

POLITECNICO DI TORINO

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Master of Science in Engineering and management

Master of Science Thesis

Implementation of Lean Approach to Quality Management Processes at Bosch Group



POLITECNICO DI TORINO

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Abstract

This master's thesis investigates the implementation of a lean approach to quality management processes at Bosch Group. The focus is on reducing governance and increasing autonomy in the quality management processes, while also emphasizing continuous improvement and updatability of documents. Additionally, the study explores the use of high UX, optimized detail level, and added value content as the lean criteria for documenting the quality management processes. The study begins with a literature review of the concepts of lean management and quality management, followed by an overview of the existing quality management processes at Bosch Group in different divisions plus Bosch Central.

The research methodology employed in this study is a qualitative case study. Data were collected through interviews with quality management personnel, document analysis of quality management procedures, and observation of the current quality management practices. The collected data were analyzed using content analysis techniques. The findings suggest that Bosch Group has a well-established quality management system in place. However, the current processes lack lean principles, leading to non-value-adding activities, overproduction, and long waiting times. The study proposes the implementation of a lean approach to quality management processes to eliminate redundant information, improve efficiency, and enhance user satisfaction worldwide in all Bosch plants.

To document the quality management processes, the study proposes the use of high UX, optimized detail level, and added value content. The high UX ensures that the processes are user-friendly and easily navigable, while the optimized detail level ensures that only relevant information is included, reducing the risk of information overload. The added value content ensures that the processes provide value to the user and are not just a collection of bureaucratic requirements.

In conclusion, the advantages of implementing a lean approach to quality management processes at Bosch Group are significant. The proposed approach can lead to improved quality, reduced costs, and enhanced customer satisfaction. By embracing a lean approach, Bosch Group can remain competitive in the manufacturing sector and continue to provide value to its customers. Additionally, a lean approach to quality management processes can help create a culture of continuous improvement, where employees are encouraged to identify and eliminate waste and inefficiencies. This can result in increased employee engagement, job satisfaction, and overall performance. The proposed approach can serve as a guideline for other organizations in the manufacturing sector to implement lean principles to their quality management processes.

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List of abbreviation

ASA	After Sales Administration (e.g. Service/Repair organization)
BPS	Bosch Production System
BT	Building Technology (Bosch Division)
BT/ET	Executive Vice President Technology
BTC	Bosch Training Center
BU	Business Unit
CAB	Corrective Action Board
CAR	Corrective Action Request (system)
CAR tool	IT tool for 8D methodology - Corrective Action Request Tool
CDC	Continental Distribution Center
CMDM Team	Central Master Data Maintenance Team
CSO	Country Sales Organization
DC	Drive Control (Bosch Division)
Defect	Non-Fulfilment of a requirement related to an indented or specified use.
EMEA	Europe, Middle East & Africa sales (region)
ERP	Enterprise Resource Planning system (e.g. SAP)
Failure	Non-Fulfilment of a demanded function.
FG	Finished Good
FIFO	First In, First Out
FMEA	Failure Mode & Effect Analysis
FQB	Field Quality Board
GB	Bosch Division (Geschäftsbereich)
HAWA	Handelsware (Trade Good)
KPI	Key Performance Indicator
LL	Lessons Learned
MFE	Manufacturing Engineer
MP	Manufacturing plant
MQI	Major Quality Issue (risk classification)
MRC	Managerial Root Cause
MRP	Manufacturing Resource Planning
PC4	SAP server for the product business
PEP	Product Engineering Process
PI	Process Indicator
PjM	Project Manager
PL	Project Leader
PM	Product Manager
Poka-Yoke	A Japanese term that means “fail-saving” or “mistake-proofing”.
PPC	Planned Production Cost
Product	Both Product and Service
PS	Problem Solving
PSS	Problem Solving Sheet - 8D Report and Problem Solving Sheet for CAR Attachment
PT	Power Tool (Bosch Division)

QAM	Quality Assurance Manual
QG	Quality Gate within Product Engineering Process
QI	Quality Issue (risk classification)
QIS	Quality Inspection Stock grouping within SAP
QM	Quality Management
QMM	Quality Management & Methods (Department)
R&D	Research & Development
RAN	Rework Authorization Notice
RAPEX	Rapid Exchange of Information System (<i>RAPEX</i>) is a rapid warning system of the European Union
RO	Regional Organization
RSO	Regional Sales Organization
RTV	Return to Vendor
SAP	Enterprise Resource Planning system/software (widely used in the BOSCH world)
SCAB	Supplier Corrective Action Board
SCAR	Supplier Corrective Action Request
SCR	Software Candidate Release
SOP	Start Of Production
SQI	Serious Quality Issue (risk classification)
SSO	Sales Support Organization
TG	Trade Goods
TRACI	Task, Responsibility, Authorization, Consultation, Information
TT	ThermoTechnik (Bosch Division)
WI	Working Instruction
WIP	Work In Progress
WMOS	Warehouse Management Operating System – Used by CDC's to manage finished goods within the warehouse.

1 Introduction

This scientific work has been done based on an internship activity at Bosch Building Technology in central Quality Management and Methods Department, Munich, Germany. One of the main roles of this department is to design and organize different quality management processes and related documentation for the stakeholders around the world. These procedures usually get updated every year, but mostly small changes are implemented for few chapters in each update. This round of updating is a full modification of the procedures / documents to a new lean version. The whole project to make the quality management processes lean, is based on the lean initiative of board of director in BT. During six months of internship, four quality management processes have been studied and analyzed to do a full modification and create a lean version for each one of them. These quality management processes are Problem Solving with 8D methodology, Blocking, Rework, and Concession.

The problems which this master's thesis aims to address are the non-lean quality management processes and related issues of worldwide users for each process. Prior to this project, all the quality management processes in BT despite of completeness and being realistic, were non-lean. The aim of this scientific work is initially to make those four quality management processes as lean as possible, and then roll them out through the whole organization and ask the relevant stakeholders to implement the procedure in their business units around the world. Finally, feedback collection from stakeholders and implementing their ideas to the lean version of each process is done to update the documents. Lastly, new lean documents are archived on the Bosch online platform. It is estimated that the whole PDCA cycle from starting to study the old version of the process to final implementation of the new lean version by the business units around the world, approximately takes six months for each procedure.

The project for making each of the procedures a lean process, starts with a deep study of the old version. First, a good understanding of the whole procedure is needed. Then a benchmark of a specific procedure in BT with other Bosch divisions (DC, TT, PT) is done to figure out the pros and cons of documentation approach in each division. After the initial benchmarking, a general structure proposal on how to rewrite the document is created. So, based on the structure, the content is selected wisely with a lean approach. Next step is to decide which chapters can be removed and/or shifted to attachment documents like WI, GP or training. WI is an attachment to the main procedure explaining how to do the work (e.g., in related IT tools) like a user manual. GP is also another attachment that provides a real practical example for each procedure. Therefore, only contents with high added value regarding the management of the quality processes will be kept in the main document. After that, there are several meetings with the relevant stakeholders worldwide, (regarding different time zones) to collect

their initial feedback and subsequently modifying the procedure. Please note that these meetings and feedback collections are prior to roll out step. Finally, before rolling out each procedure to the organization, a tutorial video is recorded to explain the changes that have been implemented in the new version. This video is recorded in two sections, first part is a general explanation over the whole modification, and the second part is covering the details of changes in the new structure and in each chapter. Since I have already had teaching experience in my career history, the second part of the videos was recorded by me for the new processes.

The objective to be achieved after implementing this project is to have user-friendly LEAN Quality Management Procedures with minimum possible number of pages and maximum understandability for the stakeholders together with a high UX. Also, one important desired goal for this project is to create procedures and related documents with CIP feature. Continuous Improvement is one main criteria for lean processes. So, updatability of these new processes is important to the QMM department.

1.1 Introduction to thesis structure

Chapter 1: Introduction to thesis structure and to the company. This chapter covers a general introduction to thesis and describe what the problem and the proposal are and what the objective of the thesis is.

Chapter 2: A short review over the company is presented in this chapter which covers some details about the company including the business sector, financial outcomes, and business area.

Chapter 3: Literature review and definition of terms. Since in this thesis four different Quality Management Processes are covered, a wide range of terminology must be known prior to read the body of thesis. So, general words plus specific phrases that are mentioned in this field of quality engineering/ management, are defined in this chapter. Also, for a better understanding for the reader, in some cases there are detailed analogies for phrases with close meaning. To write this chapter, several sources including ISO document, Bosch documents, journal articles and websites are used. Moreover, there are a few graphical representations to explain some concepts, clearer.

Chapter 4: Criticalities that have made some improvement actions necessary regarding introduction of lean criteria for processes and their documentation. All are by considering the case study of 4 quality management processes in Bosch Building Technology. These criteria have been selected based on many group discussions in the QMM department. Moreover, there is a benchmarking table to compare the old version of these procedures with same ones in other divisions of Bosch Group.

Chapter 5: Empirical analysis/ Results / lessons learned. In addition, the proposed lean approach for four mentioned quality management processes in Bosch. In this chapter an overview of all chapters of the new lean version of quality management processes will be illustrated. Moreover, there is a benchmark table to compare the new version with the old one and to the same procedures from other divisions. Also, a proposal of future effective activities for improving the whole business processes in Bosch Building Technology is mentioned.

Chapter 6: conclusion and decision.

In this chapter, a conclusion to the research presented in this master thesis is provided. The main findings and contributions of the research is summarized, and the main research question is addressed. In particular, the overall argument and key takeaways are summarized, any important limitations of the research are mentioned, relevant recommendations is given and the contribution of the research to the field is clearly explained.

Chapter 7: References.

In this chapter, a list of references used in this master thesis is provided. The references include all the sources cited in the research, including books, journal articles, and any other relevant materials. The list is presented in a specific format, following the guidelines of the chosen citation style. The reference list serves as a guide for the readers to access the materials used in the research and to further explore the topics presented in the thesis. It is important to note that the reference list is carefully checked for accuracy and completeness, to ensure that all the sources used in the research are correctly cited and acknowledged.

2 Introduction to company

In this master's thesis, Bosch Building Technology Company is considered as a practical industrial example and a great case study to show the applicability of LEAN Quality Management Processes. So, the similar procedures that are being used in Bosch are studied and related new lean version is proposed in this thesis.

2.1 Bosch Building Technology

In 1886, Robert Bosch founded the “Workshop for Precision Mechanics and Electrical Engineering” in Stuttgart. This was the birth of today’s globally operating company. Right from the start, it was characterized by innovative strength and social commitment. (BOSCH GMBH, 2022)

The history of Bosch starts with many first steps. The step into independence, onto the automotive market, into markets outside Germany, and onto the factory floor of major manufacturing. (BOSCH GMBH, 2022)

The Bosch Group is a leading global supplier of technology and services. It employs roughly 402,600 associates worldwide (as of December 31, 2021). The company generated sales of 78.7 billion euros in 2021, see Figure 1. Its operations are divided into four business sectors: Mobility Solutions, Industrial Technology, Consumer Goods, and Energy and Building Technology. As a leading IoT provider, Bosch offers innovative solutions for smart homes, Industry 4.0, and connected mobility. Bosch is pursuing a vision of mobility that is sustainable, safe, and exciting. It uses its expertise in sensor technology, software, and services, as well as its own IoT cloud, to offer its customers connected, cross-domain solutions from a single source. The Bosch Group’s strategic objective is to facilitate connected living with products and solutions that either contain artificial intelligence (AI) or have been developed or manufactured with its help. Bosch improves quality of life worldwide with products and services that are innovative and spark enthusiasm. In short, Bosch creates technology that is “Invented for life.” The Bosch Group comprises Robert Bosch GmbH and its roughly 440 subsidiary and regional companies in some 60 countries. Including sales and service partners, Bosch’s global manufacturing, engineering, and sales network covers nearly every country in the world. With its more than 400 locations worldwide, the Bosch Group has been carbon neutral since the first quarter of 2020. The basis for the company’s future growth is its innovative strength. At 128 locations across the globe, Bosch employs some 76,100 associates in research and development, of which more than 38,000 are software engineers. The company was set up in Stuttgart in 1886 by Robert Bosch (1861–1942) as “Workshop for Precision Mechanics and Electrical Engineering.” The special ownership structure of Robert Bosch GmbH guarantees the entrepreneurial freedom of the Bosch Group, making it possible for the company to plan

over the long term and to undertake significant upfront investments in the safeguarding of its future. Ninety-four percent of the share capital of Robert Bosch GmbH is held by Robert Bosch Stiftung GmbH, a charitable foundation. The remaining shares are held by Robert Bosch GmbH and by a corporation owned by the Bosch family. The majority of voting rights are held by Robert Bosch Industrietreuhand KG, an industrial trust. The entrepreneurial ownership functions are carried out by the trust. (Bosch GMBH, 2021)

Bosch Group Key Facts and Figures 2021

Bosch's global manufacturing and sales network covers nearly every country in the world.

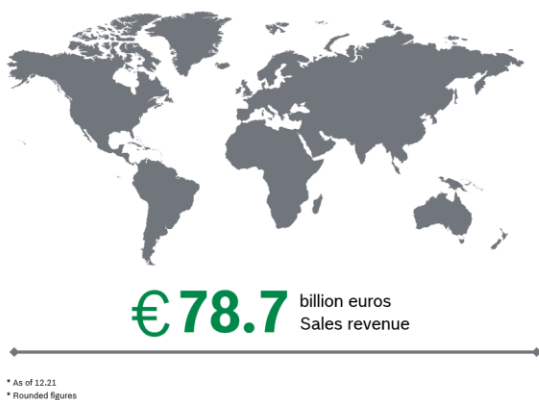


Figure 1: Key Fact and Figures (BOSCH GMBH, 2021)

It is a long success story: Everything began in 1920 with the foundation of an emergency call center in the German port city of Hamburg. Given the possibility of reporting emergencies, there was an almost tangible overnight improvement in safety from the elementary threat of fire. The emergency call center was the first of many innovations that Bosch Building Technologies has introduced over the following century. It is not only the fire sector that has continued to develop over the decades. Bosch's ever-increasing technical innovation drives advances also in further security areas. See Figure 2.

More than 100 years of continuous growth.

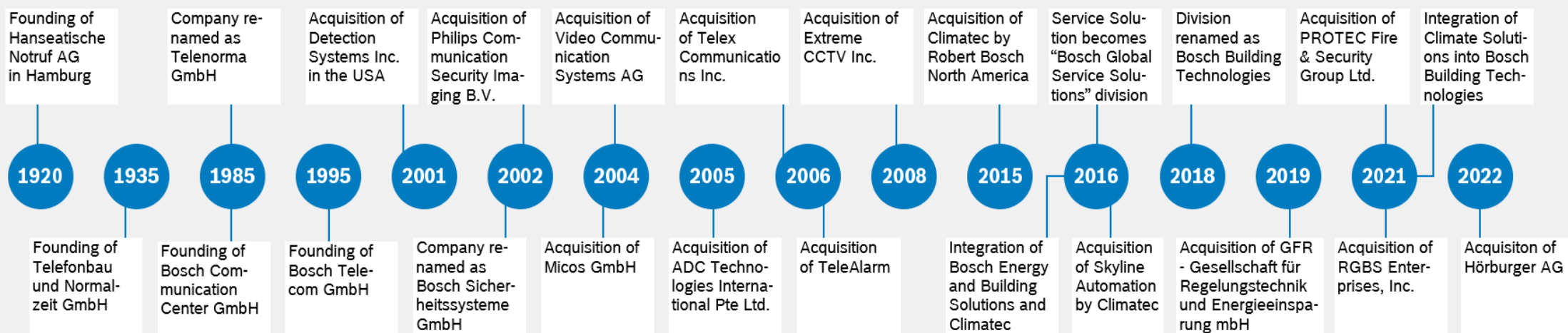


Figure 2: BT History (BOSCH GMBH, 2021)

2.2 Expansion to other security areas

In 2001, the company acquired Detection Systems, a leading U.S. manufacturer of electronic security equipment. The security range offered by Bosch became increasingly comprehensive. From 2002, the security products and services were extended with video technology. Thanks to the acquisition of Philips Communication Security Imaging, Bosch already had some expertise in video security, high-quality video security cameras, electro acoustic and conferencing systems. The expanded division was renamed Bosch Security Systems. With the addition of Telex Communications in 2006, Bosch's communications portfolio was strengthened. The enlargement of the product offer was developed with Bosch Security Systems offering integrated solutions. These were used, for example, in soccer stadiums during the first ever soccer World Cup to be staged on the African continent, taking place in South Africa in 2010. Bosch supplied not only the audio systems but also video security and fire alarm technology. (BOSCH GMBH, 2022)

See Figure 3: General Information about Bosch BT.

Building Technologies Key facts and figures 2021

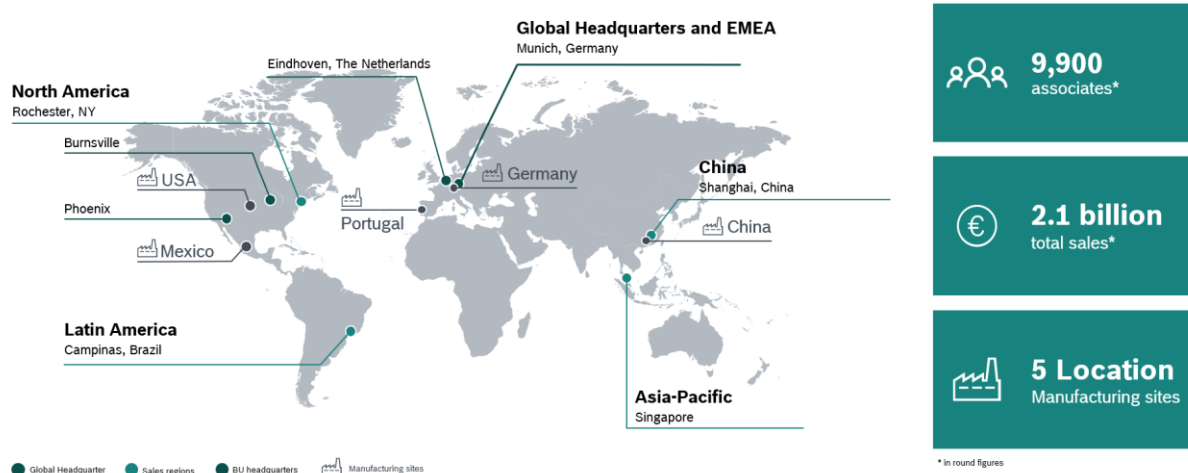


Figure 3: General Information about Bosch BT (BOSCH GMBH, 2021)

2.3 Business Area

BT aims to protect lives, building and assets, and is therefore known worldwide for security and communications products, solutions and services. The company differentiates between product and installer business. The product business can be subdivided once again into three business units: Fire Alarm Systems (FIR), Security (SC) and Communication Systems (CO). See Figure 4: Company Business Area.



Figure 4: Company Business Area (BOSCH GMBH, 2021)

In fact, BT's product portfolio includes IP and analog cameras (SC), motion detectors and signaling devices (SC), manual and automatic smoke detectors (FIR) and conference systems (CO). Products of Bosch Security Systems GmbH can be found worldwide in stadiums, airports, train stations, banks, shopping centers, museums, etc. Examples include the following facilities: Shanghai Tower (China), Hilton Bursa (Turkey), Antalya Airport (Turkey), Bank VTB Group (Russia), Museum of the History of Polish Jews (Poland) and Alliance Riviera (Nice, France).

2.4 Quality management at Bosch BT

The following graph is showing the QMM services at Bosch BT. As you can see in Figure 5, there are 4 main branches of services along with a group of IT tools that are used while providing those services. Some part of this scientific work is done under the first branch, QMS and then Quality management procedures. Also, the branch "Quality Tools and Methods" is studied in this master thesis and for some tools like "problem solving" a full modification will be done and for "Technical Risk Analysis" there would be an initial proposal then the next student will complete the modification.

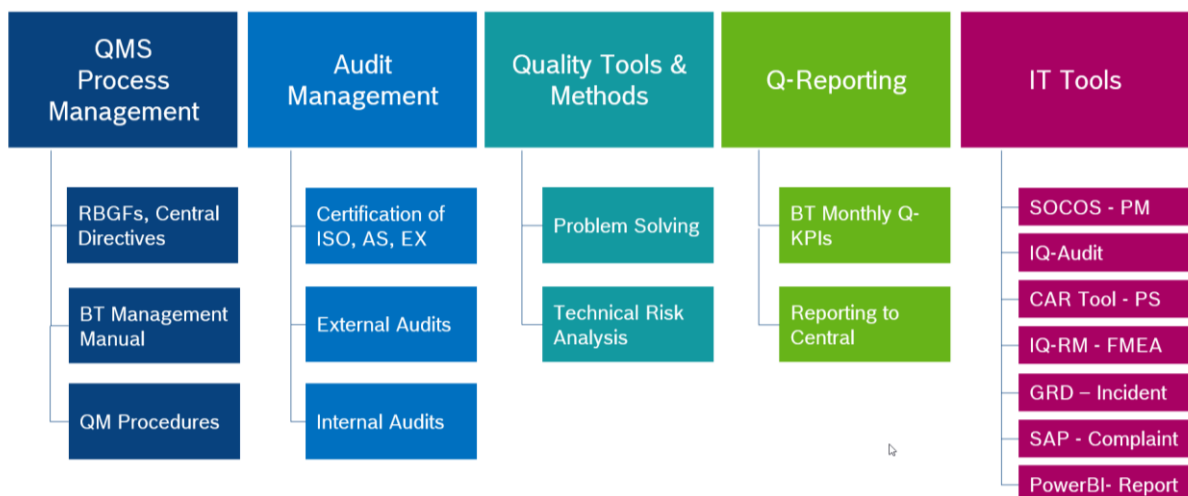


Figure 5: Quality Management at Bosch (Carl, 2022)

3 Literature review and definition of terms

Business Process:

A business process is an activity or set of activities that accomplish a specific organizational goal. Business processes should have purposeful goals, be as specific as possible and produce consistent outcomes. (TechTarget, 2022)

Business process management (BPM):

BPM is a structured approach to improving the processes organizations use to get work done, serve their customers and generate business value. A business process is an activity or set of activities that helps accomplish an organization's goals, such as increasing profits or promoting workforce diversity. BPM uses various methods to improve a business process by analyzing it, modeling how it works in different scenarios, implementing changes, monitoring the new process and continuously improving its ability to drive desired business outcomes and results. (TechTarget, 2022)

Lean Management:

Lean Management originated in the firm Toyota in the middle of the 20th century and was then conceptualized at the end of the 20th century. Its main objective is to focus on the process of waste elimination in order to cut out steps that do not create value or, in other words, to reduce anything a final customer would not agree to pay for. The Lean Management philosophy enables the continuous improvement of both the quality and robustness of the product/process pair. (Bacoup, Michel, Habchi, & Pralus, 2017)

LEAN Business:

Simply stated, a Lean business is a business that maximizes value while minimizing waste (See Figure 6: Seven wastes of LEAN). A Lean business model focuses on improving processes across the value stream in order to eliminate waste and deliver optimized value to the customer. While the Lean business model originated in the manufacturing industry, it can be applied to knowledge work in almost any industry. Unlike other business methodologies with hard and fast rules, Lean is a way of thinking that can be applied in any business environment.

A Lean business is rooted in seven principles:

- 1) Optimize the whole
- 2) Eliminate waste
- 3) Build quality in
- 4) Deliver fast
- 5) Create knowledge
- 6) Defer commitment
- 7) Respect people

(Lynn, 2022)



Figure 6: Seven wastes of LEAN (kanbanize.com, 2022)

LEAN PM:

Lean process management is a method for building a company culture that supports continuous improvement. It involves a long-term approach to daily work that encourages small, incremental changes in process operations to improve quality and efficiency.

The primary objective of Lean process improvement is to create value for the customer by optimizing resources and creating an uninterrupted workflow based on near real-time customer demands. In addition, the approach seeks to minimize or eliminate all waste of resources, effort, and time by documenting each step in a business process and then

removing or reducing steps that do not create customer value. The concept of Lean is rooted in manufacturing, but it has been adapted to fit almost every industry.

Lean process management is centered on:

- Understanding value from the viewpoint of the end customer.
- Eliminating or minimizing all waste in the creation of value.
- Continuously improving products, processes, and people.

(Yoon, 2022)

The difference between BPM and LEAN:

According to APQC, BPM is the “way of looking and managing business processes”. BPM is a business strategy, it’s a management approach used to improve business processes whereas, Lean is a technique used for process improvements. BPM is macro, the bigger picture whereas Lean falls under micro, and it fits into the bigger picture. To cut a long story short, BPM is an overall management and process improvement umbrella and Lean is one of the process improvement techniques that fit into this umbrella. Lean is one of the techniques that are used to implement BPM. (orbusssoftware.com, 2022)

The following are the benefits of Lean and BPM that will surely give an organization a long-term competitive advantage and achieve continuous business improvement:

- 1) Better approach to problem-solving
- 2) Enhanced control and automation
- 3) Faster real-time execution of processes
- 4) Reduced delivery time
- 5) Improved long-term performance
- 6) Better characterization, understanding and management of the entire value chain
- 7) Proper alignment of resources
- 8) Identification, measurement, and monitoring of KPIs
- 9) Agility and speed
- 10) Stronger customer focus
- 11) Increased revenues

(primebpm.com, 2022)

Why are current BPM solution getting obsolete?

There's a shift in the way businesses are running. The focus has shifted to speed, empowerment, and growth instead of centralization and control. BPM tools used to be a great deal in the last decade. From solving basic process problems to designing workflows, these solutions have come a long way. But they are becoming obsolete. The complex flowcharts and heavily engineered BPM tools are no longer effective for the new generation of workforce. Businesses today can't work with a slow process automation platform where it takes hours just to set up the automation.

Here are some pointers on where these BPM solutions are lagging behind:

Complex and slow

Today's world is demanding simplicity in automation. The companies want to work with solutions that can be operated by anyone and not only experts. BPM tools available in the market require hours of getting used to before it can start enhancing your business processes. Businesses need to rely on BPM agencies or BPM experts which is both costly and time-consuming.

Input Context

When a person is working on a task, it becomes a project to gather context regarding the process in the BPM. Nobody likes to go over email chains or get overloaded with information. It creates friction between departments about why proper information is not being transferred. This defeats the purpose of a BPM.

Hinders Big picture

If top and middle-level management is too busy with managing and analyzing these solutions, they have less time to analyze and identify bigger systemic problems. They can't develop new ideas of expansion in these situations. Overworked solutions that pose as BPM tools hinder the bigger picture of the business. These were a few of the many challenges of current Business Process Management. See Figure 7, that shows the future of Business Process Management.



Figure 7: The Future of BPM (Kotadia, 2020)

As we all know that every product has its own lifecycle, it begins with an introduction in the market and ends after achieving a maturity stage. There are certain things that we have learned after intensively studying the market with Primary and secondary research.

Fast Process Automation

The current way of running business processes requires a lot of technical knowledge and people are an afterthought in process designs. This results in processes being slow. New era process automation solutions would have to be fast. It should not depend on the knowledge of the user. Fast process automation is going to be the most immediate and necessary trend in the BPM market. It would change the way business processes run.

Flexibility is not a want, it's a necessity

Since the new era of the digital revolution, people are demanding flexibility even in B2B platforms. Fun and Flexible new era tools like Slack have taught us that the element of fun can be included in all kinds of tools. The rigid controls and overworked diagrams are a thing of the past. The current generation needs flexibility while using the tool. A great onboarding experience and tour of the tool will help you create a lasting impression.

Easy integration

The BPM tools that do not allow integration and collaboration will soon be obsolete and out of the market. Integration with different APIs gives developers and programmers the freedom to run the solution the way they want. It increases the productivity of people and expands the horizon for development which is immeasurable. The tools that are ready for integration will create a positive environment for the users.

No dependency on IT

Some BPM tools are code-heavy, where you need to write code for every little enhancement. This is not going to work in the future. If you want to survive in today's market, you need to nullify the dependency on coding. The amount of BPM users that know how to code is really low. You must not just cater to the bigger audience in order to stay relevant. (Kotadia, 2020)

Six Trends shaping the future of BPM:

- 1) Citizen-developer tools, automation drive democratization of BPM
- 2) Intelligent business process automation increases process efficiency
- 3) Incorporation of BPM functionality into software platforms extends its reach
- 4) Automated process discovery provides complete map of enterprise-wide processes
- 5) Adaptive process management supports agile, iterative process modeling
- 6) BPM shifts focus to systems of engagement, customer, and employee experience
(Lawton, 2022)

Once Charles Darwin said: "It is not the strongest of the species that survives, nor the most intelligent; it is the one most adaptable to change."

Complaints:

Expression of dissatisfaction made to an organization, related to its product or service, or the complaints-handling process itself, where a response or resolution is explicitly or implicitly expected. (Gang, 2020)

Problem: Deviation (nonconformity, defect, failure, fault) from a defined target state or objective state (if necessary, vaguely described) with unknown cause or an opportunity for improvement. (Koerv, Problem Solving Process & Serious Complaints, 2022)

Different types of problem occurrence are illustrated in Figure 8.

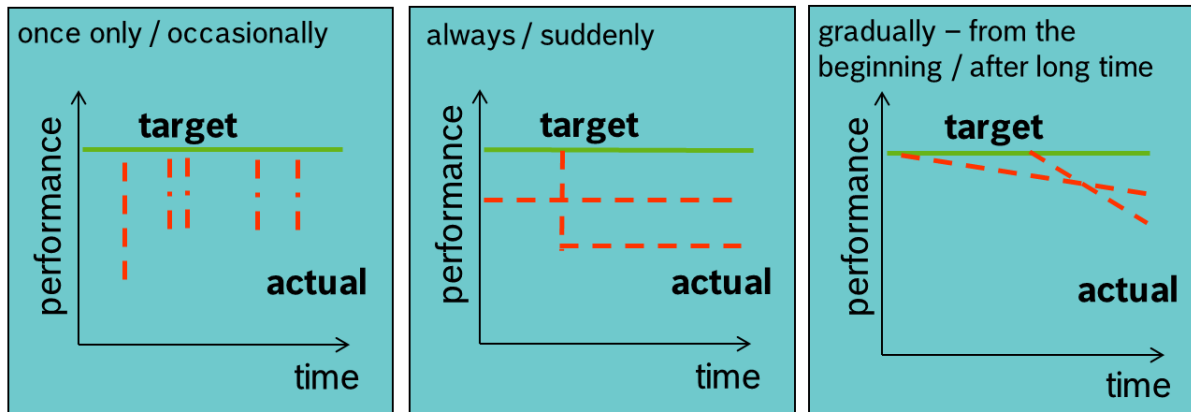


Figure 8: Different Types of Problem Occurrence (Koerv, Overview Training, Problem Solving with 8D, Blocking, Rework, 2021)

Problems to be solved with 8D Process in Bosch:

Customer Complaints

- Field and DOA failures
(processed and documented according to the 8D method)
- Testing and trials of development samples
- Initial sample inspection and initial sample reports

Internal Problems

1. Problems in product development and production process planning
2. Product complaints in the production line
3. Product problems during testing (durability, function, product audits, ...)
4. Problems during relocation
5. Supplier problems

8D Steps, see Figure 9: Overlap of Different Steps of 8D

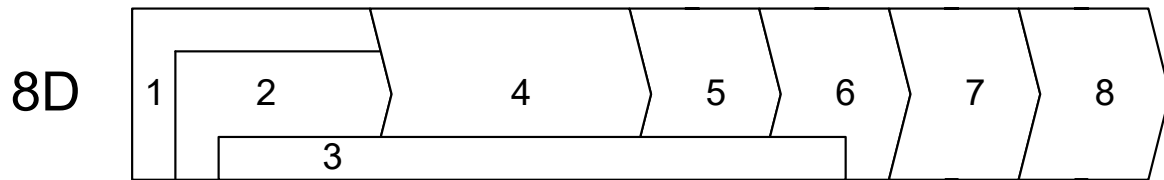


Figure 9: Overlap of Different Steps of 8D (Koerv, Overview Training, Problem Solving with 8D, Blocking, Rework, 2021)

D1: Establishing Problem Solving Team / Project

D2: Problem Description

D3: Containment Actions

D4: Cause and Effect Analysis

D5: Defining Corrective Actions and Proving Effectiveness

D6: Implementing Corrective Actions and Tracking Effectiveness

D7: Establishing Preventive Actions

D8: Final Meeting

Problem description: Limiting, unambiguous structuring and description of the problem as well as the associated symptoms and boundary conditions (result: fundamental problem). (Koerv, Problem Solving Process & Serious Complaints, 2022)

Fundamental (real) problem: Limiting description of the problem (chronologically, locally, quantitatively, etc.) with differentiation of the areas not affected by the problem also applied. (Koerv, Problem Solving, Blocking and Rework, 2023)

Technical root cause: By local (why?) and functional (how?) relations proved, fundamental interaction of causing conditions on the problem / fundamental problem. (Koerv, Problem Solving, Blocking and Rework, 2023)

Managerial root cause: Reasons for admitting the interaction of causing conditions in the business process (e.g. Out of tolerance parts were received due to a decision by local purchasing to bring on a new supplier (with a lower cost part) without following the Bosch Supplier qualification process). (Koerv, Problem Solving Process & Serious Complaints, 2022)

Preventive action: Action to eliminate the cause of a potential nonconformity or other undesirable potential situation. (Koerv, Problem Solving Process & Serious Complaints, 2022)

Containment action: Temporary measures, which keep the problem away from the customer / protect the customer from further incorrect products. (Koerv, Product Blocking/Hold Procedure, 2021)

Corrective action: Action to eliminate the root cause of a detected nonconformity or other undesirable situation. (Koerv, Problem Solving Process & Serious Complaints, 2022)

Quality Manager: Refers to the applicable BU or MP QMM/Quality function (or their delegate) who has responsibility for product quality. (Koerv, Problem Solving Process & Serious Complaints, 2022)

Quality Management: Coordinated activities to direct and control an organization with regard to quality. (ISO 9001: Requirements, 2015)

Product Blocking / Hold Procedure: When a non-conforming product is identified or suspected, shipping and / or manufacturing block may be initiated to avoid delivery to customers, to keep the product within the CDC and/or to prevent additional production of potentially non-conforming products. (Koerv, Problem Solving, Blocking and Rework, 2023)

Direct Cause: Selected and obviously valued causes for the fundamental problem (including target, actual, deviation, evidence) by prioritizing the possible causes and checking their plausibility. (Koerv, Problem Solving Process & Serious Complaints, 2022)

Rework: Action on a nonconforming product to make it conform to the requirements.

•NOTE: Unlike rework, repair can affect or change parts of the nonconforming product.
(ISO 9001: Requirements, 2015)

Rework: action on a nonconforming product or service to make it conform to the requirements.
(Elmar, 2019)

Rework Initiator/Coordinator: Individual identified within the organization to champion individual rework requirements. (Koerv, Rework Management Process, 2021)

Repair: Action on a nonconforming product to make it acceptable for the intended use.

•NOTE 1: Repair includes remedial action taken on a previously conforming product to restore it for use, for example as part of maintenance.

•NOTE 2: Unlike rework, repair can affect or change parts of the nonconforming product.
(ISO 9001: Requirements, 2015)

Repair: action on a nonconforming product or service to make it acceptable for the intended use. (Elmar, 2019)

Concession: Permission to use or release a product that does not conform to specified requirements.

•NOTE: A concession is generally limited to the delivery of a product that has nonconforming characteristics within specified limits for an agreed time or quantity of that product.
(ISO 9001: Requirements, 2015)

Quality Gate (QG): The problem can be resolved by monitoring the quality of project results and by steering a project at certain major points (so-called Quality Gates). At each Quality Gate the project results are checked against predefined criteria being derived from carefully chosen metrics. (Flohr, 2008)

4 Criticalities need improvement actions

Lean and straight to the point documentation(illustration) of business processes always helps an organization to save time and money and effort, especially if the document is going to be spread worldwide in a large scale. On the other hand, non-lean documents affect the organization dramatically in several aspects and prevents the improvement of management system. Therefore, assessing the BPM documentation in terms of being lean, is a great step to improve the efficiency of process management along the whole organization.

Most manufacturers embrace lean principles for production processes, yet these same companies usually fail to implement lean across the rest of their organizations. Two-thirds of manufacturers have made limited progress in applying their improvement approaches, with just 50 percent (median) of their employees fully engaged. Even among lean manufacturers, only 58 percent enjoy extensive or complete adoption of lean, with just 60 percent of their employees fully engaged. In terms of lean document processes for manufacturers, there is still plenty of opportunity to improve. (MPI Group, 2015)

Lean began on the plant floor, but savvy leaders are implementing it in processes throughout their organizations, in departments ranging from finance to sales to customer service. These executives know that inefficient administrative processes can be just as damaging as poor manufacturing practices — and that bridging the “lean gap” throughout their organizations can deliver major improvements in productivity, customer service, and profitability.

This lean gap is particularly striking in document workflows — the seemingly routine process of creating, processing, and archiving the papers, forms, and digital archives that underpin most business transactions. Companies that don't adopt lean document processes hamstring productivity and put corporate knowledge at risk. They also fail to take advantage of lean improvements in safeguarding documents, making workflows more efficient, and lowering document-management costs (Canon, 2016).

Manufacturers have a particularly difficult time with document processes, wrestling with overflowing filing cabinets and growing databases full of product designs, trade secrets, personnel files, compliance audits, financial statements, and legal records. Yet unlike the efficient flow of goods on the plant floor, creating and sharing documents often involve a maze of bottlenecks that can bring business to a halt, including:

- Engineers unable to find customer specifications for a previous generation of product,
- Procurement personnel unable to see price quotes for all regions and facilities,
- Quality-control staff unable to locate proof of compliance for supplier materials,
- Logistics personnel unable to supply documentation required for customs,

- Human resources staff unable to rapidly disseminate policies and plans to specific groups of employees,
- Marketing teams uncertain if they're using the current version of a document or a version that has been cleared by the legal department,
- Senior leaders unaware that documents need their review and approval, and
- Customer service representatives unaware if price lists have expired.

(Canon, 2016)

In this scientific work, as previously mentioned, Bosch Building Technology is a case study, therefore, in the old version of quality management processes the pain points and criticalities of non-lean procedures/ documents are illustrated. Then, the next chapter will present the lean proposal for each of the procedures and its documentation.

The quality management procedures are:

6. 8D Problem Solving
7. Blocking
8. Rework
9. Concession

Which are shaping a larger general process called: complaint procedure (complaints from both internal and external customers).

4.1 Lean criteria for documents

Throughout the LEAN documentation, teams must ensure that the context is well arranged, easy to read, and adequate while focusing on identifying, analyzing, and controlling the documentation wastes. This is where benefits of both agile and LEAN concepts can be leveraged during documentation. (Kellton, 2018) To consider a document as lean, there are several criteria which is based on the outcomes of several group meetings with the managers of quality department. In the following some of them are mentioned and explained:

Detail Level/ Added Value: The content of lean document should be written in a way that provides the most added value in an optimized level of details. Also, a lean document must avoid redundancy of information. One of the most repeated problems of non-lean documents is that there is too much formation redundancy throughout the whole document. Also, redundancy of the same content not only in one document, but also among a group of

documents which are strongly related to each other like a chain – in this case, 8D problem solving, Blocking, Rework- is also considered a non-lean approach.

UX: Easy to read, maintain and propagate. A lean document must have a high User Experience level so that it is easy to read in terms of text -story telling- and graphical figures. Also, so much non-value-added information in the document, prevents the main content to be readable easily. The applicability of a lean document must be straight forward to the point. Graphs and flowcharts must be easily understandable and simplified as much as possible.

4.2 Lean criteria for processes

To consider a process as lean, there are several criteria which is based on the outcomes of several group meetings with the managers of quality department. In the following some of them are mentioned and explained:

WHAT vs. HOW: In lean process management documents, describing “what” the steps are, is enough and add adequate value, therefore explanation about “how” those steps must be done, is out of scope of a process management document. A work instruction attachment can cover those “how” explanations.

Governance/ Autonomy wise: one of the main and important aspects of a lean process management, is to balance the governance and autonomy. Procedures with detailed instructions, do not let users to have enough autonomy and make the process so rigid, and consequently the chance of implementing minor changes by the users to improve the process, significantly decrease.

CIP/Updatibility: A lean processes is a process with a logical and clean structure that can be modified and updated very easily without misleading the user. Moreover, too many numbers of attachments as sub documents for each individual procedure in this scientific work is considered as a sign of non-lean documentation for a procedure.

Examples of such kind of repetition among documents are as the following:

There are too many abbreviations that are mentioned separately in these three documents that can be merged as it will be shown in the next chapter. There are some specific same chapters that are standard for all these documents, and they are mandatory, so they are mentioned separately and can be avoided by merging these procedures. Reference documents are also redundant.

To have a clearer understanding of the conditions of non-lean documents, an overview of the old procedures is mentioned in the following.

4.3 “Problem solving and complaints procedure” Old Version

Overview

This document was initially created on 2011 in Bosch BT and it was updated last time in August 2022. The old version of this document contains 13 pages and has 5 attachments. In the following,

the chapters and related pain points will be discussed.

(Koerv, Problem Solving Process & Serious Complaints, 2022)

Note: All sentences with light blue colour in tables, are new context in the old version compared to its previous version.

Chapter 1 and 2 are titled as “Purpose and Description” and “Scope and Applicability” respectively. These are regular standard chapters for all central documents of procedures. These two chapters almost will be kept the same also in the proposal of new lean version.

Chapter 3 is titled as “Definition and Terms” in the form of a table containing 42 terms or abbreviation. This table contains too much information and redundancy of the same abbreviation with the Blocking and rework procedures is considerable. So, this table needs refinery action after merging those 3 procedures to this one.

Chapter 4 is titled as “Roles and Qualification”. In this chapter users are referenced to a large attachment called “BT PS Competence Matrix” that really does not help them in the very first place and they have to read that attachment carefully to be able to use the problem solving procedure. Therefore, a better lean approach for this chapter is needed in a way that provides a summary of main roles and related tasks, then afterward if still more details are required, users can go for the attachment and study the details.

Since the old version of “Competence Matrix” is a large file and making a clear screenshot of it is not possible, here it is not possible to show the old version but in the lean version of problem solving, this attachment also will be modified and in the related chapter it will be shown.

(Koerv, BTCompetent Matrix PS 8D, 2021)

Chapter 5 is titled as “activity description”, and it has several sub chapters as following:

1. Decision to Start an 8D

This subchapter is considered as a redundancy of information since in the TRACI table, the steps of 8D procedures including the “decision” is mentioned.

Moreover, the attachment mentioned in this chapter is going to be modified as a lean subdocument. This attachment is called “8D initiation Criteria”.

(Koerv, 8D Initiation Criteria, 2020)

2. Notification of BT/QM and Involvement of FQB (TRACI step 9)

This subchapter is a new section in this document regarding the previous version and it will be kept in the lean version.

3. Definition of Risk Levels

This table is correct from the content point of view but UX wise, it is not the best way it can be presented, since there is only “yes” options diagonally. So, it will be modified in the next version. See Table 1: Quality Risk Level.

Risk Level Risk Description	Serious Quality Issue (SQI)	Major Quality Issue (MQI)	Quality Issue (QI)
Serious quality issue according CDQ .	Yes	No	No
Customer and/or standard lead-time to customer is affected	n/a	Yes	No
Root Cause is unknown and customer is not affected.	n/a	No	Yes

Table 1: Quality Risk Level (Koerv, Problem Solving Process & Serious Complaints, 2022)

4. Problem Solving Method with 8D Description

This subchapter contains too many references with few explanations about each D step itself. See Table 2: 8D Problem Solving Steps - the old version.

D Step	Description	Additional References
8D Initiation	8D Initiation	<p>8D Initiation Criteria per role</p> <p>Specific role procedures:</p> <p>Customer Interfaces:</p> <p>Complaint Process</p> <p>For Tech Support:</p> <p>Incident Handling</p> <p>For Repair Handling:</p> <p>Repair Process</p> <p>For BT-IE:</p> <p>Support Handling</p> <p>For BT-IN Climatec:</p> <p>chapter 5.4.2</p>
D1	Establishing Problem Solving Team	BT Competence Matrix PS / 8D
D2	Problem Description	<p>Definition of Risk Levels (chapter 4.4.3)</p> <p>For SQI: Risk Assessment (RAPEX)</p> <p>For MQI: Handling of Risks and Opportunities (according FMEA)</p>
D3	Containment Actions	<p><i>Future Customers:</i></p> <ul style="list-style-type: none"> Blocking/Hold Procedure and Rework Management Procedure <p><i>Existing Customers:</i></p> <ul style="list-style-type: none"> <i>BTPD 10027 Service Documentation – documentation to hand over defined actions to ASA</i> <i>In case of Preventive Recall: Handling must be organized with service project leader – recalled products with no failure found must be marked as “Do not count” see: IRIS Code Condition Y</i> <i>Commercial Return handling</i>
D4	Cause and Effect Analysis	<p>Definition of Risk Levels (chapter 4.4.3)</p> <p>For SQI: Risk Assessment (RAPEX)</p> <p>For MQI: Handling of Risks and Opportunities (according FMEA)</p>
D5	Defining Corrective Actions and Proving Effectiveness	
D6	Implementing Corrective Actions and Tracking Effectiveness	
D7	Establishing Preventive Actions and Lessons Learned	Lessons Learned process
D8	Final Meeting	<p>“8D Evaluation Tool”</p> <p>For BU/Plant QI/MQI/SQI: Optional (select for assessment team “Self-Assessment”)</p> <p>For 8D Peer Evaluation: MQI and SQI: mandatory, see 6.2 TRAC Table 8D Peer Evaluation (select for assessment team “8D Expert or Similar”)</p>

Table 2: 8D Problem Solving Steps (Koerv, Problem Solving Process & Serious Complaints, 2022)

Chapter 6 is titled as “8D Documentation and CAR Attachments”.

This chapter is more like a user manual for IT tools that users have to follow during the problem solving procedure and it also contains too much information and in some sections not added value data, e.g., some of the references. See Table 3.



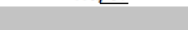
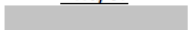
Category	Remarks	Product			Audit		
		QI	Major*	Serious*	QI	Major	
CAR Type	Documented in	8D	8D	8D	PA or 8D	8D	
8D Report Problem Solving Sheet (PSS) ** ***	 Attached as: *.XLS or *.PDF	Optional	Required	Required	Optional	Optional	
Lessons Learned Report	 – Attachment 1 Attached as: *.DOC or *.PDF and Uploaded in FEBER	In Case of: Recurrence Top failure Transferrable finding Customer escalation others			Required	Optional	Required
Evaluation Form	8D Evaluation Tool Status: Submitted	Optional	Optional: BU/Plant “Self Assessment” Required: 8D peer evaluation “8D Expert or similar”	Optional: BU/Plant “Self Assessment” Required: 8D peer evaluation “8D Expert or similar”	Optional	Required: BU/Plant “Self Assessment”	
Final Meeting	CAR System Sponsor section field “Reporting” with date and participants and/or  Attached as: *.PDF	Optional	Required	Required	Optional	Required	
Signature/ Approval by Sponsor	CAR system approval by sponsor and/or  Signed & attached as: *.PDF	Required ***	Required	Required	Optional	Required	

Table 3: 8D Documentation and CAR Attachments (Koerv, Problem Solving Process & Serious Complaints, 2022)

Chapter 7 is titled as “Communication and Processing Time of the 8D Steps”.

This chapter is not practical that much in term of UX. Also, since it is explaining in detail, it is not considered lean. Moreover, it seems to be a user manual rather than a processes management content. So, it would be better to have the related content inside the TRACI table.

Chapter 8 is titled as “Complaints against external Suppliers”.

The aim of this chapter is to describe different types of complaints and related user manual to cope with each one of them, but the content is not clean and is not in a logical order. Moreover, this chapter should have been located earlier in the document. Overall, the structure of this chapter is not understandable for the user and it is one of the worst cases regarding the UX. In our new lean version this chapter would be one of the early chapters with a standard structure covering different types of complaints.

Chapter 9 is titled as “Management Review Board - Corrective Action Board Meeting (CAB)”

This chapter contains important information, but also plenty of not needed content. So, in the new proposal there will be only the content with highest added value.

Chapter 10 is titled as “Method Description” and it is only the introduction of another sub document named “Booklet 16” that can help the users to implement the 8D methodology for the problem solving. In the lean version, the reference to this booklet will be mentioned in the related step in TRACI table.

Chapter 11, 15 and 16 are titled as “Confidentiality, Product liability and Records retention”, “IT Tools” and “Process Indicator” respectively that have not been changed, since they are standard chapters for the procedures. They will be moved to the end of document in the lean version, since they are common chapters for all three processes that are going to be merged.

Chapter 12 is titled as “TRACI Table 8D Process”. This chapter is the backbone of the 8D problem solving procedure. The steps which are explained here are the main stages of the problem solving procedure. Also, Responsible people or departments are mentioned at the right side of this table. Some sub steps are also visible in this table that makes it more complicated to read and understand. One main problem of this TRACI table is that the D steps are not mentioned clearly for some of the rows of the table. In the lean proposal, the design and layout of this table will be changed, and the responsible people would be modified.

See Table 4: 8D Problem Solving TRACI Table.

	T = Task R = Responsible A = Authority C = Consultation () = If required Activity:	Business Unit MKP	Business Unit ENG	Quality Manager	8D team leader	Issuer / Approver	Receiving Department	Logistics / Planner	8D Sponsor	QMM / Approver
1	Customer / Internal Contact checks issue/ticket for 8D criteria MQI/SQI and escalates if criteria fulfilled						R			
2	Assesses risk of customer complaint, incident of individual and systemic issues						R			
3	Decision 8D criteria fulfilled yes/no aligned in the team	C	C	C			R			
4	Selection 8D Sponsor	C	C	C			R			
5	Enters request into the CAR database and assigns 8D Sponsor. CAR is issued & 8D Sponsor receives e-mail notification. 8D Step 1			R		T				
6	8D Sponsors confirms 8D and assigns 8D team leader and 8D team - 8D Step 1 according Competence Matrix BTCD				C				R	
7	Assesses risk, need for team assignment and immediate containment requirements. (8D Step 1)			C	R				C	
8	Is this a serious 8D SQI according to CDQ or a MQI according chapter 5.4 ?		C	A	R					
9	Notifies BT/QM according chapter 5.2			R						
10	Is Block required?			A	R			C		
11	If yes, notifies quality & follows Blocking Process (BTPD)				R					
12	Identifies & implements Immediate Containment Actions (8D Step 3).				R					
13	Identifies/Verifies Root Cause (for the problem & escape) and verifies/updates risk assessment. (8D Step 4)			(C)	R				(C)	
14	Defines potential corrective actions and provides proof of effectiveness. (8D Step 5)			(C)	R				(C)	
15	Introduces permanent corrective actions and tracks effectiveness (8D Step 6)			(C)	R				(C)	
16	Identifies and communicates Preventive Actions/Lessons Learned & selects "answered" button on CAR to notify QMM to review the identified actions. (8D Step 7)				R					
17	Reviews/approves CAR for effective problem-solving methodology, all requirements met, etc. Optional: Performs 8D evaluation & publishes score. (CAR tool: entry % value, 8D evaluation tool: select assessment team: "self assessment") (8D Step 8)									R
18	If approved, CAR moves to Pending Issuer Approval status (Step 2/4). If rejected CAR returns to Issued status (Step 1/4). (8D Step 8)									R
19	Reviews/Approves CAR from the customer's point of view. (8D Step 8)					R				
20	If approved, CAR Status = "Approved Pending Final Closure (Step 3/4)". If rejected, CAR returns to Issued status (Step 1/4). (8D Step 8)								R	
21	Performs final review of CAR for closure. If Major or Serious CAR, organizes closing meeting for review of evaluation. (8D Step 8)				C				R	
22	Closes CAR. Status moved to "Approved (Step 4/4)". (8D Step 8)								R	
23	If CAR originated from a customer complaint, notifies complaint issuer of resolution. (8D Step 8)									R

Table 4: 8D Problem Solving TRACI Table (Koerv, Problem Solving Process & Serious Complaints, 2022)

Chapter 13 is titled as “TRACI Table 8D Peer Evaluation”. Except the right side of the table that is related to responsibilities, in the new lean version nothing will be change. So, this table will be present in the lean version with the same design.

See Table 5: 8D Peer Evaluation TRACI Table.

	T = Task R = Responsible A = Authority C = Consultation I = Information () = If required Activity:	8D Sponsor	8D team leader	8D team members	QMM / Approver	BT Divisional PS Coach	Peer Evaluator (PS Expert)	PS Coordinator
1	Selects CAR with risk level MQI/SQI after CAR is set to Step 2 “QMM approval” and gets confirmation for peer evaluation from PS Coordinator					R		A
2	Assigns 8D independent peer evaluator (PS Experts) for approved MQI/SQI and informs manager of selected PS Expert about the assigned task					R		I
3	Evaluates 8D and documents in 8D evaluation tool (select assessment team: “8D Expert or similar”). Notifies PS coordinator about finished 8D evaluation.						R	I
4	Invites for review meeting 8D Sponsor, 8D team leader, 8D team members, QMM Approver	I	I	I	I		I	R
5	Explains 8D evaluation and gives feedback to 8D sponsor, 8D team leader, 8D team members, QMM Approver. PS coordinator moderates’ discussion.	I	I	I	I		R	T
6	Notifies finished 8D evaluation and review meeting to BT Divisional PS Coach					I		R
7	Next CAB meeting: Reports important results and if needed starts internal improvement activities for future 8D	C						R
8	3 Monthly: Invites peer evaluators (PS Experts) for alignment meeting for leveling, common understanding of 8D requirements and spot checks of 8D evaluations					R	I	

Table 5: 8D Peer Evaluation TRACI Table (Koerv, Problem Solving Process & Serious Complaints, 2022)

Chapter 14 is titled as “Responsibility for this Process/ Process Document” and there is no added value for this chapter since we are presenting the responsible departments or people for the procedure. Moreover, in the first page of document the author and the approver are mentioned. So, there will not be such a chapter in the lean version.

Chapter 17 is titled as “References” and is also a standard chapter for all procedures. This reference table will be merged with the same table in two other procedures and after refining the redundant information it will be only one reference table.

4.4 “Product Blocking / Hold Procedure” Old Version Overview

This document was initially created on 2003 in Bosch BT and it was updated last time in January 2021. The old version of this document contains 18 pages. In the following the chapters and related pain points will be discussed. This procedure supports D3 in the 8D process used in 8D Problem Solving Procedure and describes how blocks initiated from the specific IT tool are managed and communicated.

(Koerv, Product Blocking/Hold Procedure, 2021)

Chapters 1 and 2 are titled as “purpose and description” and “scope and applicability” respectively and they are standard chapters for all processes. So, no change is done.

Chapter 3 is titled as “Definition and Terms” which is again a standard chapter for all processes but as the content of this procedure is going to be changed and also to be merged with other processes, the table of abbreviation will be refined and created from the scratch in the new lean version.

Chapter 4 is titled as “Blocking and Un-Blocking Procedure Decision to Start an 8D” and this chapter is all about a flowchart explaining the procedure. Since in next chapters there is a TRACI table to explain the process step by step, this flow chart is not needed any more and now adays in new approach to document the processes flowcharts are not really welcomed as before. So somehow it is considered as redundant information and old fashioned. The proposal is to remove it completely later for the new lean version. This chapter has several sub chapters which are explaining the stages of the blocking procedure with respect to this flowchart. Also, some chapters cover the roles and responsibilities of blocking procedure. This information about the roles will be in a simple table in the new version together with the other roles for other procedures. Moreover, there are some information regarding the pre blocking meeting that will be moved to the TRACI table in the new procedure. Types of Blocking are also mentioned under this chapter very detailed which is not necessary. So, in the lean proposal types of blocks will be presented in a simple table which has a higher UX compared to current long definitions.

See Figure 11: Product Blocking / Hold Procedure Flowchart.

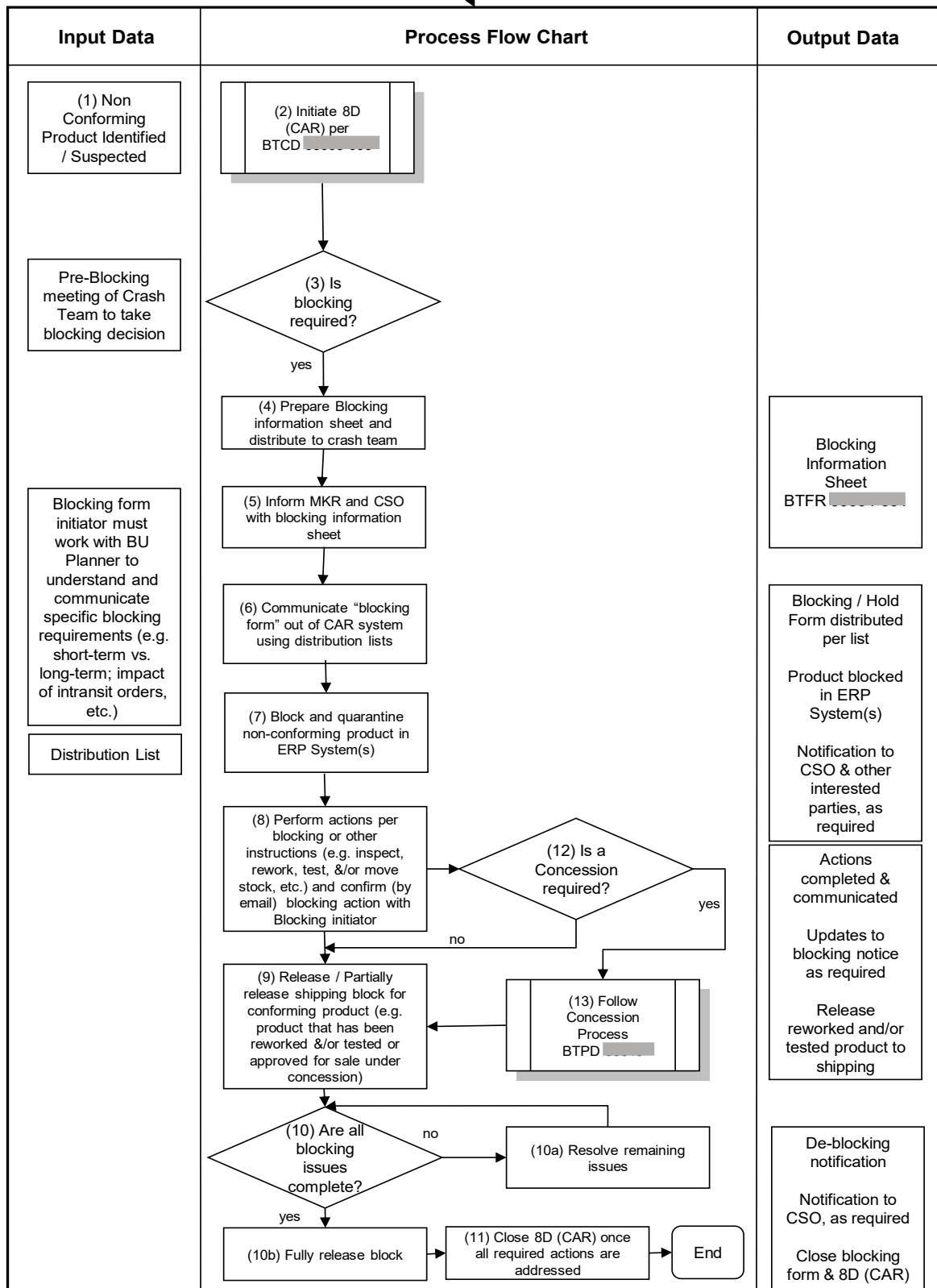


Figure 11: Product Blocking / Hold Procedure Flowchart (Koerv, Product Blocking/Hold Procedure, 2021)

In this chapter there is also a subsection covering the distribution list which is used in the related IT tool for blocking procedure in the organization. This is a large table of different affected areas and the responsible people who can be involved regarding each area. All in all, since the goal of the new lean version is to give more autonomy to the users around the organization, our proposal is to remove this distribution list.

Moreover, this distribution list is considered as a Working Instruction (WI) which is inside a Quality Management Process. Since in the lean version contents must describe the “what” and not “how” this part of the document together with other subsections related to describing the “how”, will be shifted into the new working instruction that is an attachment of the new lean version of 8D problem solving, blocking and rework.

See Table 6: Product Blocking / Hold Procedure Distribution List

Distribution Lists → (X) = If required Functions to be included ↓	Block ASA/Service	Block BU (various)	Block CDC (various)	Block RSO (Various)	Block Plant (Various)
Affected ASA/Service Associates (Need to be included in ALL CDC blocks)	X				
Affected BU Development Manager(s)		X			
Affected BU Manager(s)		X			
Affected BU Planner(s)		X			
Affected BU Finance Manager(s)		X	(X)		
Affected Product Manager(s)		X			
Affected Purchasing Manager(s)		X			X
Affected Logistics Manager(s)		X	X		
Affected CDC (Warehouse) Manager(s)			X		
Affected Stock Integrity Coordinator(s)			X		
Affected Customer Svc / Order Desk Mgrs.				X	
Affected Marketing & Sales Manager(s)				X	
Affected National Sales Manager(s)*				X	
Affected Regional Sales Manager(s)				X	
Affected Technical Support Manager(s)				X	
Affected Factory Manager(s)					X
Affected Factory Planner(s)					X
Affected Quality Manager(s)		X	X	X	X
CMDM team (e-mail: st.cmdm@de.bosch.com)			X		X

Table 6: Product Blocking / Hold Procedure Distribution List (Koerv, Product Blocking/Hold Procedure, 2021)

Chapter 5 is titled as “TRACI table”. The main pain point of this table is that there are several sub steps. Also, the description on each step is not enough, instead there are some separate chapters explaining the steps. Also not having a unique responsibility for one responsible person in the table, like having “T” and “R” for a same responsible person is vague and unclear. In addition, some steps do not have any responsibilities at the right side and they are more like a title for sub steps, which is far from how TRACI works. So, it is a headache for the user. The proposal is to bring the explanatory chapters all in one place in a new TRACI table in the lean version and only provide one unique responsibility for each person or department.

See Table 7: Product Blocking / Hold Procedure TRACI Table

T = Task R = Responsible A = Authority C = Consultation I = Information () = If authorized Activity:	BU VP = BU Manager	Product Manager	BU Planner or Operational	Marketing & Sales	Distribution Center	Engineering	Quality Manager or authorized designee	Manufacturing plant	Receiving Department	8D Team Leader / Crash	Team Leader	8D Sponsor	CMDM team	ASA/Service
1. Non-conforming product identified / suspected or Product Upgrade requires existing product to be reworked									R					
2. Initiate 8D (CAR) per BTCD-()		C				C	C		R					
3. Is Block required?	I	C		C		C	A		C	R	C			
4. Pre Blocking Meeting, draft “blocking information form” send to core crash team (Check all items impacted e.g. production, shipping of current stock, shipping of “in-transit” stock, shipping of new orders)		C	C	C			C			T/R				
5. Inform Marketing, Sales and CSOs with blocking information form		T / R												

T = Task R = Responsible A = Authority C = Consultation I = Information () = If authorized Activity:	BU VP = BU Manager	Product Manager	BU Planner or Operational	Marketing & Sales	Distribution Center	Engineering	Quality Manager or authorized designee	Manufacturing plant	Receiving Department	8D Team Leader / Crash	Team Leader	8D Sponsor	CMDM team	ASA/Service
6. Communicate blocking form (CAR system) using blocking distribution lists ----- Notifies CSO		C	T/R	C			C			T/R				
7. Block & Quarantine Product in ERP Systems														
<ul style="list-style-type: none"> Set production block in SAP 													T/R	
<ul style="list-style-type: none"> Set production block in other ERP systems (if applicable) 								T/R						
<ul style="list-style-type: none"> Set CDC shipping block in SAP (Activate Lock Code within WMOS) or other ERP system ("full" and "partial" shipping blocks) 					T/R								T/R	
<ul style="list-style-type: none"> Set CSO shipping block in SAP ("full" and "partial" shipping blocks) 			T/R											
<ul style="list-style-type: none"> Set "full" shipping block in SAP (PC4) to block new sales orders 													T/R	
<ul style="list-style-type: none"> Set inspection flag for all "in-transit" orders in SAP 			T/R											
<ul style="list-style-type: none"> Set inspection flag for all new purchase orders in SAP 													T/R	

T = Task R = Responsible A = Authority C = Consultation I = Information () = If authorized Activity:	BU VP = BU Manager	Product Manager	BU Planner or Operational	Marketing & Sales	Distribution Center	Engineering	Quality Manager or authorized designee	Manufacturing plant	Receiving Department	8D Team Leader / Crash	Team Leader	8D Sponsor	CMDM team	ASA/Service
<ul style="list-style-type: none"> Block product in other ERP systems 					T/R									
8. Performs actions per blocking or other instructions (e.g. inspect, rework, test, &/or move stock etc.) and confirms blocking action with blocking initiator.			C		T/R			T/R						T/R
9. Partially release shipping block for non-defective product (e.g. product that has been reworked and/or tested or approved for sale under concession). Send updated Blocking Notice			T/R		T/R		C			T/R				
10a. Determine if all blocking issues complete & resolve remaining issues.			C		C		C	C		T/R				C
10b. Fully Release shipping and/or production block <ul style="list-style-type: none"> Send De-Blocking Notice Release block in SAP & in other ERP systems (same as 5a) Notifies CSO 			T/R	--	T/R		C			T/R			--	--
11. Closes 8D (CAR) once all required actions are addressed and completed.										T/R				
12. Is concession warranted?	C	C	C	C			A			T/R				

T = Task R = Responsible A = Authority C = Consultation I = Information () = If authorized Activity:	BU VP = BU Manager	Product Manager	BU Planner or Operational	Marketing & Sales	Distribution Center	Engineering	Quality Manager or authorized designee	Manufacturing plant	Receiving Department	8D Team Leader / Crash	Team Leader	8D Sponsor	CMDM team	ASA/Service
13 Follow concession process 'BTPD- [redacted]'							C			T/R				

Table 7: Product Blocking / Hold Procedure TRACI Table (Koerv, Product Blocking/Hold Procedure, 2021)

Chapter 6 is titled as “Method Description” which is only addressing to booklet 16, a guid for 8D Problem solving. So, this chapter will also be removed.

The rest of the chapters are standard chapters which will be kept in the new lean version as well.

4.5 “Rework Management Processes” Old Version Overview

This document was initially created on 2008 in Bosch BT, and it was updated last time in January 2021. The old version of this document contains 10 pages. In the following, the Chapters and related pain points will be discussed. This procedure also has 3 attachments: Rework and/or Inspection Instructions Template, Rework and/or Scrap Authorization & Instructions Form (RAN), and Handling of rework orders. The purpose of this process is to document the responsibilities of concerned departments with regard to the specification, approval, communication and deployment of product rework at Manufacturing Plants (MP), Continental Distribution Centers (CDC), Country Sales Organizations (CSO), Business Units (BU), ASA and third parties.

(Koerv, Rework Management Process, 2021)

Chapters 1 is titled as “Purpose and Description” as a standard chapter for all processes. So, no change is done.

There is no chapter regarding “Scope and Applicability”, so a standard chapter is missing in this procedure. In the lean version it would be present.

Chapter 2 is titled as “Definition and Terms” and it is also only a title without any table. So, also for related abbreviation of rework, there would be a table in the lean version.

Chapter 3 is titled as “Procedure Information” which has 17 sub chapters for explaining the whole procedure. First of all, it is not user-friendly at all to have so many subchapters, and secondly, the information that have been provided in these subchapters are from variety of different subjects and from the lea point of view, the order of content is not satisfying. Again, here in this document there is a flowchart that considering the TRACI table in the next chapters, it is kind of redundancy of information without added value. Additionally, in few numbers of these 17 subchapters there are some contents that is more like a user manual than a process management. Their content is more about how to use the specific IT tool for running the rework through the organization. So, in the lean version they will shift to a Working Instruction (WI). The rest of the subchapter are regarding different steps of implementing the rework procedure. So as before, the proposal for these explanatory chapters is to move them to the TRACI table to have all the steps in one place. Moreover, there are information regarding

defining the roles for different tasks during the rework in between these subchapters, but the proposal is to have all roles and qualifications for all three procedures of 8D problem solving, blocking, and rework, in one table in the integrated document. Therefore, this subchapter will be also deleted.

One important subchapter of the old version is covering the release procedure after rework is done. Since release is a part of blocking procedure, in the new lean version the decision is to keep this step inside the TRACI table of the blocking procedure.

Following is Figure 12: Rework Management Processes Flowchart:

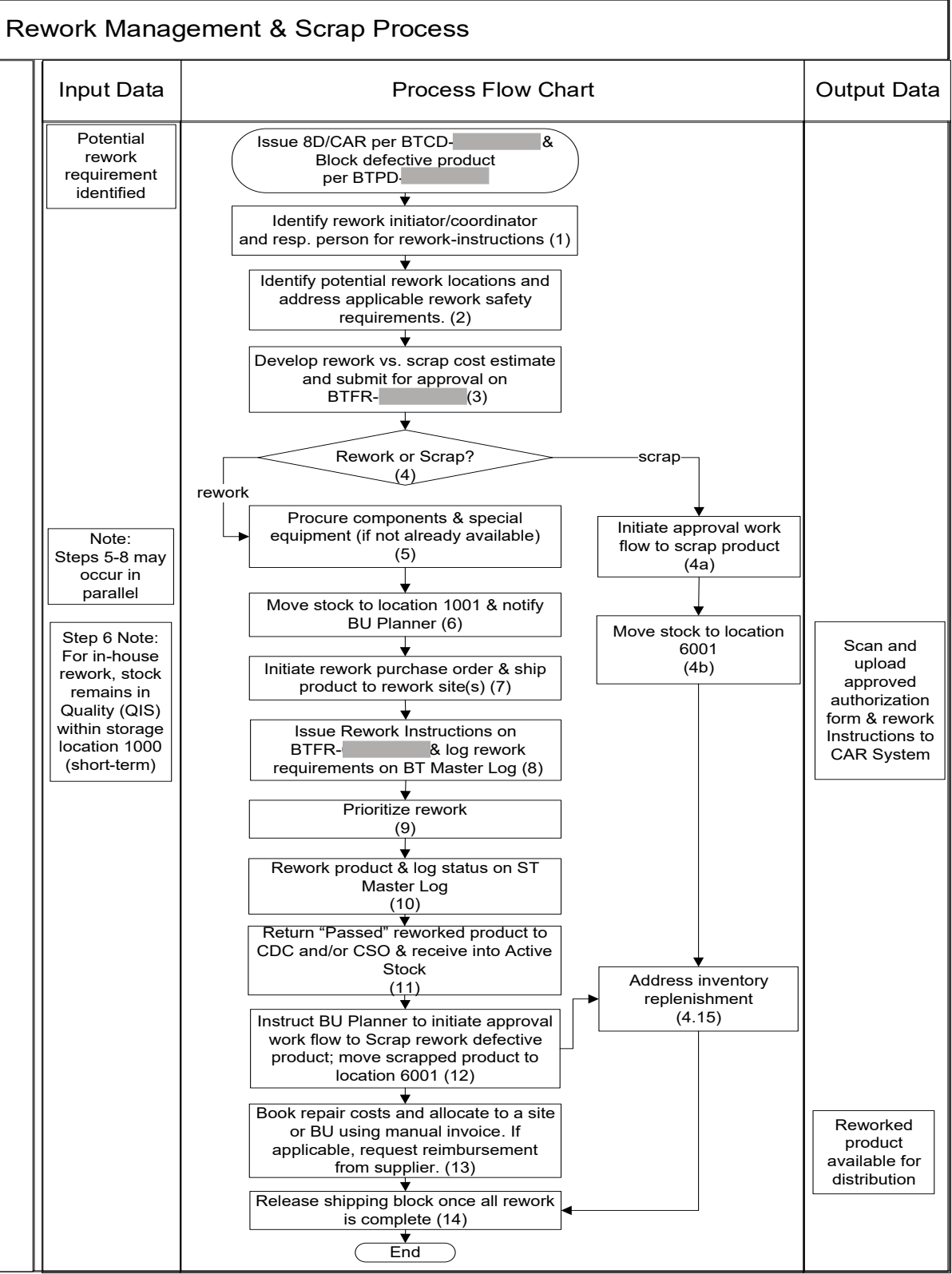


Figure 12: Rework Management Processes Flowchart (Koerv, Rework Management Process, 2021)

Chapter 4 is titled as “TRACI Table”. See Table 8.

#	<p>T = Task – Contributes to the work R = Responsible – Organizes, initiates, pushes A = Authority – Ultimate decision or tie breaker C = Consultation – Who should be consulted prior to a final decision or action I = Information</p> <p>Activity:</p>	VP BU	Quality Manager	MFE	BU Planner	Engineering	Product Manager	MP/CLP + Original MP / Purchasing	BU Controlling	CDC and/or CSO	Rework Initiator/Coordinator	Site Coordinator	8D Team Leader
1.	Identify Rework Initiator/Coordinator based on type of rework, root cause, identify responsible person for rework-instructions	A	C		C	C	C						T/R
2.	Identify potential rework location(s) and address applicable rework safety requirements. <ul style="list-style-type: none"> The rework location decision is based on the type of rework to be done, capability of people, availability of equipment, capacity, shipping costs, import/export requirements, etc. 		C	C	C	C	T	T		C	R	C	C
3.	Develop Rework vs. Scrap estimate and submit for approval. According to local signature authorization levels.		C	C	C		C	C		C	R		C
4.	Approve Rework vs. Scrap		T				T		A		R		I
4a	If decision is made to scrap product, initiates approval work flow				R								
4b	Moves stock to location 6001.									R			
5.	If rework is approved, (a) Procures special equipment (e.g. fixtures, programming tools, safety equipment, test equipment, etc.) if required and arranges shipment to site. Also provides shipment delivery and tracking information to Rework Initiator/Coordinator. (b) Procures materials, if required, and arranges shipment to rework site. Also provides shipment delivery and tracking information to Rework Initiator/Coordinator.					R				T	T		
6.	Moves stock to location 1001 (1101 at CDC Greer) and notifies BU Planner.									R			
7.	Initiates order within SAP (a) Creates Rework Purchase Order & corresponding Outbound Delivery within SAP (b) Ships product to rework site(s)				R								
8.	Issues Rework Instructions on BTFR-00027-001 and logs rework requirements on BT Master log.										R		
9.	Prioritizes rework with guidance from management.											R	
10.	Reworks product per Rework Instructions, provides updates to Rework Initiator/Coordinator & logs status on BT Master Log.											R	
11.	Returns “Passed” reworked product to CDC and/or CSO Receives product into Active Stock.									R		R	
12.	Instructs BU Planner to initiate eWorks approval to scrap defective product (rework failures) by providing an updated authorization form. Upon approval of eWorks flow, closes open rework PO for “bad” product by creating an unplanned booking on rework PO to location 6001. Indicates that inventory can be closed.				T						R		
13.	Books rework costs and allocate to a site or BU using manual invoice. Contacts supplier, if applicable, for reimbursement for rework costs.							R		R			
14.	Releases shipping block once all rework is complete.										R		C
15.	Takes action to address inventory replenishment				R								

Table 8: Rework Management Processes TRACI Table (Koerv, Rework Management Process, 2021)

The main pain point of this table is that there are several sub steps. Also, the description on each step is not enough and instead there are some separate chapters explaining the steps. Also not having a unique responsibility for one responsible person in the table, like having “T” and “R” for a same responsible person is vague and unclear. Almost the same problems with the TRACI of Blocking Process, so it is a headache for the user. The proposal is to bring the explanatory chapters all in one place in a new TRACI table in the lean version and only provide one unique responsibility for each person or department.

Chapter 5 is titled as “Quality Record” and it is about archiving the procedure in an IT system. This chapter is necessary, and it will be present in the new TRACI table in lean version.

Chapter 6 is titled as “Process Indicator” which says there is no performance indicator for this procedure so it will be removed in the next version.

Chapter 7 is titled as “Abbreviations, Definitions and Term” which is surprisingly the same as the title of chapter 2, but here there is a table. UX wise it is not recommended to have such a table at the end of the document, it is better to have it in early pages. But all in all, as the content of this procedure is going to be changed and to be merged with other processes, the table of abbreviation will be refined and created from the scratch in the new version.

Chapter 8 is titled as “References” and is also a standard chapter for all procedures. This reference table will be merged with the same table in two other procedures and after refining the redundant information it will be only one reference table.

4.6 “Concession for Serial Delivery and QG” Old Version Overview

This document was initially created on 2008 in Bosch BT, and it was updated last time in March 2022. The old version of this document contains 13 pages, and it has 3 attachments. In the following, the chapters and related pain points will be discussed. The concession process describes the limited use or delivery of products and services which are deviating from specified requirements. The Concession is to address deviation in hardware, software, services or to a manufacturing process (e.g., rework of parts). Additionally, this procedure describes a risk release for products and services within the development process.

(Celebi G. , 2022)

Chapter 1 is titled as “Purpose and Description” as a standard chapter for all processes. So, no change is done. There is no chapter regarding “scope and applicability”, so a standard chapter is missing in this procedure. In the lean version it would be present.

There is no chapter regarding “Scope and Applicability”, so a standard chapter is missing in this procedure. In the lean version it would be present.

Chapter 2 is titled as “Definition and Terms” which is again a standard chapter for all processes but as the content of this procedure is going to be changed and to be merged with other processes, the table of abbreviation will be redefined and created from the scratch in the new version.

Chapter 3 is titled as “General” and describes the limitation of usage of concession and some other restriction. The content of this chapter will be moved to the new TRACI table in the lean version.

Chapter 4 is titled as “Concession Types” and it also contains a very complicated graph. The main pain point of this chapter is the naming of the different concession types and also the graphical representation. Both are a little complicated. Therefore, the proposal for making this chapter as lean as possible is to provide a new graph and also rename the concession types properly. Current categorizing of the concession types is as the following:

- Concession for serial delivery, subdivided into MP concession and TG concession. Manufacturing Plant concession is for deviations found in manufacturing process and Trade Good concession is for deviation found in goods supplied by a supplier.
- QG Concession: A ‘QG-Concession’ applies to a failed QG3 or QG4. A passed QG2 is mandatory.

The graphical representation can be found in Figure 13: Types of Concession

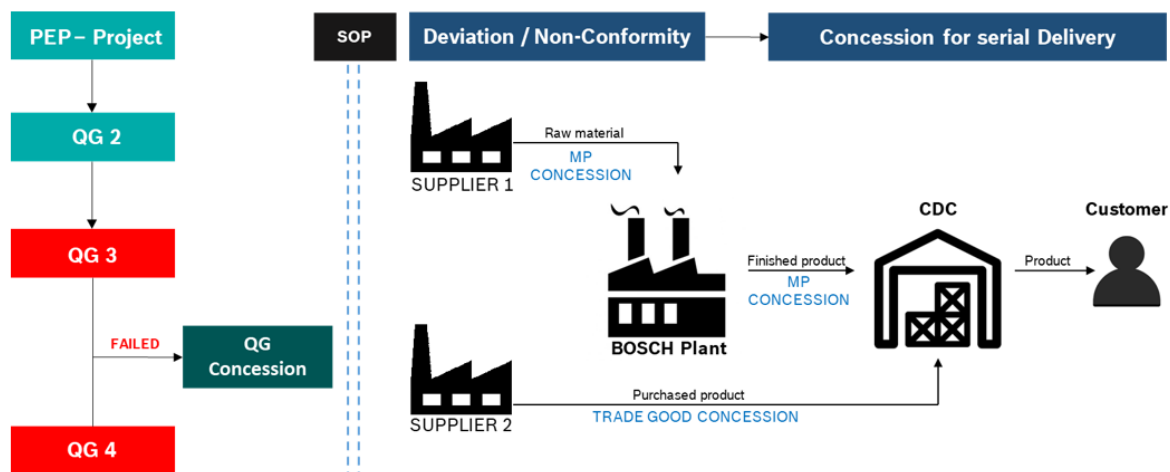


Figure 13: Types of Concession (Celebi G. , 2022)

Chapter 4 is titled as “Process”. This is the main chapter of this procedure which explain the whole procedure for all types of concession. The problem is that in chapter 4 there are two large TRACI tables for two types of concession. See Table 9: TRACI Table of Concession for Serial Delivery and Table 10 : TRACI Table of QG Concession. Moreover, after the TRACI tables there are several pages of explanation about each step of the TRACI table. In addition, there is a flow chart which tries to cover the steps of procedure as well. All in all, there are 6 pages of several repeated information to cover the process step which is really not needed. Another disadvantage of separate explanations of TRACI steps, is that the users must jump several times among different pages to follow and understand the whole content. The first TRACI is only for the first type of concession which is concession for serial delivery. This is a large TRACI table with too many steps and sub steps. Also, there are plenty of responsible people or departments that are engaged in the concession procedure. The second TRACI table is only for QG concession but still has so many similarities to the first one and from the lean point of view it is redundancy of information without adding any new value. Moreover, it is not easy for the user to check at a same time two tables. So, the proposal for the lean version is to have an identical TRACI table for all types of concession therefore, different types of concession will be merged in a new TRACI table in the next version.

Task Responsibility Authority Consultation Information (*)-if applicable	Requester	Development department	Manufacturing department	PUR	Purchasing department	PM	Head of QMM (MP / BU)	QMM (MP / BU)	Sales department	ASA department	Logistic department
Activity:											
1. Request a concession	R										
2. Initial applicability check	R							C			
3. Prepare concession form	R							C			
3a. Check whether repeated concession	R							C			
3b. Check if concession form is filled correctly								R			
3c. Issue concession number								R			
4. Problem caused by supplier?				(R)	I			(R)			
4a. Initiate Corrective Action Request to supplier				(R)	I			(R)			
4b. Check if other plants are affected and inform e.g. MP/QMM				(R)	I			(R)			
5. Check if ASA needs to be involved	R	C						C		C	
6. Perform risk analysis (4 options below) <i>and approve during step 9 with work-on</i>											
6a. MP concession	R	T	T			(T)		T			
6aa. MP concession: additional if supplier related				T							
6ab. MP concession: additional if logistic related											T
6b. Trade good concession	R	(T)		(T)	T	T		T			
7. Issue CAR and follow up	R							A			
8. Complete concession form and get necessary approvers confirmed	R							T			
9. Get a concession approved	R										
9a. Start approval cycle	R										
9b. Ensure availability of all required documents	R							T			
9c. Approve concession according table 4.5.2											
9d. Inform organization about approved concession	R	I	I	I	I	I	I	I	I	I	I
10. Customer approval required?	I					R		A	C		
10a. Customer approval	I					R		I			
11. Release concession							R				
11a. Ensure all associated actions are complete								R			
11b. Ensure product traceability	R							T			
12. Storage of Concessions	I							R			
13. Monitor concession	I							I	I		R
14. Close the concession/archiving	T					I		R			I

Table 9: TRACI Table of Concession for Serial Delivery (Celebi G. , 2022)

Task Responsibility Authority Consultation Information (*)=if applicable												
Activity:	PJM	ER	QR	PM	BT/QM	BU/MKR	PR	MBI / MR	LR	SR	CMDM	
1. Request a concession	R		I									
2. Initial applicability check	R		C									
3. Prepare concession form	R		C									
3a. Check whether repeated concession			R									
3b. Check if concession form is filled correctly			R									
3c. Issue concession number			R									
4. Problem caused by supplier?			(R)				(R)					
4a. Initiate Corrective Action Request to supplier			(R)				(R)					
4b. Check if other plants are affected and inform e.g. MP/QMM							R					
5. Check if ASA needs to be involved	R	C	C							C		
6. Perform risk analysis <i>and approve during step 9 with work-on</i>	R	T	T	T			(T)	(T)	T			
7. Optional: Issue CAR and follow up	R		A									
8. Complete concession form and get necessary approvers confirmed	R		T									
9. Get a concession approved	R											
9a. Start approval cycle	R											
9b. Ensure availability of all required documents			R									
9c. Approve concession according table 4.5.2												
9d. Inform organization about approved concession	R	I	I	I	I	I	I	I	I	I	I	I
10. Customer approval required?	I		A	R		C						
10a. Customer approval	I		I	R								
11. Release concession					R							
11a. Ensure all associated actions are complete			R									
11b. Ensure product traceability	R		T									
11c. Inform CMDM to set products in S3 (temporarily, based on the concession)			R									I
11d. Set products temporarily in S3												R
12. Storage of Concessions	I		R									
13. Monitor concession	I		(R)			I			(R)			
14. Close the concession/archiving	T		R	I					I			

Table 10 : TRACI Table of QG Concession (Celebi G. , 2022)

The flowchart bellow describes the concession steps relating to risk analysis and also documents relating to risk analysis. But all this information is a repetition of the similar data in the TRACI table. Therefore, it will be removed in the lean version.

See Figure 14: Concession Risk Analysis below:

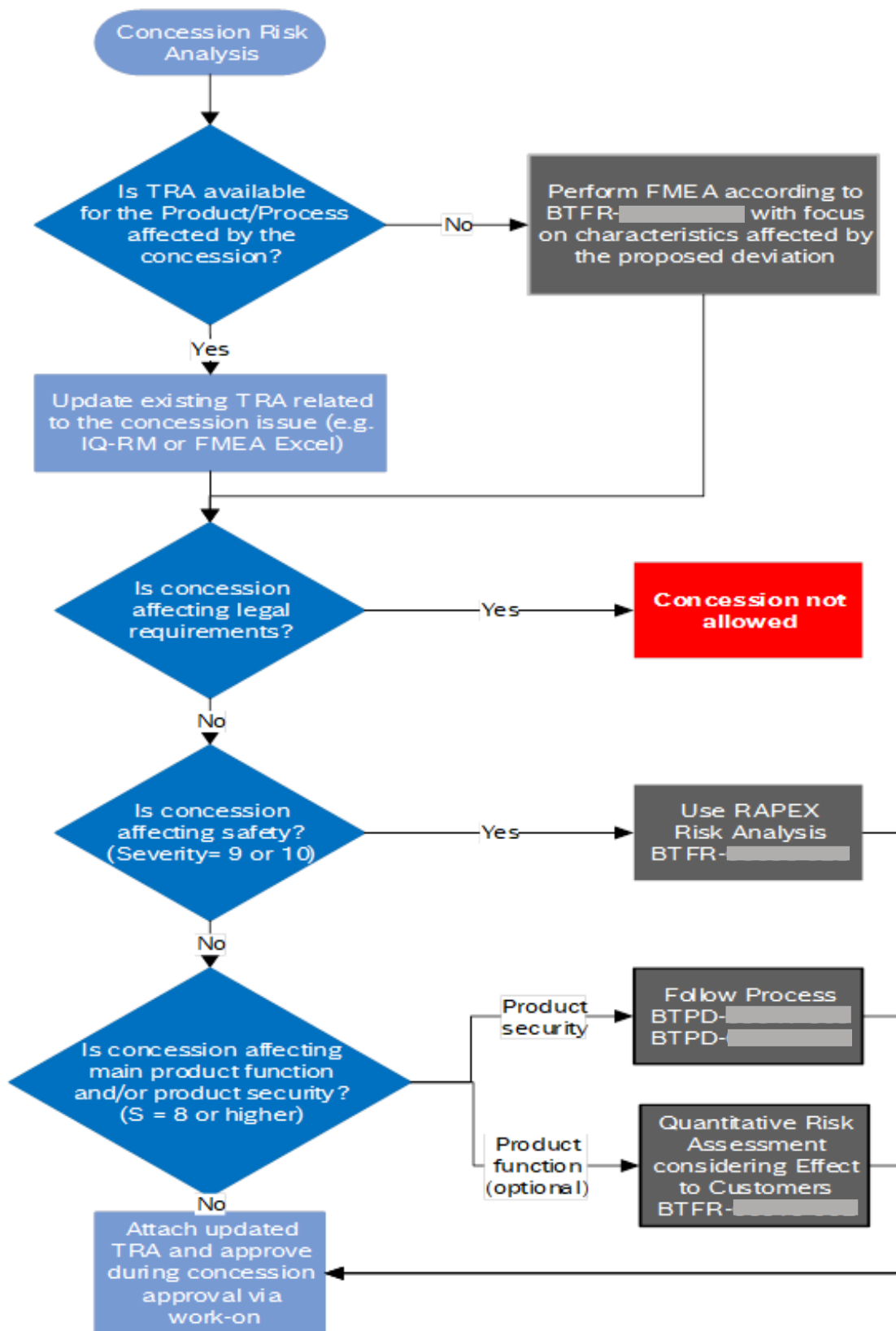


Figure 14: Concession Risk Analysis (Celebi G. , 2022)

The next sub chapter is regarding financial calculation of risk impact. It is titled as “Concession Value Calculation”. The aim of this table is to calculate the financial impact of different scenarios. In the lean proposal this table would be kept with minor changes. See Table 11.

Case summary	Application Case	Concessions Formula
No customer impact	In case a customer impact can be excluded (confirmed before approval workflow by BU/QMM) as the Q-issue does not affect the final product. e.g. manufacturing process, raw material related, ...	Concessions Value = Raw material quantity * Raw material PPC
Risk based calculation	In case potential customer impact can be expected and the probability of the Q-issue can be professionally calculated.	Concessions Value = FG quantity * FG PPC * Probability of Risk * Cost for field exchange
Worst case calculation	In case potential customer impact can be expected but the probability of the Q-issue is not known or cannot be calculated.	Concessions Value = FG quantity * FG PPC * Cost for field exchange

Table 11: Concession financial Impact (Celebi G. , 2022)

The last sub chapter in chapter 4 is covering the approval process in two different concession types, so there are two large approval tables with many approvers. See Table 12 and Table 13. The pain point is separate approving procedure for different types and also engaging three members of the board of management for approving. Therefore, in the lean version the solution is to merge these two tables and re-arrange the approvers.

A: O:	Approval mandatory Optional approval	BU/ENG	Plant Manager	Purchasing group Lead for HAWA	PUC	BU/QMM	BT/QM	MP/QMM	Site logistic manager	BU/GP or BU/PG	MP/QMM of receiving plant	PM	BT/MG	BT/EC	BT/ET	BT Board Member*	BT/PU	BU/MKR	BT/ASA	Customer	
MP Concession		A	A			A		A	O	O		O								O	
	Additional if raw materials involved			A	A												A				
	Additional for plant-to-plant-deliveries									A											
	Additional for customer-specific-concessions										A							O		A	
	Additional for repeated concessions						A						A		A	A					
	Additional where the financial risk/impact is > 250000 EUR/USD						A						A	A	A	A					
Trade Good Concession				A		A				A		A					O		O		
	Additional for customer-specific-concessions																	O		A	
	Additional for repeated concessions						A								A	A	A				
	Additional where the financial risk/impact is >250000 EUR/USD						A							A	A	A	A				

BT Board Member * - Business unit specific board member

Table 12: Approval Table of Concession for Serial Delivery (Celebi G. , 2022)

A: O:	Approval mandatory Approval optional	PJM	BU/ENG	Plant Manager	Purchasing group Lead for HAWA	QR	BU/QMM (head of department)	BU/GP or BU/PG	PM	BT/EC	BT/ET	BT Board Member*	BT/QM	BT/MKR	BT/ASA	Customer
	Concessions for own products	A	A	A		A	A	A	A				A			
	Concessions for trade goods	A	A		A	A	A	A	A				A			
	Additional for customer specific concessions													O		A
	Additional for key and regular Projects										A	A				
	Additional if a QG-question related to ASA has been rated as red														A	
	Additional for repeated concessions										A	A				
	Additional where the financial risk/impact is >250000 EUR/USD									A	A	A				

Note: Persons who have double roles need to sign only once.

BT Board Member * - Business unit specific board member

Table 13: Approval Table of QG Concession (Celebi G. , 2022)

The last paragraph of this chapter covers the IT tool related activities that should not be under a management process document, and it could either be shifted to a WI or remove completely and assign the IT tool activities to the users with full autonomy.

Chapter 5 is titled as “References” and is also a standard chapter for all procedures. This reference table will be redefined after full modification of the information in lean version of the document.

4.7 Bosch Wide Benchmarking

As it is shown in Table 14, a comparison in number of pages of the old version of different quality management processes at BT with other divisions of Bosch is done which could be a suitable benchmark to check the lean status of old version of processes – only in terms of volume of the document-.

Processes	Number of Document Pages in Divisions			
	BT	PT	TT	DC
Problem Solving	13	7	10	7
Blocking	18	0	3	11
Rework	13	0	3	3
Concession	13	11	7	6

Table 14: Benchmarking of Old versions of Processes

5 Empirical analysis/ Results / lessons learned

5.1 Restating the topic

QMM is responsible to provide quality management procedures and manage them for the worldwide stakeholders. Since the product portfolio and the production methods change during the time, QMM needs to make sure that quality management processes are still valid and practical, so they have periodic modifications of the processes based on the new issues have been raised by users since the implementation of the previous version. These modifications are usually small changes due to hints related to specific topics that stakeholders have provided worldwide. From January 2022, a lean initiative has been released by the board of management at BT to modify all the processes with a lean approach and create a new version of them for the stakeholders. This initiative also affects the quality procedures, so in this scientific work that is named "Implementation of Lean Approach to Quality Management Processes" the old version of 4 procedures have been studied and a new lean version is proposed for each one of them.

5.2 Approach

The very first step to start this project is to provide a clear understanding of each process. So initially a careful study has been done to shape a bird view of the process. Therefore, the workflow, tasks, approvers and responsible people or departments for each task and approvals were clear and well understood. In this stage several meetings with the owner and/or author of the process have been held. In addition, several hours of tutorial videos in Bosch tube platform have been watched.

Since a final report regarding lean versions of procedures compared with their old versions will be presented to the board of management, the second important step is to do a proper benchmarking in terms of lean status of the same procedures in other divisions of the Bosch Group such as DC, PT and TT. The information gained through this benchmarking not only will be valuable for the final presentation to the managers, but also is helping to propose a new structure for the lean version. Therefore, the second step is to find a new structure to provide the content in a more lean approach -mostly reduction of redundancy and governance-. This achievement could become easier through a strong benchmarking with the processes of other divisions. This benchmarking also helps to collect some probable missing information for each process, that can be mentioned in the documents of the other divisions. Also, always a benchmarking with the central directives regarding each process has been implemented to gain and/or double check the definitions. At the end of this stage, a new general structure to

present the information of the process will be fixed. For sure, small changes will be acceptable and implemented due to possible limits.

The third main step is to rewrite the procedure within the new structure, approved in the previous step by the process author. This step is very critical and during rewriting the contents, benchmarking with other division is done several times. Decisions regarding keeping or removing specific tables and also graphical figures, are taken in this stage as well. Sometimes a graphical representation is redesigned, sometimes, removed and in one case a new graph is added to the content. The same happened for the flowcharts and as team decision, flowcharts in all procedures, have been removed. Please note that the content of flowcharts, shifted to TRACI tables as the most user-friendly way of describing the steps of a procedure.

Generally, all the content with a “user manual” orientation which is describing how to do a task, has been shifted to a separate document called WI as an attachment of the main document. In addition, parts of old version, which is playing a tutorial role, has been removed completely, since in quality management processes, there is no need for training material.

5.3 Methodology

Generally, a qualitative methodology has been used to write this thesis. In some areas, just to illustrate the difference between old and new version of the process, some quantitative KPIs have been used. To provide the new lean proposal, deductive research on the old version of each document in addition to same procedure in other divisions and especially central directives related to the topic has been done.

During drafting the new version, repeated feedback meetings with stakeholders, helped to implement a correct approach. Moreover, after the final draft is ready, before publishing it on the related platform of the Bosch Group, a feedback meeting with key stakeholders around the world has arranged and they have been asked to provide their feedback via an excel sheet on the shared drive. That excel sheet was so valuable to correct the mistakes and provide an errorless document.

All in all, the main methodology to run this project is a repeated cycle of PDCA.

Finally, each document was sent to a native English speaker colleague to do a proof reading.

Following is my proposal for the new lean approach for those four Quality Procedures:

5.4 “Problem solving, Blocking and Rework” LEAN Version

Since problem solving, blocking and rework procedures are strongly interconnected, the lean version that has been proposed for them is an integrated document covering all of them. Therefore, the structure of the lean version is completely different with the old versions of each individual process, and sometimes the order of chapters is rearranged to make the content as user friendly as possible. All in all, these three processes are defined under three chapters of the new lean version of the document considering that problem solving process is the backbone of the new lean process. Following is an overview of this new lean version:

Chapter 1 is titled as “Abbreviations” and compared to old version the order of this chapter has been rearranged. The purpose of this reordering is to make the first chapter of the document as a user guide for the entire document. This abbreviation table is covering all the abbreviations in three procedures excluding the abbreviation of different organizational positions, since the positions are known to the organization and there is no added value if the positions are also mentioned in the abbreviation table. See Table 15: New Abbreviation Table of PS, Block, Rework below:

8D	System using 8 Disciplines for Problem Solving and root cause analysis.
BU	Business Unit
CAB	Corrective Action Board
CAR	Corrective Action Request
CAR tool	IT tool for 8D methodology - Corrective Action Request Tool
CDC	Continental Distribution Center
CMDM Team	Central Master Data Maintenance Team
CSO	Country Sales Organization
ERP	Enterprise Resource Planning system (e.g. SAP)
FQB	Field Quality Board
KPI	Key Performance Indicator
LL	Lessons Learned
MP	Manufacturing plant
MQI	Major Quality Issue (risk classification)
PC4	SAP server for the product business
PS	Problem Solving
PSS	Problem Solving Sheet - 8D Report and Problem Solving Sheet for CAR Attachment
QG	Quality Gate within Product Engineering Process
QI	Quality Issue (risk classification)
RAPEX	Rapid Exchange of Information System (<i>RAPEX</i>) is a rapid warning system of the European Union
RSO	Regional Sales Organization
SAP	ERP system at BT
SCR	Software Candidate Release
SQI	Serious Quality Issue (risk classification)
WIP	Work In Progress
WMOS	Warehouse Management Operating System
PL	Project Leader
GB	Bosch Division (Geschäftsbereich)
RO	Regional Organization

Table 15: New Abbreviation Table of PS, Block, Rework

Chapter 2 and 3 are titled as “Purpose and Description” and “Scope and Applicability” respectively and they cover the related content for all the three procedures. In addition, several related document from Central Bosch or documents that are kind of supportive attachments for this integrated process are mentioned.

Chapter 4 is titled as “Application of Problem Solving” and new contents about problem solving is provided under this chapter compared to the old version. These contents are kind of prerequisites for both the main process which is problem solving and also dependent processes of blocking and Rework.

4.1 is “Types of Complaints”. As earlier in the literature review mentioned, all of these processes are considered under the complaint management process, so the very first prerequisite for this lean version is to define types of complaints. See Table 16 below:

Type	Complaint by	Receiving Department	Overall responsibility for processing	Registration IT-System	More details /references
External Complaint	External Customer	Bosch Unit acting as supplier		IT tool of customer touchpoint (e.g., SAP CRM)	BTCD-001 ^[R-1] Front Page
Internal Complaint	Bosch Unit acting as Customer	Bosch Unit acting as supplier		CAR tool	Current Doc.
Complaint against external supplier	Bosch Unit acting as Customer	External Supplier	PUG or QMM* of Bosch unit acting as customer.	CAR tool SAP/PC4 Notification	BTPD-000 ^[R-12]

*QMM is only responsible for Trade Goods & externally manufactured products with BT development

Table 16: Types of Complaints

In addition to describe types of complaints, it is needed to identify the workflow of complaint management. Figure 15 is the graphical representation of general workflow of complaints:

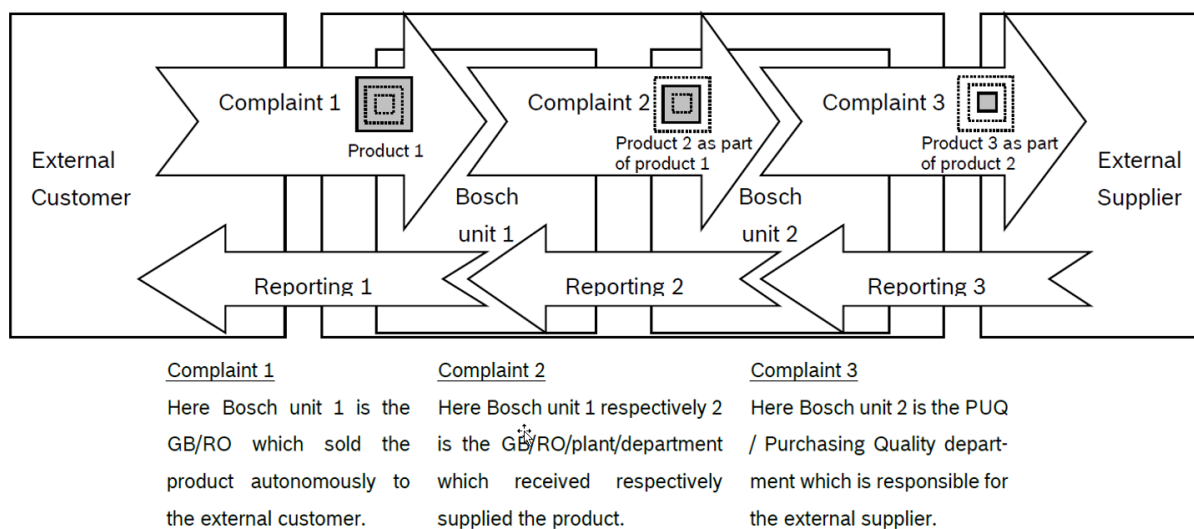


Figure 15: Complaints workflow (Bosch Central, 2018)

4.2 is “Problem Solving Method with 8D Overview” and it is a replacement of “Problem Solving Method with 8D Description”, a subchapter of chapter 5 in the old version. Table 17 is the new lean table:

D Step	Function	Description
(D0) 8D Initiation	8D Initiation	After receiving a complaint, 8D Method is triggered.
D1	Establishing Problem Solving Team	Problem Solving Team is set up, resources and qualifications are ensured
D2	Problem Description	Fact collection, definition of fundamental problem and the preliminary risk level assessment.
D3	Containment Actions	Information and supports to customer and implementation of actions are done rapidly.
D4	Cause and Effect Analysis	Technical and managerial root cause is confirmed for occurrence and non-detection. Verify the risk assessment.
D5	Defining Corrective Actions and Proving Effectiveness	Corrective actions with effectiveness are agreed.
D6	Implementing Corrective Actions and Tracking Effectiveness	Corrective actions with effectiveness are established. Containment actions from D3 are removed.
D7	Establishing Preventive Actions and Lessons Learned	Standards are updated. Experiences are exchanged (lessons learned)
D8	Final Meeting	Evidence of final meeting is available. Review and evaluation of all 8D steps are done.

Table 17: Steps of 8D

4.3 is “Roles and Qualification” and it is totally a new chapter which its goal is to define all the roles that are going to be used in three TRACI tables of problem solving, blocking and rework. This table is a kind of supplementary content for the attachment of BT PS competence matrix. Table 18 is the new roles and qualification description:

Roles	Task Summary
8D Sponsor	Assigning the 8D Team Leader and ensuring the resources of 8D Team. Responsible for the 8D report, review, and prioritization.
8D Team Leader	Leading and moderating the 8D team.
8D Team Member	Provide professional/technical input to the problem solving.
PS Expert	Supporting the 8D team leader and ensuring correct implementation and application of 8D standards.
PS Coach	Qualifying the PS experts and trainer for PS trainings
PS LL Coordinator	Tasks of PS Expert + Coordinating the internal network of Problem Solving and Lessons Learned in BU/ Plant/ Local
BT PS & LL Coordinator	Tasks of PS coach + Coordinating the BT network of Problem Solving and Lessons Learned. Annually plan and perform 8D Assessments (external assessments).
Blocking Coordinator	Initiation and coordination of blocking actions worldwide. The 8D team leader selects the blocking coordinator or takes over the role.
Logistic Planner	Logistic responsible for the BU
Rework Coordinator	Defines and coordinates the rework activities worldwide. The 8D team leader select the rework coordinator or takes over the role.
Site Coordinator	Defines and coordinates the rework activities locally. The Rework Coordinator selects the Site Coordinator or takes over the role.
Quality Manager	Refers to the applicable BU/QMM or MP/QMM or PUQ (or their delegate) who has responsibility for product quality. QMM approver is the quality manager or a delegate to review the CAR after step D7.
Peer Evaluator	PS experts performing 8D assessments (external assessments)

Table 18: Roles and Qualifications

The lean **Competence and Qualifications** requirements of roles for BT associates involved in problem-solving with 8D are defined in the BT PS competence matrix. See *Table 19*.

Roles	Task Description	TrainM Curricula
8D Sponsor	<p>Take responsibility for the specific 8D report (content and duration of the assigned problem solving process). Understand and prioritize the problem. Nominate the 8D team leader and define the review committee. Ensure the availability of required problem solving competences and skills in the team. Ensure the availability of required appropriate resources in the team (escalation level). Ensure the implementation of defined corrective actions to all TRCs and MRCs. Active participation in team meetings/-reviews, in particular in final meeting.</p>	RBW_QM_Problem_Solving_Leader_Qualification (recommended)
8D Team Leader	<p>Nominate 8D team members and define their responsibilities. Ensure selection and application of appropriate problem solving methods. Ensure adherence to the time schedule. Moderate 8D team meetings. Ensure correct documentation. Represent the 8D team in internal meetings (spokesperson of the team). Where necessary more local Problem Solving experts can be nominated.</p>	BT_QM_8D_Team_Leader
8D Team Member	<p>Provide professional/technical input to the problem solving.</p>	Solving_a_Problem_Using_8D_Method (recommended)
PS Expert	<p>Provide support to 8D Team Leader and Sponsor in application of methods and for 8D self-assessments (on-the-job-training). Provide support, if product problems arise (Problem Solving approach). Ensure correct implementation and application of 8D standards. Foster exchange of Problem Solving/8D experience. Each location shall certify at least one Problem Solving Expert to ensure support for the 8D teams. Supporting the 8D team leader and ensuring correct implementation and application of 8D standards.</p>	BT_QM_Problem_Solving_Expert
PS Coach	<p>Qualifying the PS experts and trainer for PS trainings (PS001, PS002, PS003). Support methodically, if complex product problems arise (PS approach).</p>	BT_QM_Problem_Solving_Coach
PS LL Coordinator	<p>One Problem Solving & Lessons Learned Coordinator is nominated by each BU/plant (location where necessary) (network representative). Evaluate the 8D using the BGN 8D evaluation tool, after closure of 8D (self-assessment). Lessons Learned coordinator for BU/plant CAR Administrator 8D peer evaluations (external 8D evaluations) for the responsible BU/Plant/regions. Present results and outcomes to the BU/plant/local management. Tasks: transfer of information regarding Problem Solving/8D from BT/QMM to local Problem Solving network and the other way round. Coordination, maintenance of BU and or local Problem Solving and Lessons Learned network. Execute maturity evaluation for the responsible area.</p>	BT_QM_Problem_Solving_Expert
BT PS & LL Coordinator	<p>Coordinates BT Problem Solving and Lessons Learned network. Forms the interface to PS Coaches of other divisions. Qualifying the PS experts and trainer for PS trainings (PS001, PS002, PS003). Support methodically, if complex product problems arise (PS approach). Annually plan and perform 8D Assessments (external assessments).</p>	BT_QM_Problem_Solving_Coach

Table 19: Lean Competence Matrix

4.4 is “Definition of Risk Levels” and it is updated compared to the old version and it is simpler. Table 20 is the new version:

Risk Description	Risk Level
Serious quality issue according [REDACTED]	SQI
Customer and/or standard lead-time to customer is affected	MQI
Root Cause is unknown, and customer is not affected.	QI

Table 20: Quality Risk Levels

4.5 is “Notification to BT/QM and Involvement of FQB” which is almost the same as before since it was a new chapter initially in the previous version.

4.6 is “8D Documentation and CAR Attachments” which is not a new chapter, but it has been updated into a simpler and more understandable table. Table 21 is the new version:

Document Name	Reference / Doc	Risk of Quality Issue		
		QI	MQI	SQI
8D Report PSS (Pictures, drawings, test results, proof of effectiveness)	BTFR-[REDACTED] [R-2]	O	M	M
Rework Authorization Form and Instruction template	BTFR-[REDACTED] [R-7]	(M)	(M)	(M)
8D Supplier Corrective Action Form	BTFR-[REDACTED] [R-13]	(M)	(M)	(M)
Lessons Learned Report	CD-[REDACTED] [R-14]	O	O	M
Evaluation Form	8D Evaluation tool Status: Submitted	O	O: Self-assessment M: 8D expert *	O: Self-assessment M: 8D expert *
Final Meeting Minutes	Informal Record	O	M	M
Signature/ Approval by Sponsor	CAR Approval + if needed an additional WorkON	M	M	M

O: Optional M: Mandatory (M): Mandatory only if applicable *: Acc. 8D peer evaluation TRACI

Table 21: CAR Tool Attachments for 8D Documentation

4.7 is “Management Review - Corrective Action Board Meeting (CAB)” and it is almost not changed compared to old version.

4.8 is “TRACI table of 8D Problem Solving”.

This sub chapter is the heart of 8D problem solving procedure since it is describing the process step by step with responsible people or departments. The structure of the TRACI table is updated and in the new layout, two new columns named “input” and “output” is added to the table to provide better understanding of each step. Also, the order of responsible people in this TRACI table is the same order as the future TRACI tables for blocking and rework procedure. The new lean TRACI table is presented in the next three pages. See Table 22.

Step	No	Input	T = Task R = Responsible A = Approval/Agreement C = Consultation I = Information (*) = If required	Out Put	BU - MKP	BU - ENG	Quality Manager	Logistic Planner	Receiving Dep. (Issuer)	8D Team Leader	8D Sponsor	QMM Approver
D0	1	Customer Complaint	Identify the need for an 8D. Check the issue/ ticket in terms of risk level fulfilling SQI/ MQI/ QI criteria. Acc. BTCD-() [R-1]	8D Need Identified					R			
	2	Identified 8D Need	Inform the organization and get a team decision whether the 8D criteria is fulfilled or not.	Decision Confirmed	C	C	A		R			
	3	Confirmed Decision	Select the 8D Sponsor. The (future) 8D/CAR sponsor can be: <ul style="list-style-type: none"> Head of department where the root cause is most probably located. (Usually, the head of department of design, manufacturing, logistics, or purchasing takes over the role.) Business manager of product line. Quality manager (only in exceptional cases). 	8D sponsor selected	C	C	C		R			
D1	4	Sponsor Name	Enter request into CAR tool and assign 8D Sponsor. Inform Organization if needed through the distribution list.	CAR is issued & 8D Sponsor receives e-mail notification			R		T			
	5	Notifications	Confirm 8D, assign 8D team leader and 8D team acc. to competence Matrix BTCD-() [R-3] Follow principles of the 8D method acc. CGP-() [R-15]	8D and Team confirmed						C	R	
	6	Start of 8D	Communicate the decision of starting of 8D back to the complaint origin (e.g., ASA tech support level 1 or internal customer) and document it in relevant ticket system.	Decision communicated and documented					R			
D2	7	Start of 8D	Evaluate and verify the preliminary risk level based on the problem. For MQI acc. BTCD-() [R-16] and for SQI acc. BTFR-() [R-4]	Risk level is verified.			C			R	C	
	8	Start of 8D	Check whether it is a serious 8D SQI according to CD-() [R-10] or an MQI.	SQI/MQI is checked		C	A			R		
	9	Evaluated SQI/MQI	Notify BT/QM to decide on FQB involvement. Use 4Q chart [R-17]. Also see chapter 4.5.	BT/QM is notified			R					
	10	Described Symptoms	Collect all facts and describe the problem fundamentally.	Fundamental Problem described							R	
D3	11	Evaluated Risk level	Identify Containment Actions. (Relating to products for both existing and future customers)	Containment actions Identified						R		
	12	Identified containment actions	If Blocking is needed, follow the Blocking Process, Chapter Blocking . Continue the 8D Processes in parallel from No. 14 .	Blocking need is checked			C	C		R		
	13	Blocking triggered	If concession is needed, follow the Concession Procedure. BTPD-() [R-18]	Concession Need Checked			C			R		

Step	No	Input	T = Task R = Responsible A = Approval/Agreement C = Consultation I = Information (*) = If required	Out Put	BU - MKP	BU - ENG	Quality Manager	Logistic Planner	Receiving Dep. (Issuer)	8D Team Leader	8D Sponsor	QMM Approver
D3	14	Identified Containment Actions	Implement other containment actions if needed.	Containment Actions Implemented						R		
	15	Implemented Containment Actions	Communicate the status of containment actions back to the complaint origin and document it in relevant ticket system. Repeat this communication during the whole 8D process if needed. The first information must be available within two days after receiving the complaint.	Status Communicated and Documented					T	R		
	16		Inform the external customer directly if needed. Repeat this communication during the whole 8D process if needed.	External customer is informed	R							
	17		If shortening 8D is permitted (minimum D1 to D3) release a possible blocking and continue to Step D8, No. 24 . Otherwise continue to step D4.	D1 to D3 implemented						T	R	
D4	18	Fundamental Problem	Identify/ Verify Root Cause (for occurrence and non-detection) and verify/ update the risk assessment.	Root Cause is defined			(C)			R	(C)	
D5	19	Defined Root Cause	Define the potential corrective actions and provide proof of effectiveness.	Potential Corrective action is defined			(C)			R	(C)	
D6	20	All potential Corrective Actions	Introduce permanent corrective actions and track effectiveness.	Selected Corrective actions implemented			(C)			R	(C)	
	21	Implemented Corrective Actions	Remove containment action from D3.	Containment actions are removed				T		R		
	22	Implemented Corrective Actions	Go to Blocking TRACI Table No. 13 for releasing .	Blocking Released				T		R		
D7	23	Completed D6	Identify Preventive Actions and communicate Lessons Learned & select “answered” button on CAR to notify QMM to review the identified actions. Acc to CGP- [R-19] . Document the LL in FEBER [R-20] .	Preventive actions & LL are identified						R		
D8	24	Completed D7	Review the CAR for effective problem-solving methodology in the 8D Team. Recommended activity acc. chapter 4.6: Perform 8D evaluation & submit the score using 8D evaluation tool . (Select assessment team “self-assessment”, in CAR tool enter % value)	8D evaluation performed and scores submitted						I		R
	25	Completed Review	Approve (or reject if needed) the CAR from QMM Approver point of view - CAR status turns to “pending issuer approval”.	CAR Status Updated								R
	26	New CAR Status	Approve (or reject if needed) the CAR from customer point of view – CAR status turns to “pending reviewer approval”	CAR Status Updated					R			
	27	New CAR Status	Approve (or reject if needed) the CAR from reviewer point of view - CAR status turns to “pending sponsor approval”.	CAR Status Updated								R

Step	No	Input	T = Task R = Responsible A = Approval/Agreement C = Consultation I = Information (*) = If required	Out Put	BU - MKP	BU - ENG	Quality Manager	Logistic Planner	Receiving Dep. (Issuer)	8D team leader	8D Sponsor	QMM Approver
D8	28	New CAR Status	Perform the final review of CAR for closure. If Major or Serious CAR, organize a closing. It is recommended to review the evaluation if available.	CAR Status updated						C	R	
	29	New CAR Status	Communicate the status of containment actions back to the complaint origin and document it in relevant ticket system. If CAR originated from a customer complaint, notify complaint issuer of resolution.	8D implementation is communicated and documented					T	R		
	30	8D is implemented	Inform the external customer directly if needed.	Customer is informed	R							
	31	New CAR Status	Approve (or reject if needed) the CAR from sponsor's point of view – CAR status turns to "Approved".	8D Closed Final CAR status							R	

Table 22: Lean TRACI Table of 8D PS

4.9 is "TRACI Table of 8D Peer Evaluation" and this table is also almost the same as before, only some responsible people/departments have been changed. Table 23 is the new table:

No	INPUT	T = Task R = Responsible A = Approval/Agreement C = Consultation I = Information (*) = If required	Out Put	8D Sponsor	8D team leader	8D Team	QMM/ Approver	BT PS LL Co.	Peer Evaluator	PS LL Co.
1	List of New MQI, SQI	Assign 8D independent peer evaluator (PS Experts) for approved MQI/SQI.	Peer evaluators assigned to list					R		I
2	List of MQI & SQI with assigned peer evaluators	Evaluate 8D and document in 8D evaluation tool (select assessment team: "8D Expert or similar"). Notify PS coordinator about finished 8D evaluation.	8D evaluation submitted in the tool						R	I
3	Submitted 8D evaluation	Invite 8D Sponsor, 8D team leader, 8D team members and QMM Approver for review meeting.	Invitation sent	I	I	I	I		I	R
4	Sent invitation	Explain 8D evaluation and give feedback to 8D sponsor, 8D team leader, 8D team members, QMM Approver. PS coordinator leads the discussion.	8D evaluation meeting is finished	I	I	I	I		R	T
5	Finished 8D evaluation meeting	Notify finished 8D evaluation and review meeting to BT Problem Solving Lessons Learned Coordinator.	Notification sent Evaluation finished							R
6	Finished 8D evaluation	Next CAB meeting: Report important results and if needed start internal improvement activities for future 8D.	Result reported, activities started	C						R
7	Sent annual PS meeting invitations	Invite peer evaluators (PS Experts) -regularly e.g., monthly- for alignment meeting regarding leveling, common understanding of 8D requirements and spot checks of 8D evaluations.	Peer evaluators aligned					R	I	

Table 23: Lean TRACI Table of 8D Peer Evaluation

Chapter 5 is titled as “Blocking”. This procedure is the first process that is mentioned to be used during the 8D problem solving. It is mentioned in step D3, No12. In this chapter prior to describe the process steps, a short definition of the purpose of blocking process is given as the following:

When a non-conforming product is identified or suspected, shipping and/or manufacturing block may be initiated to avoid delivery to customers, to keep the product within the CDC and/or to prevent additional production of potentially non-conforming products.

5.1 is “Blocking Team and Blocking Decision” which is to identify the minimum team members that blocking coordinator will use to form the blocking team.

5.2 is “Categories of Product Blocks used in Blocking Form” which is a new introduction to different types of blocking. In the lean version it is a clean and simple table, whereas in previous version it was several paragraphs of explanations. Table 24 is the new version.

Production Block		Stops manufacturing (and the purchasing of associated components) of the product.
Shipping Block	Partial Block	<ul style="list-style-type: none"> Defective product is blocked by the applicable CDCs within the ERP system. Sales orders can be booked for stock that is not defective. In transit orders and new purchase orders are not automatically blocked unless selected in blocking form.
	Full Block	<ul style="list-style-type: none"> The applicable CDC's will block the defective product. The CMDM group will block the ability to create sales orders at selected locations. Products cannot be shipped to rework locations.
In-Transit Order Block		<ul style="list-style-type: none"> Orders that have been placed but not yet delivered to the indicated CDCs are blocked by the operational buyer or the BU Planner (depending upon the BU) so that they will be quarantined upon receipt.
New Purchase order Block		<ul style="list-style-type: none"> The ability to generate a new Purchase Order for product is blocked by the CMDM team. Purchasing/ Logistics cannot place orders to replenish stock until the block is lifted.

Table 24: Categories of Blocking

5.3 is “Blocking TRACI Table” and the structure of the TRACI table is updated. See Table 25. In the new layout, two new columns named “input” and “output” is added to the table to provide better understanding of each step. In this TRACI there are two jumps to other processes. One is a jump (or forward) to the rework process, and the other one is a jump back to 8D process. Below is the new table:

No	Input	T = Task R = Responsible A = Approval/Agreement C = Consultation I = Information (*) = If Required	Out Put	BU MKP	BU Eng.	Quality Manager	Logistic Planner	CDC and / or CSO	ASA Service PL	Manufacturing Plant	CMDM Team	Blocking Coordinator
1	Blocking needed from D3	Initiate the Blocking.	Blocking initiated									R
2	Blocking needed from D3	Arrange the Pre-Blocking meeting. Draft the “blocking information form” (Check all items impacted e.g., production, shipping of current stock, shipping of “in-transit” stock, shipping of new orders). Send the form to the blocking team.	Meeting is done Blocking Information is sent	C		C	C					R
3	Blocking Information Sheet	Inform Marketing, Sales and CSOs with blocking information form.	Blocking Information Sent	R								
4	Meeting Done	Communicate blocking form (CAR system) using blocking distribution lists.	Blocking Form Sent			C						R
5	Received Blocking Form	Set the production block. (SAP or other ERP systems)	Production Block activated							(R)		R
6		Set CDC/ CSO/ ASA shipping block in all required locations worldwide. (SAP or other ERP) (“full” and “partial” shipping blocks).	Shipping Block activated				R	T	T		(R)	
7		Set “in-transit” order block.	In-transit Order Block Activated				R					
8		Set new purchase order block.	New Purchase Order Block Activated									R
9	Activated Blocking	Send confirmation of “blocking activated” to the blocking coordinator.	Blocking Activation confirmed				R					I
10	Received Blocking Form & Instructions	Create a new internal order number to record defined actions costs, like: <i>Inspecting, Sorting, Testing, Reworking, Scraping, etc.</i> Assign the task to the BU Controller.	Internal order number created									R
11		If rework or scrap is needed, continue to chapter 6 . Then continue with No. 12 .	Rework/Scrap Initiated				C	C	C	C		R
12	Deviation From Specification (Possibly after rework)	Go to 8D TRACI Table Step D3, No. 13 for concession check.	Concession Need Checked									R
13	Concession checked	Partially release shipping block for non-defective product (e.g., product that has been reworked and/or tested or approved for sale under concession) with sending the updated Blocking Notice.	Shipping blocked released partially			C	T	T	T		T	R

No	Input	T = Task R = Responsible A = Approval/Agreement C = Consultation I = Information (*) = If Required	Out Put	BU MKP	BU Eng.	Quality Manager	Logistic Planner	CDC and / or CSO	ASA Service PL	Manufacturing Plant	CMDM Team	Blocking Coordinator
14	Possible passed rework	If needed return "Passed" reworked product to CDC and/or CSO and update the inventory list.	CDC/CSO's Inventory Updated				R					
15	Status of defined actions	Determine if all defined actions relating to blocking are completed.	All Actions Completed			C	C	C	C	C		R
16	All Actions Completed	Check the completion of the recorded costs, if applicable, contact supplier for reimbursement. (->PUQ or PUE)	Cost Report Completed									R
17		Fully Release all blocks - Send De-Blocking Notice.	Blocking Fully Released	I		C	T	T	T	T	T	R
18		Notify the CSO and Sales and Marketing about the release status.	Blocking Closed	R								
19	Closed Blocking	Go to 8D TRACI Table Step D7, No. 23	-									R

Table 25: Lean TRACI of Table Blocking

Chapter 6 is titled "Rework" and this is totally different with the old rework procedure since plenty of non-added value content is removed from the old version and also there are no chapters regarding how to work with the IT tools. Moreover, the definition of rework and repair is added to this chapter with respect to Bosch Central Directives. Table 26 is the new TRACI table of rework Procedure.

No	Input	T = Task R = Responsible A = Approval/Agreement C = Consultation I = Information (*) = If required	Out Put	Quality Manager	Logistic Planner	BU Engineering	Product Manager	CDC / CSO / Plant	Rework Coordinator	Rework Site Coordinator	Blocking Coordinator
1	Rework/Scrap Initiated	Identify rework coordinator based on type of rework (e.g., mechanical rework, SW update, etc.) for different locations.	Rework Coordinator nominated	C	C	C	C				R
2	Cost & Risk Evaluation	Decide to rework the products vs. scrap them based on cost estimation and risk evaluation acc. to BTFR- ^[R-7] .	Decision Taken	C	C		C	C	R		C
3	Decision Taken	Approve rework vs. scrap acc. to BTPD- ^[R-21] . Including the approval of BU Controlling.	Decision Approved	T			T		R		I
4	Scrap Approved	If decision is made to scrap the products, scrap them.	Products Scraped		I			T	R	T	
5	Rework Approved	Identify potential rework location(s) and address applicable rework safety requirements based on risk evaluation. Considering the type of rework, capability of people, availability of equipment, capacity, shipping costs, import/export requirements, etc.	Rework Locations Identified	C	C	C	T	C	R	C	C
6		Create and Issue Rework Instructions using BTFR- ^[R-7] and attach to the CAR tool .	Rework Instruction Created						R		I
7	Identified Rework locations	Ship products to rework site(s).	Products Relocated		R			T	C	C	I
8	Rework Instruction Created	Assign the required rework activities to the identified locations.	Rework Tasks Assigned					T	R	T	
9	Assigned Rework Instructions	If needed procure special equipment and material. (e.g., fixtures, raw material, programming tools, safety equipment, test equipment, etc.)	Material Purchased		I				R	T	
10		Rework the products per rework instructions, provide updates of the status to rework coordinator.	Rework Done						I	R	
11	Rework Done	Go to Blocking TRACI Table If there is no deviation, continue directly with No. 13 for release. If there is deviation from specification (considered as a repaired product), follow the Concession Procedure BTPD- ^[R-18] and then continue with No. 13 for release.	---						C	R	

Table 26: Lean TRACI Table of Rework

Chapter 7 is titled as “Confidentiality” and this chapter has not been changed regarding the last version.

Chapter 8 is titled as “IT Tools” and this chapter has not been changed regarding the last version.

Chapter 9 is titled as “Process Indicator” and this chapter is also unchanged and it only covers the KPIs of Problems solving process.

Chapter 10 is titled as “References” and the new table of references is the created out of merging the three reference tables of different processes and then removing the repeated ones.

5.5 “Concession” LEAN Version

The lean version of Concession procedure consists of 6 pages that is more than 50% reduction in volume compared to previous version that was 13 pages. There are also three attachments for this document and new Bosch Tube Video to explain the changes that have been implemented in detail.

Chapter 1 and 2 are titled as “Abbreviations, Definitions and Terms” and “References” and they are updated based on the new content in the lean version of the document. The reason to bring these two chapters at the beginning is to have all the helpful information for the user in the very first page of the document as a user guide for the rest of the pages.

Chapter 3 is titled as “Description and Purpose” and the structure of its sentences is updated also a new statement is added regarding the software product. This new statement was due to a conclusion of one of several meetings with stakeholders during drafting the new lean version.

Chapter 4 is titled as “Concession Types” and is one of the most updated chapters through the document which also affects the later chapters. In this chapter the naming of concession types is updated, and they are renamed to new phrases. Previously the three concession types were “Concession for serial delivery, subdivided into MP concession and TG concession” and “QG Concession”. New naming is as the following: “Concession after QG4” divided into two categories of “MP Concession” for deviation identified in Bosch manufacturing plants and “BU Concession” for all other deviations identified. And “PEP Concession” that is used for deviation identified during PEP which is after a Red QG3 or Red QG4. Moreover, a new graphical representation is also provided to make it easier to understand which concession type to be used regarding different stage of the product lifecycle. Figure 16 is the new graph.

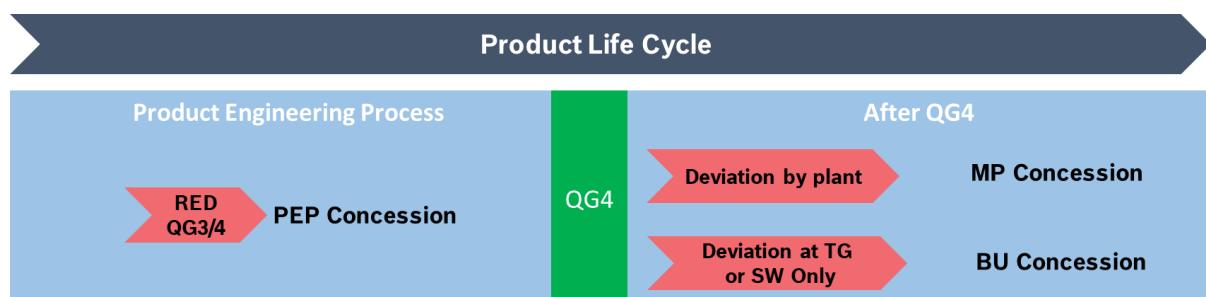


Figure 16: Types of Concession

Chapter 5 is titled as “TRACI Table” and it is the heart of concession procedure since it is describing the process step by step with responsible people or departments. See Table 27. The structure of the TRACI table is updated and in the new layout, two new columns named “input” and “output” is added to the table to provide better understanding of each step.

Below is the new TRACI table:

Process step	Input	Process	Output	Requester (MP/BU/PjM)	BU-Eng. Dept.	PM	MP Process Eng.	PUR, PUG	Logistic	QMM (BU or MP)	ASA
Trigger of Concession	Deviation from Specifications	<p>T: Task R: Responsibility A: Agreement/ Approval C: Consultation I: Information (*): If applicable</p> <p>Trigger the Concession only when the nonconformity is well evaluated and the risk of nonconformance is acceptable.</p> <p>Exceptions where concession is not allowed are:</p> <ul style="list-style-type: none"> • Non-compliance with legal requirements, e.g., RoHS, N2580, N33.6 • Non-compliance with safety requirements, e.g., Safety Directives (Except risk is acceptable). <p>Depending on concession type, responsible requesters are:</p> <ul style="list-style-type: none"> • MP Concession: MP • BU Concession: BU • PEP Concession: PjM <p>The concession team is derived by the TRACI table. The requester and the QMM can involve additional people to complete the concession team.</p>	Concession team defined	R	(C)	(C)	(T)	(T)	I	C	
Repeated Concession	Expiration/ Exhaustion of time/Quantity	<p>Check/apply for a repeated concession, if extension of time or quantity for the existing concession is required.</p>	Repeated concession identified	R						C	
Risk Analysis	Trigger of Concession	<p>Carry out a risk analysis according to BTCD- [REDACTED] [R-11] and attach it to the WorkON approval. Use either existing FMEA or do a new assessment based on FMEA method according to BTFR- [REDACTED] [R-12].</p> <p>Use the BTFR- [REDACTED] [R-7] for potential safety risks. Use the BTFR- [REDACTED] [R-9] for Quantitative Risk Assessment. Use the BTGP- [REDACTED] [R-13] Good Practice, For additional information</p> <p>The team performing the risk assessment must be part of the WorkON approval. acc. chapter 6.1.</p> <p>Minimum Team in addition to requester:</p> <ul style="list-style-type: none"> • MP: MP Process Eng., Eng. dept, QMM • BU: Eng. Dept., PM, QMM, • PEP Projects: Eng. Dept, PM, QMM, 	Professional Risk assessment documented	R	(T)	(T)	(T)	(T)	(T)	T	
Problem Solving and Corrective Actions	Deviation From Specification	<p>Initiate the CAR [R-1] using the 8D methodology BTCD- [REDACTED] [R-6] for all nonconforming products in serial production. Implement the containment actions if required, e.g., putting all affected nonconforming products and processes on hold. For new product introduction following the PEP process, CAR is optional. If the 8D is not used, the reason must be documented in the concession deviation form. Implement corrective actions based on the root cause analysis. If no 8D is used, containment and corrective actions must be documented in the concession deviation form. The implementation of the actions must be monitored.</p> <p>Ensure the product traceability for all products shipped under concession, throughout the supply chain.</p>	Sustainable Problem Solving	R	(T)	(T)	(T)	(T)	(T)	A	

Process Step	Input	T: Task R: Responsibility A: Agreement/ Approval C: Consultation I: Information (*): If applicable	Process	Output	Requester	BU-Eng. Dept	PM	MP Process Eng.	PUR, PUG	Logistic	QMM (BU or MP)	ASA
					(MP/BU/PIM)							
Content Check and Application of Concession	Trigger of Concession		Complete concession deviation form. The content, plausibility, completeness shall be checked and agreed upon with the QMM, including the required signatures.	Concession Forms filled	R						T	
Customer Involvement/ Approval	Specific Customer Request		For customer specific concessions, check the customer involvement, before triggering the concession. The decision is documented in the Concession Deviation Form and agreed by QMM.	Customer Approval	R		T			C	T	C
Concession approval and <u>WorkON</u>	Completed Concession Forms		Start the approval cycle, ensure availability of all required documents. Depending on the issue, the departments for Manufacturing, Development, Purchasing, Product Management, Logistic and Quality Management might be included in the approval process. Approve the concession according to the minimum requirements defined in table 6.1. Carry out the approval of the concession form using ' <u>WorkON</u> ', except the customer specific approval. Build the <u>WorkON</u> approval in a way that the team which has performed the risk assessment should approve first and then other <u>WorkON</u> approvers confirm the approval of the document(s) acc. the table 6.1. Inform organization and responsible people who approved the concession after final approval.	Concession Approved and Documented	R	(A)	(A)	(A)	(A)	(A)	A	(A)
Release of Products	Approved Concession		The concession will be set into force with the approval of the responsible Head of QMM (MP/BU) which must be the last approver.	Products released							R	
Monitoring	Time and Quantity		Time and /or quantity limitations must be monitored continuously by the responsible person named in the concession.	Monitoring Performed						R	I	
Measurement of PI	Number of Repeated concessions		The Process Indicator is the number of repeated concession and needs to be measured by the BUs and MPs to identify root cause and potential improvement for future.	PI measured							R	
Storage, Closure and Archiving	Time and Quantity Consumed		The requester is responsible for closure of the concession. The responsible QMM shall store all approved concessions in SAP and in the SharePoint: BT Concessions [R-5] Close the concession when all associated actions are successfully implemented and verified, but latest if time or quantity limits are reached. Notify the approvers about the closure. The storage in SAP ensures the archiving requirements of Bosch according to BTCD- [REDACTED] [R-3]: <ul style="list-style-type: none"> 15 years calculated after the end of the product life In all cases where the end of product life cannot be determined, the retention period is set as 35 years alternatively. 	Concession Archived	I		I	I		I	R	

Table 27: Lean TRACI Table of Concession

As it is shown, the explanation of the whole concession procedure for all two types of concession is taking place in the TRACI table in only two pages and compared to the old version that was two different TRACI tables with a flowchart totally in 6 pages, it is considerably updated toward becoming lean. Moreover, number of steps and number of responsible people/ departments have been decreased significantly compared to the old version.

Chapter 6 is titled as “Approval Rules” and the order of this chapter is changed compared to the past and also it is shifted from presenting the approval process in two different tables for two different types of concession to one professional approval table for all concession types. According to the new context, “*The requester shall select all necessary approvers according to the approval table below and add optional approvers if required, depending on risk and impact of the concession. The concession team approves prior to management within the same WorkON*”. WorkOn is an IT tool used in Bosch. Table 28 is the new version:

Concession approval		Concession Team	Product Manager	BU Manager	BU/ENG	BT/PU	MP/PM	ASA	BT/QM	BU/QMM	MP/QMM	BT/ET
After QG4	MP	A	O	A	A	O	A	I		A	A	
	BU	A	A	A	A*	A		I		A		
PEP	QG	A	A	A	A	O	A**	I		A		
	Key and Regular								+I			+I
Financial impact > 250.000 EUR									+A			+I

Table 28: Lean Approval Table for Concession

The Financial impact applies to all the concession types.

+ Additional approval is required.

* BU/ENG not involved in Trade Goods

** MP/PM is only relevant if the plant is responsible for the production.

Chapter 7 is titled as “Calculation of Potential Financial Impact” and is about Potential alternatives to calculate the concession value. Previously the table of this calculation was in three sections, but in the lean approach it is defined in two parts as shown in Table 29.

	Application Case	Concessions Formula
No customer impact	In case a customer impact can be excluded (confirmed before approval workflow by BU/QMM) as the Q-issue does not affect the final product. e.g., manufacturing process, raw material related, ...	Financial Impact= Raw Material Quantity * Raw Material PPC
Risk based calculation	In case potential customer impact can be expected and the probability of the Q-issue can be professionally calculated. Worst Case: Probability = 1, if customer impact cannot be calculated.	Financial Impact= FG quantity * FG PPC * Probability of Risk * Cost for Field Exchange

Table 29: Lean Table of Potential Financial Impact

5.6 Critical decision on QG4 in chapter 4 of the new version of Concession

Regarding the benchmarking among the three other divisions and also considering our original concession procedure, further usage of Concession for Red QG4 is concluded. Table 30 is the benchmarking of “RED QG RELEASE DECISION” in three Bosch divisions:

Questions	DC	TT	PT
Concession used for PEP release?	No	No	Yes
Solution for red QG?	Escalation	LDR Limited Delivery Release	Concession for a red QG3/4
Definition, Roles and responsible people?	<ul style="list-style-type: none"> An escalation including a risk evaluation has to happen. Escalation basically means, obtaining consent/approval to the proposed further proceeding from hierarchical higher levels. The escalation decision has to be made by the respective BU- respectively SU management. For cross-GE (GE= operating unit) projects, approval and escalation have to be regulated separately in case of need (usually project specific). 	<p>LDR definition: A delivery release of a product with limitations (quantity, period, constraints, etc.) in case of a red QG4 without the approval to “continue with acceptable risks”.</p> <p>Reasons for a LDR might be:</p> <ul style="list-style-type: none"> Lifetime tests not completed, forecast positive Open 8D’s in project at D6 but not closed out Remaining risks due to a product launch into a completely new market or application. 	<p>Concession For finished in-house-produced goods:</p> <ul style="list-style-type: none"> Before QG3/4 After QG3/4 <p>Approval</p> <ul style="list-style-type: none"> Manager of the expert/engineer who had executed the risk analysis (A) Head of -/QMM (A) Product Owner (I) BU/QMM or PA/QMM for AC (I)
Related Forms?	<ul style="list-style-type: none"> CD-Quality Gates 	<ul style="list-style-type: none"> TT-Concession- TT- [REDACTED] TT-PEP-TT- [REDACTED] TT-Quality Gates-TT- [REDACTED] 	<ul style="list-style-type: none"> PT-Quality Gates-PTCD- [REDACTED] PT-Concession-PTCD- [REDACTED]

Table 30: Red QG Release Decision Benchmarking for Concession

5.7 Benchmarking of lean vs. old version vs. other divisions:

As can be seen in Table 31, a comparison in number of pages of different quality management processes at BT with other divisions of Bosch is done for both old and new lean integrated version. This table could be a suitable benchmark.

Process / Attachment	BT	TT	DC	PT
# of Pages 8D PS (until 2022)	13	10	7	7
# of Pages Blocking (until 2022)	8	3	11	--
# of Pages Rework (until 2022)	18	3	3	--
# of Pages Combined format (2023)	14	16	21	7
# of Attachments Combined format (2023)	8	27	4	1

Table 31: Benchmarking of 8DPS+Block+Rework

As can be seen, the number of pages in the combined document is much less than other divisions. Also, number of attachments has a reasonable ranking among other divisions. See Table 32.

8DPS + Blocking + Rework	2017	2020	2023	Benchmarking	TT	PT	DC
Pages	47	44	14		16	7	21
Attachment	6	8	8		27	1	4
Sub-docs	6	7	5		--	5	3

Table 32: Over Time & Divisional Benchmarking of 8DPS + Block + Rework

In the table above in addition to information provided in the last table, also the number of sub documents are mentioned and also annual progress of modification of these documents is shown.

Concession benchmarking is illustrated separately in Table 33.

Concession	2018	2021	2023	Benchmarking	TT	PT	DC
Pages	27	13	6		7	11	6
Attachment	1	3	3		4	2	2
Sub-docs	3	3	3		1	5	38

Table 33: Over Time & Divisional Benchmarking of Concession

5.8 Future effective activities to make the rest of procedures lean.

Due to positive feedback from stakeholders around the world on the first four lean processes, the BT/QMM decided to initiate a worldwide survey on lean business process. Also decided to create the lean version of two other quality management processes named “Trade Goods Quality Policy” and “Technical Risk Analysis”.

5.8.1 Survey

Implementing this survey will be in March 2023 as an initial data collection for a master thesis of the next student. Here an overview of the survey is mentioned. The first question is why lean business process? The following are the proper answer to this fundamental question:

- Saving time, money and effort
- Increasing autonomy and responsibility
- Increasing understandability / the User Experience
- Balancing the level of details

After realizing why there is a need to lean processes, the next question is How to achieve it? The following are the proper answer to this second important question:

- Listing the non-lean Business Processes in different BUs
- Ranking the results
- Listing the recommended improvements for each process
- Collecting the reasoning for improvements

Based on the above-mentioned questions and answers, the survey will be designed in a proper manner. Figure 17 shows an overview of the survey:



Figure 17: Overview of Survey on BT Worldwide Lean Business Processes

5.8.2 Lean “Trade Good Quality Policy” procedure

This process was updated last time in 2021 and it is already so lean compared to those four quality processes that have been covered in this master thesis. But still slight modifications can be implemented in order to have even a more lean version of the process and document. This procedure is a supplementary to “Quality Management Purchasing and Logistics”. Due to the complex procedural structure and the agreement above, this procedure summarizes responsibilities for trade good quality in order to ensure clear responsibilities between BU/QMM and BT/PUQ. Figure 18 explains the hierarchical level of the procedures for trade good projects:

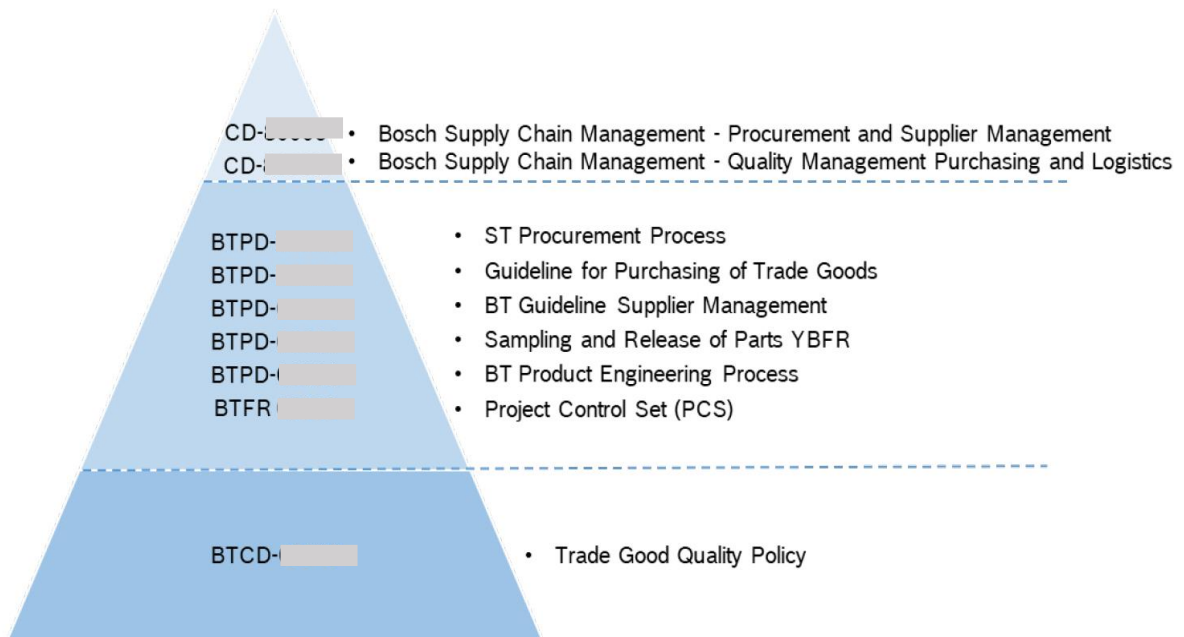


Figure 18: Breakdown of Procedures in Hierarchical Order (Celebi, Dingeldey, & Engel, 2021)

The general tasks and responsibilities can be divided into three main phases in the Product Life Cycle. Figure 19 shows the three main areas of the PLC:

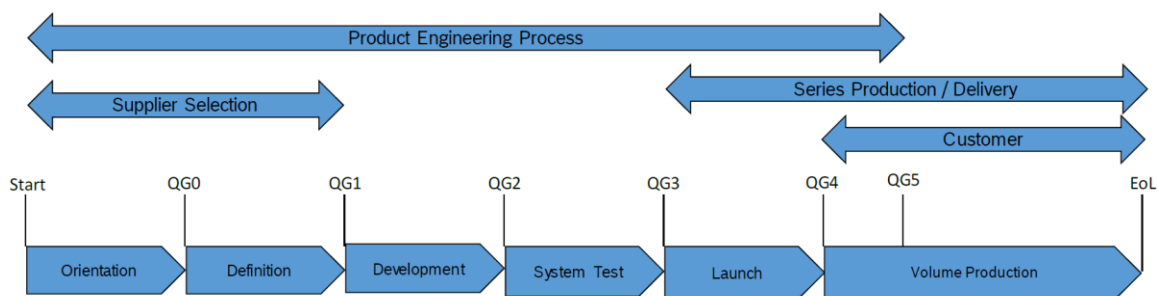


Figure 19: Phases of Product Life Cycle (Celebi, Dingeldey, & Engel, 2021)

Note: preparing this document will be done until the end of this internship program, but the new lean procedure will be rolled out in March 2023 with the support of the new intern student. So, the detail explanations of this process and the lean proposal of it, will not be covered in this master thesis.

6 Conclusion and discussion

In the pursuit of achieving a lean approach to quality management processes at Bosch Group, this scientific work has been a testimony to the author's unwavering commitment, diligence, and expertise in developing lean quality management processes that have revolutionized the organization's efficiency and productivity. Additionally, the main structure of the new lean version was proposed by the author, which is a testament to the thorough research, analysis, and dedication that went into the development of this lean quality management process. The new lean version of the documentation of processes is a result of extensive consultation, benchmarking, and collaboration with stakeholders from various regions worldwide, making it a comprehensive, effective, and updatable process that is optimized for a better user experience and increased problem-solving efficiency. Also, two tutorial videos regarding the clarification of new lean processes were recorded by the author of this thesis and published on the BoschTube portal.

The introduction of a new layout for TRACI tables and, subsequently, a new combination of content inside the TRACI tables, has been a significant milestone in the successful implementation of the lean approach to quality management processes. The new layout provides a more intuitive and structured view of the process, allowing for better management and tracking of issues. This improvement has led to a better UX and understanding of the processes.

One of the key features of this new lean version is to provide more autonomy to users, allowing them to take more control over the quality processes. This shift away from heavy governance from central departments allows for a more efficient and effective problem-solving, blocking, rework, and concession process. Another key feature of the new lean version of the documentation of processes is that it is significantly updatable. This means that procedures can be easily updated and modified as necessary, ensuring that the process stays current and relevant. The new version also features an optimized user experience and understandability, making it easy for users to navigate and utilize the system. This, in turn, leads to better monitoring, tracking and communication of the quality management processes.

The new lean version of the documentation of processes also optimized the detail level, making it more comprehensive and complete than the old version, it allows for a more effective problem-solving process.

As future effective activities to spread this lean approach to other processes, a large survey for the whole organization is going on aimed at finding non-lean processes from the stakeholder's point of view worldwide. Consequently, with the results of this survey, more

quality management processes will be modified with a lean approach. Also, modification of two other procedures, "Trade Good Quality Policy" and "Technical Risk Analysis" has been done by the author of this thesis and will be rolled out to the whole organization in spring 2023.

In conclusion, the notable benefits of implementing a lean approach to quality management processes are significant at Bosch Group. These benefits include improved quality, reduced costs, enhanced customer satisfaction, increased employee engagement and job satisfaction, and overall improved organizational performance. By adopting a lean approach, organizations can create a culture of continuous improvement where waste and inefficiencies are identified and eliminated, leading to sustained improvements in quality and productivity. Furthermore, the adoption of lean principles can also promote a more collaborative and empowered workforce where employees are encouraged to participate in decision-making and problem-solving activities. Overall, the adoption of a lean approach to quality management processes can provide organizations with a competitive advantage and help to ensure long-term success in today's dynamic business environment.

Furthermore, this suggested method can serve as a model for other manufacturing organizations to apply lean principles to their quality management processes.

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