft DMs, PMs and/or IETMs

Regarding the time schedule for the draft DMs and PMs delivery, the required modules is created at this process. DMs are published as a draft PMs at this process to create a demo version of the whole publications. In addition hard copy or IETM level of publications are also produced in order to check whether they are appropriate for the Technical Manual Preparation Plan and control the integration of DMs, layout of IETMs and hard copy formats.

Step 29.1 Conduct In Process Reviews

During this process, the customer or government representative who worked or informed during the QA process review may conduct this review. Those reviews are conducted for the content validations in terms of completeness, logical aspects, safety and accurateness. In addition, warning, caution and related notes are displayed consistently with the related components or equipments in the DMs also need to be validated. The consistency of the controls and indicators; the content and figures, illustrations and 3D models need to be reviewed and confirmed.

CSDB features and authoring activities required to be validated in order to correct whether there is an inappropriate implementation. All of the expected outputs need to be taken and validated for the remaining work. Corrections and changes in the process can be retrieved at the beginning with less labor loss and cost. Therefore, this process is better to be considered as a demo of the main approval.

Step 29.2 Address and Correct In Process Review Concerns

This process step is one of the most effective ones. During the in process reviews; there are so many problems occurred, decision points and change requirements may exist. Therefore, those concerns and problems or new experiences need to be recorded for the lessons learned mechanism, addressed in order to discuss with the customer or government to solve or decide. Solving the problems and implementing the decisions taken with the customer is critical for the coming certification and approval step.

Step 30. Acquire Final DMs, PMs and IETMs

This final validation process is very important for validating the correct system or equipment

configuration with the correct information. Regarding the validation process defined in Technical Manual Preparation Plan and the Integrated Logistics Support Plan, all of the draft DMs reviewed, revised and verified with a specific code in S1000D throughout the identification and status section. With the help of this feature, the validated DMs can be differentiated from the not reviewed ones. Validation need to be conducted throughout some items described by Junod J. & J. (2011):

- Technical and engineering information need to be coherent with the system
- Information set need to consist all of the configuration of the system
- Target audience of the manuals and information sets are required to understand the procedures and need to perform the required tasks with the help of described information.
- DMs need to be satisfactory to fulfill the approved maintenance and support concepts in the plan.
- IETM requirements need to be fulfilled in terms of navigation, logical settlement, usability and functionality aspects.
- IETM need to have a structure of table of contents which has a detailed hierarchical level of topics and navigation to the related parts.
- Source files and DMs need to be prepared by a decided xml schema in the Technical Manual Preparation Plan or DTD schema defined in S1000D.

Step 30.1 Validation Process

At this step, the managerial level of technical publication preparation team need to validate all of the DMs, PMs, IETMs, hard copy based outputs and training materials if any. All of the requirements defined in Technical Publication Preparation Plan considering the covers and CD/DVD formats need to be prepared. In addition final DMRL, final project BR document and other deliverables need to be composed and published.

Step 31. Compose Validated Deliverables and Verification Process Execution

While everything is perfectly working and ready in our database and document management system; after deploying all of the DMs, PMs and IETMs to customer or governments' own system, there need to be some integration validations. IETM Viewers or Information sets connected to the DMs need to work efficiently in their circumstances. Therefore, this step helps to provide mutual agreement on the final product. If there is and page layout and format standard for the hard copy versions, the system need to be verified whether to provide the accurate result, or not. This process of the verification includes publishing and digital structure and format of the content by checking grammar, spelling, layout, STE and other issues.

At this step, it is very critical to inference lessons learned and sharing mechanism in order to transfer the know how for later projects. Findings related with the lessons learned issues need to be take in to consideration to increase the quality and not to have the same problems for later projects. Sharing is also important as indicated in the findings because the subcontractors or other contributors should learn from others' experiences.

Step 31.1 Verification Satisfactory?

As a sub-task of this phase, all of the Technical Manuals need to be verified by the customer or government. The required corrections need to be conducted parallel on each of the manuals and the expected accurate publications need to be provided. At this point, if government finds a deficiency in the manuals on both content or format based issues, the technical publication creation team corrects or resolves the problems. Those acceptance problems need to be recorded and reported for the later potential projects in order to consider.

Step 32. Acceptance Committee certification of TM Sheet

In defense company, there are some acceptance procedures to complete the project. The main acceptance document is “Minutes of the Inspection and Acceptance” which includes so many checklists and acceptance test reports. After passing all of the controls, reviews and acceptance tests, the certification of the publication is consigned to the customer or government.

Step 33. Load the Accepted DMs, PMs, IETMs and visuals to the CMS of Customer/Contractor

Finally, the prepared system for the technical publications is transferred to the government’s or customer’s content management system as final delivery.

Step 34. Prepare TM Package for Distribution.

At this step, the responsible team (may be on customer or government site or in a project team) will produce the final versions of the manuals and created the IETMs and hard copies according to the final formats ready for distribution.

5.3 Conclusion

In the specific defense company, there is a lack of S1000D dependent technical publication creation process although there exist mandatory use of this specification in some of the multi-organizational projects. In this study, we suggested a detailed S1000D process regarding the existing technical publication preparation process, organizational structure, roles and other integrated processes in the company. The company contributed to a S1000D mandatory project without any internally defined process by getting support and directives from the main contractor before. Since there exist not any conducted study about S1000D, the team experienced some problems, determine gaps and had internal and external conflicts during that process. All of the divisions from this company supported this study and also some of the S1000D experienced team members contributed to the semi-structured interviews with their answers and opinions. The aim of this study is to define not an exact but a guiding way to use during the S1000D based TM preparation with considering the intra-company issues and regulations. The suggested process work-flow can be adopted and tailored regarding the specific requirements and implementations of various projects.

Regarding the defined road-map in the specific division of the defense company, S1000D working group is planned to be composed to conduct the preliminary and in process studies during the potential S1000D mandatory projects. This group is going to consider this thesis study as a basis and will tailor or improve the process steps according to the contractual

obligations and the specific needs of the project. In addition, Undersecretariat for Defense Industry also begin to conduct research on this domain and established a team to work on Integrated Logistics Support issues and specifications. Therefore, the suggestions and expectations that we stated in this thesis study will be shared to the related team of Undersecretariat for Defense Industry during the regular advisement meetings.

The specific division of this defense company has an annual sharing symposium in which we are planning to present this study to create awareness for the S1000D mandatory potential projects. In the light of this study, technical publication creation team will consider the key components, findings, experiences and the suggested work-flow as a resource for their own project. In addition, some of the participants that I interviewed stated that they can use or tailor this suggested process in their serial production phase of the project. On the other hand; we thought that in this kind of institutional company, process changes are conducted throughout change proposals and improvement suggestions forms, so the suggested process work-flow can be implemented as a pilot and then it takes the final version by additions and changes with the help of those improvement and change processes.

5.4 The Future of Technical Publications and S1000D

Regarding the findings obtained in the light of research questions, the future of S1000D and technical publications seems to continue in an advancing and improving way. We are anticipating that there will be some critical points to go beyond to benefit from the specification in an expected level in Turkey. Especially, similar to Simplified Technical English standard, authorities in Turkey may also publish a dictionary to provide consistent use of Turkish in technical publications. This also enables sub-contractors a guide to prepare contractor oriented manuals and contractors can also use those sub-contractor documents without any re-work to adopt them to their own manuals. S1000D dependent tools also need to support this simplified Turkish usage and existing tools need to be customized.

As we mentioned before, Undersecretariat for Defense Industries need to give support to this specification. They can publish a guideline and all of the contributors and sub-contractors may follow the directions while creating technical publications. S1000D is more popular in multi-organizational projects, so the contractors and sub-contractors may have to consider this guideline, therefore implementations become consistent and accurate. Another future implementation about the specification can be the contribution of Undersecretariat for Defense Industry for forming an association with the companies and sub-contractors who agreed on a national language and format in technical publications. As a result; with the help of this modular structure, consistent, coherent, customizable and re-usable data packages can be created and used in the industry which brings labor-force and cost-effective solutions. Those suggested implementations need to be conducted after this thesis work in order to set an S1000D aware technical publication solutions in Turkey.

It was foreseen that Undersecretariat for Defense Industry need to take place and set the required control mechanism in the first coming S1000D mandatory project in order to provide consultancy and guidance to the organizations with the contribution of the data obtained from this thesis study. In the direction of the strategic targets, Undersecretariat for Defense Industry and individual defense and aerospace organizations may conduct additional studies in terms of S1000D specification and technical publications.

Considering the supportive tools for S1000D specification, technical publications' future is shifting from a stabilized documentation to a modular approach with the increase in use of S1000D. Importance given to the technical data's competency, effectiveness and reuse, the assessment and evaluation of the publications can be a new approach in accordance with S1000D. There can be an automated evaluation tools for the technical data which gets feedback from the users and target group of that publications. Developments in web, publishing and presenting domains bring new improvements to adopt technical publications to those new technologies. Training of the systems are using technical hand books of the systems as a source, so the training materials can also deviated from the data created in technical publications. Training materials has various types namely, flash and HTML based trainings, print out materials and simulations. Therefore new S1000D issues need to consider those types and define new standards by enclosing those formats.

As international specification for technical publications which is utilizing a common source database, S1000D is evolving as a future standard for both civil, defense and aviation industries' technical publications. Especially in multi-national or multi-contributor projects, both our findings and the literature mention about the benefits to use this specification. US and most of the developed countries are publishing national guidelines for using S1000D in their defense and avionic systems' projects which shows the tendency on using and supporting this specification. With the improving needs about technical publications, S1000D is developing a solution or infrastructure to implement new approaches with the help of Steering Committee. Preparing technical manuals and training materials in separate ways seemed as a problem in S1000D Issue 2.3 as mentioned in findings of the interview, but now Issue 4.0.1 has the feature to create SCORM compatible training materials.

Considering the marketplace of the S1000D supportive tools, there are so many leading actors in the market. The previous versions of the industrial tools which are supporting the first issues of the specification are working as a standalone database and software while the latest issues supported tools are working in an integration with some of the PLM software, mechanical CAD programs and other ILS databases.

With the rapid developments of S1000D and supportive tools, there are leading companies providing technical publication, LSA, product support and maintenance tasks with integrated life cycle solutions. Therefore, the future of S1000D seems to get integrated with other domain specifications especially in defense and aerospace industry. In recent projects regarding defense industry, S1000D obligation takes place in contract documents. In a worldwide perspective, this specification will be the preferred technical publication specification as it keeps up all of the needs and new developments. In Turkey case, S1000D is also trending with the increase in multi-national projects especially in aerospace and defense industries. According to Wilen (2011), ASD has an aim to integrate all of the ILS Specifications by connecting them with each other as technical publications specification (S1000D), material management specification (S2000M), logistics support analysis specification (S3000L) and scheduled maintenance analysis specification (S4000M). To provide this connection both internal and external, exchange specification DEX is created and will be improved to cover all of those ILS solutions.

As technical publications' future seems to go with interactive systems, database related maintenance support systems; S1000D will be developed to consist all of the new technologies and formats. Issue 4.0.1 shows that the training materials are covered by the specification. Therefore, the simulation systems or high level interactive systems can be the new target of

the specification to include.

In a general manner and professional market of S1000D; aerospace, defense and space companies will try to decrease costs to author, maintain and manage the DMs of technical data throughout the life-cycle of the product. It's acceptance as the main specification for technical publications, the future of S1000D is estimated as the improvements of S1000D specification implementations. With the help of automated tools, software wizards or some professional solutions; the future will simplify the usage and applications of S1000D in whole ILS life-cycles for defense, aerospace and space vehicles.

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APPENDIX A

Mülakat Soruları

A.1 Kişisel Bilgiler

Bu Soru-Cevap formunun amacı, aşağıda verilen sorulara dayanarak S1000D zorunlu projelerde, uygulama sürecinde yaşadığınız deneyimleri paylaşmanızı sağlamaktır. Lütfen formda isim belirtmeyiniz. Tez çalışmasında, Kişisel Bilgilerinize, Proje ismi ve özelliklerine yer verilmeyip, genel tanımlar kullanılacaktır. Soru-Cevap kısmında Proje ismi kullanmanızda bir sakınca yoktur, gizli kalacaktır.

- Çalışmakta olduğunuz şirkette pozisyonunuz/göreviniz nedir?
- Ne kadar zamandır bu kurumda çalışıyorsunuz? / Sektör deneyiminiz ne kadar?
- Yaşınız? Eğitim durumunuz nedir?
- Çalışmış olduğunuz S1000D spesifikasyonu temelli Teknik Yayın üretimi projesinde, rolünüz ve sorumluluğunuzu tanımlar mısınız?

A.2 Sorular

1. S1000D spesifikasyonu temelli Teknik Yayın üretme projesinde, proje başlamadan önce nasıl bir süreç tanımladınız? Ön çalışma olarak yaptıklarınızı paylaşabilir misiniz? Herhangi bir eğitim aldınız mı? Eğitim verdiniz mi? Eğitim süresi, yeri ve katılımcılarla ilgili detaylı bilgi verebilir misiniz?
2. S1000D temelli Teknik Yayın üretim sürecinde, şirket içi konular ve süreç akışını yorumlar mısınız? Süreçte eksik veya işlevselliğini düşük gördüğünüz durumlar oldu mu?
3. Sözleşmede S1000D zorunluluğu bulunan teknik yayın üretimi projesi kapsamında; spesifikasyonu uygulama ve adaptasyonu sürecinde yaşadığınız problemler, zorluklar ve kritik konularla ilgili deneyimlerinizi paylaşabilir misiniz?
 - Ayrıca, entegrasyon sürecinde kurum içi çatışma veya anlaşmazlık durumları oldu mu? Böyle bir durumda çözüm için izlenmesi gereken bir iş akışınız var mıydı?
 - Eğitimler, Kodlandırma Standardı çakışmaları veya organizasyon hiyerarşisi ile ilgili anlaşmazlıklar oldu mu? Olduysa çözmek için nasıl bir yol izlediniz?

4. Proje kapsamında yer alan diğer yüklenici firmalarla, organizasyonlar arası durumlar, entegrasyon ve veri değişimi konularında varsa yaşanan sıkıntılar nelerdir? Süreçte eksik veya hatalı gördüğünüz durumlar var mıydı?
 - Kurumlar arası ortak yapılan S1000D temelli bir proje olması sebebiyle, bu projede entegrasyon sürecinde yaşamış olduğunuz problem ve zorluklar nelerdir? Kurumlar arası yaşanan anlaşmazlık ve çatışmalarda nasıl bir çözüm yolu izlediniz? Bu çözüm yolları önceden tanımlanmış mıydı?
5. Proje kapsamında, süreçte ve sonrasında kazanılmış dersler mekanizması oluşturuldu mu?
6. Deneyimlerinize dayanarak, bir Savunma Sistemi projesinde S1000D temelli süreç is akışını nasıl tanımlarsınız, kritik gördüğünüz adımlar bazında bir tanımlama yapabilir misiniz?
7. Aşağıda listelenen, S1000D spesifikasyonunda yer alan kritik konularla ilgili düşünceleriniz nelerdir? Proje yaşam döngünüzde, Teknik Yayın üretimi sürecinde bu konulara ne ölçüde yer verdiniz?
 - S1000D uygulanacak projede, Teknik Yayın üretiminde içerik geliştirme, genellikle mühendislik dokümanları sonlandırılmadan önce baslar. Bu durum sorun yarattı mı? Nasıl?
 - Süreçte yeni Data Modüller eklenebilir ve halihazırdakiler çıkartılabilir. Böyle bir durum yaşandı mı?
 - İçerik, S1000D de gerekli olan Simplified English gereksinimleri ile uyumlu olarak geliştirilmek durumundadır. Bu durumla ilgili görüşleriniz nelerdir?
 - Elde eski verinin olduğu durumlarda, içerik yazma isinden çok veri taşıma işi ön plana çıkabilir. Böyle bir durum oluştu mu?
 - CAD verisinin illüstrasyon geliştirme için kullanım süreci genelde zahmetlidir. Sorun yaşadınız mı?
 - Projeye dahil olacak kişilerin S1000D ve SGML/XML yapısına aşina olması kritiktir. Bu yönde bir eğitim alındı mı? Personel seçimi nasıl yapıldı?
 - Projede görevli kişilere rollerine göre farklı seviyelerde eğitimler verilmelidir. Size verilen eğitimler yeterli miydi?
 - Proje Yöneticisi, takım liderleri (PKDY'ler) ve teknik yayın ekibinin dahil olduğu bir grup oluşumu sağlanmalıdır. S1000D çalışma grubu türünde bir oluşum var mıydı?
 - İş kuralları "Business Rules" tanımlanması kritiktir. Bu kapsamda S1000D'nin hangi versiyonunun kullanılacağı, data modül kodları, data modül türleri ve ürün ağacı kırılım yapısı detaylı bir şekilde tanımlanır. Bu uygulama yapıldı mı?
 - Tanımlanan roller için bu veritabanına erişim ve kullanım kuralları/yetkilendirme tanımlanır. Tanımlama nasıl yapıldı?
 - Yazılan Data modüllerin hangi yöntemle veri tabanına aktarılacağı, nasıl gözden geçirileceği ve kimlerin bu aşamada rol alacağı belirlenir. Projede izlenen yol nasıldı?
 - Data Modüllerde tüm prosedürün mü anlatılacağı yoksa sonuçların ayrı bir DM olarak mı verileceği belirlenir. Kim, nasıl belirledi?

- Data Modül onay sürecinin veritabanına aktarıldıktan sonra mı/aktarılmadan önce mi yapılacağı karara bağlanmalı ve bu karar doğrultusunda revizyon stratejisi belirlenmelidir. Bu tür bir strateji benimsendi mi?
 - Proje grubu yaşadıkları problemleri ve süreci tartışmak üzere belirli aralıklarla bir araya gelmeli ve sonraki adımlarda düzeltmeleri/değiřtirmeleri gereken durumları paylaşmalıdırlar. Sonraki projeler için "Çıkarılan Dersler" maddelerini belirlemeli ve sonraki projelerde başta bu çıkarımları ekiple paylaşmalı ve dikkate almalıdırlar. Paylaşım grubu oluşturuldu mu?
 - Tüm süreçte projeye dahil her bir kişiye tüm kurallar ve alınan kararlar aktarılmalı ve tüm işleyiřten proje grubunun tamamı haberdar olmalıdır. Destek için kime gidecekleri de bu aşamada belirlenmelidir. Destek ve işleyiř, karar paylaşımları nasıl yapıldı?
 - Eğer varsa altyükleniciye de Business Rules aktarılmalı ve beklenen içerik tanımlanmalıdır. Altyüklenici kullanıldı mı? BR aktarımı yapıldı mı?
8. S1000D tabanlı is akışı geliştirme sürecinde yararlı olacağını düşündüğünüz deneyim, yaşadığınız kritik bir durum veya önerileriniz var mı?
9. S1000D uygulamanın gerekliliğine ve faydalı olduğuna inanıyor musunuz? Zorunluktan dolayı mı yapılmalı? Tüm dünyada kabul edilen Teknik Yayın standardı olması hakkında ne düşünüyorsunuz?

APPENDIX B

Etik Kurul Başvuru ve Onay Formları

**Orta Doğu Teknik Üniversitesi İnsan Araştırmaları
Etik Kurulu Başvuru Formu**

Orta Doğu Teknik Üniversitesi (ODTÜ) bünyesinde yapılan ve/ya ODTÜ çalışanları/öğrencileri tarafından yürütülen ve insan katılımcılardan bilgi toplamayı gerektiren tüm çalışmalar, ODTÜ İnsan Araştırmaları Etik Kurulu incelemesine tabidir. Bu başvuru formu doldurulduktan sonra diğer gerekli belgelerle birlikte ODTÜ İnsan Araştırmaları Etik Kuruluna başvuru yapılmalıdır. Çalışmalar, Etik Kurulun onayının alınmasından sonra aktif olarak başlatılmalıdır.

1. Araştırmanın başlığı: *“Savunma Sanayi Şirketinde, ihtiyaçlara yönelik S1000D Spesifikasyonu temelli Teknik Yayın Üretim Süreci İş Akış Şeması Tanımlama: Örnek Olay İncelemesi”*
 2. Araştırmanın niteliği (Uygun olan kutuyu işaretleyiniz) Öğretim Üyesi Araştırması Doktora Tezi
 Yüksek Lisans Tezi Diğer (belirtiniz) _____
 3. Araştırmacının/Araştırmacıların:
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Telefonu: 05327626265 Adresi: Ümit Mahallesi Kermes Sitesi No 1/1 Ümitköy, Yenimahalle ANKARA
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 4. (Varsa) Danışmanın: Adı-Soyadı: Prof. Dr. Kürşat ÇAĞILTAY Telefonu: 05438495962
 5. Veri Toplanacak Dönem: Başlangıç 23/11/2012 Bitiş 15/12/2012
 6. Veri Toplanması Planlanan Yerler/Mekanlar, Kurum ve Kuruluşlar:
a. ASELSAN AŞ. Macunköy Tesisleri e. Savunma Sanayi Müsteşarlığı
b. ASELSAN AŞ. Akyurt Tesisleri f. _____
c. TAI AŞ. g. _____
 7. Çalışmanın/Projenin desteklenip desteklenmediği: Desteksiz Destekli
Desteklenen bir proje ise, destekleyen kurum: Üniversite TÜBİTAK
 Uluslararası (belirtiniz) _____ Diğer (belirtiniz) _____
 8. Başvurunun statüsü: Yeni başvuru Revize edilmiş başvuru Bir önceki projenin devamı
Bir önceki projenin devamı ise, yürütülen çalışma önceden onaylanan çalışmadan herhangi bir farklılık gösteriyor mu? Evet Hayır
Evet ise açıklayınız: _____

- * Lisans Öğrencilerinin araştırmalarını yönlendiren akademik danışmanlarının veya hocalarının olması gerekmektedir.
- 9 Çalışma katılımcılara, herhangi bir şekilde yanlış bilgi vermeyi, çalışmanın amacını tamamen gizli tutmayı gerektiriyor mu? Evet Hayır
Evet ise açıklayınız: _____

10. Çalışma katılımcıların fiziksel veya ruhsal sağlıklarını tehdit edici sorular/maddeler, prosedürler ya da manipülasyonlar/uygulamalar içeriyor mu? Evet Hayır

Evet ise açıklayınız: _____

11. Katılımcı sayısı: 10 (Yaklaşık)

12. Kontrol grup kullanılacak mı?: Evet Hayır

13. Aşağıda sunulan listeden, çalışmanın katılımcılarını en iyi tanımlayan seçenekleri işaretleyiniz.

- Üniversite Öğrencileri
- Çalışan Yetişkinler
- Halihazırda İş Sahibi Olmayan Yetişkinler
- Okul Öncesi Çocuklar
- İlköğretim Öğrencileri
- Lise Öğrencileri
- Çocuk İşçiler
- Yaşlılar
- Zihinsel Engelli Bireyler
- Fiziksel Engelli Bireyler
- Tutuklular
- Diğer (belirtiniz) _____

14. Aşağıda yer alan uygulamalardan, çalışma kapsamında yer alacak olanları işaretleyiniz.

- Anket
- Mülakat
- Gözlem
- Bilgisayar ortamında test uygulamak
- Video/film kaydı
- Ses kaydı
- Alkol, uyuşturucu ya da diğer herhangi bir kimyasal maddenin katılımcılara kullanılması
- Yüksek düzeyde uyarıma (ışık, ses gibi) maruz bırakma
- Radyoaktif materyale maruz bırakma
- Diğer (belirtiniz): _____

Bu bölüm ilgili bölümleri temsil eden İA Etik Alt Kurulu tarafından doldurulacaktır.
Project No: 2012-FEN-029

İAEK DEĞERLENDİRME SONUCU

Sayın Hakem,

Aşağıda yer alan üç seçenektan birini işaretleyerek değerlendirmenizi tamamlayınız. Lütfen ikinci ("Revizyon Gereklidir") ve üçüncü ("Ret") değerlendirmeleri için gerekli açıklamaları yapınız.

Değerlendirme Tarihi: 29.04.2013

İmza:

1.	Herhangi bir değişikliğe gerek yoktur. Veri toplama/uygulama başlatılabilir <input checked="" type="checkbox"/>
2.	Revizyon gereklidir _____ a. Gönüllü Katılım Formu Yoktur _____ b. Gönüllü Katılım Formu Eksiktir _____ Açıklama: c. Katılım sonrası bilgilendirme formu yoktur _____ d. Katılım sonrası bilgilendirme formu eksiktir _____ Açıklama: e. Rahatsızlık kaynağı olabilecek sorular/maddeler ya da prosedürler içerilmektedir. _____ Açıklama: f. Diğer _____ Açıklama:
3.	Ret _____ Açıklama:

Orta Doğu Teknik Üniversitesi İnsan Araştırmaları
Etik Kurulu Başvuru Formu Proje Bilgi Formu

1. Çalışmanızın ayrıntılı açıklamasını, hipotezlerinizi de içerecek şekilde yazınız.

"Savunma Sanayi Şirketinde, ihtiyaçlara yönelik S1000D Spesifikasyonu temelli Teknik Yayın Üretim Süreci İş Akış Şeması Tanımlama: Örnek Olay İncelemesi"

Büyük ölçekli organizasyon ve projelerde, özellikle Savunma Sanayi projelerinde müşteri dokümantasyonu söz konusu olduğunda gerek kurumlar arası entegrasyon, gerekse standart teknik yayın üretimi konularında ciddi sıkıntılar olduğu gözlemlenmiş ve bu süreçle ilişkili bir iş akışı şeması tanımlanmadığı, sorumlulukların ilgili kurum ve kuruluşlarca, uygun şekilde paylaşılmadığı gözlemlenmiştir. Türkiye'deki Savunma Sanayi kuruluşları dikkate alındığında, projelerin birçoğunun farklı firmalarla imzalanan ortak projeler olduğu gözlemlenmektedir. Böyle bir durumda, müşteri dokümanlarını tek tip üretmek ve teknik yayınların (Teknik El Kitapları, Bakım/ Onarım El Kitapları, Resimli Parça Kataloqları) standardizasyonunu sağlamak kompleks bir hal almaktadır, bu dokümanların revizyon kontrolleri, versiyon stratejileri, yönetimleri ve entegrasyonları zor hale gelmektedir. Özellikle, büyük entegre sistem projelerinde; sistemler, alt birimler ve cihazların entegrasyonu söz konusu olduğunda, farklı savunma sanayi firmaları, farklı altyükleniciler ve küçük firmalarla çalışıldığında, tüm endüstrinin kabul ettiği bazı standart ve spesifikasyonlar dikkate alınarak üretim yapılması tutarlılık ve idame edilebilirlik açısından kaçınılmazdır. Aynı şekilde, müşteri dokümantasyonları ve teknik yayın üretiminde belli bir spesifikasyon temelli ilerlemek, entegrasyon maliyetlerini ve tutarsızlıkları önleyecek, ürün niteliğini belli seviyede koruyacaktır. Dolayısıyla, birlikte çalışılabilirlik esasları gereği, verinin niteliği, maliyeti ve yönetimi söz konusu olduğunda, S1000D Spesifikasyonu (*International Specification for Technical Publications Utilizing a Common Source Database*) teknik yayın üretim sürecinde zorunlu olarak tüm katkıda bulunan şirketler tarafından kabul edilmelidir.

Bu tez çalışması ile; bir savunma sanayi şirketinde, müşteri dokümantasyonu ve teknik yayın üretim sürecinde S1000D spesifikasyonu dikkate alınarak, halihazırdaki süreçlere entegre bir iş akışı tanımlanmaya çalışılacaktır. Teknik Yayınların planlama, organizasyon, üretim ve revizyon kontrolleri ve modifikasyonları gibi konular ele alınarak, daha önce tecrübe edilmiş bir S1000D tabanlı proje incelenecek, atlanan noktalar, eksiklikler, kritik görülen konular ve çıkarılan dersler incelenerek süreçlere yansıtılacaktır.

2. Veri toplama sürecinizi, kullanılacak yöntem, ölçek, araç ve teknikleri de içerecek şekilde yazınız. (Araştırmada kullanılan her türlü ölçek ya da anketin bir kopyasını bu dökümanla birlikte teslim ediniz.)

Araştırmada kullanılacak yöntem, Soru - Cevap türü bir mülakat yaparak katılımcılardan bilgi toplamaktır. Soru-Cevap Formunun bir kopyasına ekler bölümünde erişebilirsiniz.

3. Çalışmanızın beklenen sonuçlarını yazınız.

S1000D temelli projede yaşanan durumlardan ders çıkarmak ve yeni tanımlanacak sürece bu eksiklikleri ve kritik noktaları dahil ederek daha kapsamlı bir iş akışı yaratmak.

4. Çalışmanız, katılımcıların fiziksel ve/ya ruhsal sağlığını tehdit edici ya da onlar için stres kaynağı olabilecek unsurları içermekte midir? Evet ise, açıklayınız. Bu unsurların etkilerini ortadan kaldırmak ya da en aza indirmek için, alınacak önlemleri açıklayınız.

Hayır.

5. Çalışmanın amacının, tamamen ya da kısmen katılımcılardan saklanması söz konusu mu? Evet ise, nedenlerini açıklayınız. Bu durumun veri toplanmasının sonunda katılımcılara nasıl açıklanacağını belirtiniz.

Hayır.

6. Bu çalışmanın, alanınıza ve/ya topluma yapacağı olası katkıları yazınız.

Bu çalışma, Türkiye Savunma Sanayi şirketlerinde sözleşmeler gereği zorunlu olabilen S1000D Spesifikasyonu temelli teknik yayın üretiminin çok kısıtlı örnekleri olması sebebiyle, uygulamada yaşanan ve yaşanacak sıkıntıları minimuma indirmeyi hedefleyen bir çalışmadır. Yurt Dışı Savunma Sanayi firmaları bu spesifikasyonu zorunlu hale getirmiş, Savunma Bakanlıkları spesifikasyonun uygulamada kullanımına yönelik rehberler hazırlamış, hatta sivil endüstride de S1000D son yıllarda kullanılmaya başlanmıştır. Fakat Türkiye’de henüz sayılı birkaç yurtdışı ortaklı projede zorunlu tutulan bu spesifikasyonun uygulamasına yönelik hiçbir çalışma yapılmamış ve hatta Savunma Sanayi Müsteşarlığı tarafından da rehber vb. hiçbir destek sağlanmamaktadır. Dolayısıyla bu çalışma, savunma sanayinde sonraki çalışmalara örnek olması açısından kritik bir rol oynamaktadır.

7. Daha önce yürüttüğünüz ya da yer aldığınız araştırmaların başlıkları, tarihleri ve (varsa) destek sağlayan kurumun/kurumların adını yazınız.

Araştırmacının: Adı-Soyadı: Ayşe Hilal BAYRAK

İmzası



Danışmanın: Adı-Soyadı: Prof. Dr. Kürşat ÇAĞILTAY

İmzası



KATILIM SONRASI BİLGİ FORMU

Bu çalışma daha önce de belirtildiği gibi ODTÜ Enformatik Enstitüsü Bilişim Sistemleri Bölümü Yüksek Lisans öğrencisi Ayşe Hilal BAYRAK tarafından, Prof. Dr. Kürşat ÇAĞILTAY danışmanlığında yürütülmekte olan "Savunma Sanayi Şirketinde, ihtiyaçlara yönelik S1000D Spesifikasyonu temelli Teknik Yayın Üretim Süreci İş Akış Şeması Tanımlama: Örnek Olay İncelemesi" çalışmasıdır.


Büyük ölçekli organizasyon ve projelerde, özellikle Savunma Sanayi projelerinde müşteri dokümantasyonu söz konusu olduğunda gerek kurumlar arası entegrasyon, gerekse standart teknik yayın üretimi konularında ciddi sıkıntılar olduğu gözlemlenmiş ve bu süreçle ilişkin bir iş akış şeması tanımlanmadığı, sorumlulukların ilgili kurum ve kuruluşlarca, uygun şekilde paylaşılmadığı gözlemlenmiştir. Türkiye'deki Savunma Sanayi kuruluşları dikkate alındığında, projelerin birçoğunun farklı firmalarla imzalanan ortak projeler olduğu gözlemlenmektedir. Böyle bir durumda, müşteri dokümanlarını tek tip üretmek ve teknik yayınların (Teknik El Kitapları, Bakım/ Onarım El Kitapları, Resimli Parça Katalogları) standardizasyonunu sağlamak kompleks bir hal almakta, bu dokümanların revizyon kontrolleri, versiyon stratejileri, yönetimleri ve entegrasyonları zor hale gelmektedir. Özellikle, büyük entegre sistem projelerinde; sistemler, alt birimler ve cihazların entegrasyonu söz konusu olduğunda, farklı savunma sanayi firmaları, farklı altyükleniciler ve küçük firmalarla çalışıldığında, tüm endüstrinin kabul ettiği bazı standart ve spesifikasyonlar dikkate alınarak üretim yapılması tutarlılık ve idame edilebilirlik açısından kaçınılmazdır. Aynı şekilde, müşteri dokümantasyonları ve teknik yayın üretiminde belli bir spesifikasyon temelli ilerlemek, entegrasyon maliyetlerini ve tutarsızlıkları önleyecek, ürün niteliğini belli seviyede koruyacaktır. Dolayısıyla, birlikte çalışılabilirlik esasları gereği, verinin niteliği, maliyeti ve yönetimi söz konusu olduğunda, S1000D Spesifikasyonu (International Specification for Technical Publications Utilizing a Common Source Database) teknik yayın üretim sürecinde zorunlu olarak tüm katkıda bulunan şirketler tarafından kabul edilmelidir.

Bu anket çalışması ile; daha önce uygulanan S1000D tabanlı teknik yayın ve müşteri dokümantasyonu üretim projelerinde yaşanan tecrübeler dikkate alınarak halihazırdaki süreçlere entegre bir iş akışı tanımlanmaya çalışılacaktır. Teknik Yayınların planlama, organizasyon, üretim ve revizyon kontrolleri ve modifikasyonları gibi konular ele alınarak, daha önce tecrübe edilmiş bir S1000D tabanlı proje incelenecek, atlanan noktalar, eksiklikler, kritik görülen konular ve çıkarılan dersler incelenerek süreçlere yansıtılacaktır.

Bu çalışmadan alınacak ilk verilerin Ocak 2013 sonunda elde edilmesi amaçlanmaktadır. Elde edilen bilgiler sadece bilimsel araştırma ve yazılarda kullanılacaktır. Çalışmanın sonuçlarını öğrenmek ya da bu araştırma hakkında daha fazla bilgi almak için aşağıdaki isimlere başvurabilirsiniz. Bu araştırmaya katıldığınız için tekrar çok teşekkür ederiz.

Prof. Dr. Kürşat ÇAĞILTAY (Tel: 0312 210 3683; E-posta: kursat@metu.edu.tr)

Ayşe Hilal BAYRAK (Tel: 0312 592 2158; E-posta: e138248@metu.edu.tr)


Prof. Dr. Kürşat ÇAĞILTAY


Ayşe Hilal BAYRAK

Gönüllü Katılım Formu

Bu çalışma, Prof Dr. Kürşat Çağiltay danışmanlığında, Ayşe Hilal BAYRAK tarafından tez çalışması olarak yürütülmekte olan; projelerde teknik yayın üretimine yönelik kullanılan S1000D spesifikasyonu ve Türkiye’de Savunma Sanayi’nde spesifikasyonun uygulamasını inceleyen bir çalışmadır. Çalışmanın amacı, katılımcıların daha önce çalışmış oldukları S1000D temelli teknik yayın üretimi projelerinde edindikleri deneyimi paylaşımlarını sağlamaktır. Çalışmaya katılım tamimiyle gönüllülük temelinde olmalıdır.

Soru-Cevap anketi yaklaşık 20-30 dk. sürecek ve ankette sizden kimlik bilgilerinize yönelik hiçbir bilgi istenmeyecektir. Cevaplarınız ve projelerle ilgili aktardığımız özel konular tamimiyle gizli tutulacak ve sadece araştırmacılar tarafından değerlendirilecektir; elde edilecek bilgiler bilimsel yayımlarda kullanılacaktır. Araştırmaya yönelik oluşabilecek sorularla ilgili olarak Ayşe Hilal Bayrak (e138248@metu.edu.tr) ile iletişime geçebilirsiniz.

Danışman: Prof. Dr. Kürşat ÇAĞILTAY (Bilgisayar ve Öğretim Teknolojileri Eğitimi Bölümü & Enformatik Enstitüsü / ODTÜ)

Araştırmacı: Ayşe Hilal BAYRAK (Bilişim Sistemleri, Enformatik Enstitüsü / ODTÜ)

Bu çalışmaya tamamen gönüllü olarak katılıyorum ve istediğim zaman yarıda kesip vazgeçebileceğimi biliyorum. Verdiğim bilgilerin bilimsel amaçlı yayımlarda kullanılmasını kabul ediyorum.
(Formu doldurup imzaladıktan sonra uygulayıcıya geri veriniz).

İsim Soyad:

İmza:

Tarih: ----/----/----