BACHELOR THESIS

IMPLEMENTING A RESPONSIBILITY FRAMEWORK AT TRIOLIET

TRIOLIET
FEEDING TECHNOLOGY

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Preface

This research is conducted as closure for a Bachelor of Science. I conducted this research in my third year of studying Industrial Engineering and Management at the University of Twente. The research is conducted at Trioliet, a premium provider of livestock feeding machines and equipment.

I want to thank the employees who work at Trioliet and contributed to the research. The research required the expertise of the employees to conduct the research. Trioliet created a pleasant experience and environment. I want to give special thanks to my supervisors at Trioliet, who supported and guided me through the research. The supervisors were very approachable and accessible, this created an informal work relationship. They were always available for evaluations and brainstorm sessions.

I want to thank my supervisors at the University of Twente, Leo van der Wegen and Fabian Akkerman. The supervisors provided me with feedback through the research and increased the quality of the research.

Enjoy reading my thesis.

Delano Leonardo Alberto

March 2023

Summary

Trioliet produces, assembles and develops feeding machines for the livestock industry. Trioliet started as a small family company and is grown into a big international provider of feeding machines all over the world. This growth brought more complexity and customer-specific requests into the projects. This complexity and customer-specific requests require Trioliet to improve its project management. Trioliet manufactures eleven types of feeding machines, this research will be focused on the Triomatic and Solomix Stationary projects because these machines are manufactured on project-basis.

To determine the core problem regarding project management preliminary research is conducted. The fifteen key managers involved in the Triomatic and Solomix Stationary projects were interviewed. The preliminary research concluded that 'Departments don't have a clear responsibility framework' is the core problem. A responsibility framework is a model that can be applied in multiple situations and clarifies the responsibility of entities during a process. This core problem resulted in the research objective 'Implement a responsibility framework regarding project management in Trioliet for the Triomatic and Solomix Stationary projects'.

Literature defined a list of responsibility frameworks regarding project management. The advantages and disadvantages of these frameworks were matched with the objective of the research and the organization structure of Trioliet to determine the most suitable framework. An organization structure is based on the project characteristics of a company. The organization structure of Trioliet is a weak matrix organization, this implies that Trioliet mostly focuses on the utilisation of departments and has limited/part-time focus on projects. The most suitable responsibility framework in a weak matrix organization is the RACI framework. RACI is the most applicable framework, because it is easy to use and flexible, which is useful during the implementation and focusses on the responsibility distribution between departments instead of responsibility distribution within a department. The RACI framework is a responsibility framework that assigns responsibility roles to a task and department. The responsibility roles are responsible, accountable, consulted and informed.

The literature review is followed by in-depth interviews with key employees to determine the tasks and responsibility distribution during the Triomatic and Solomix Stationary projects. The interviews resulted in a list of tasks, responsibility distribution and the project parameters. These project parameters group the projects based on the comparable tasks during the projects. These projects do not have the same end product but have similar tasks in the production of the projects. After gathering the data the RACI frameworks were incorporated into a RACI framework tool. The tool displays the RACI frameworks based on the project parameters.

Once the RACI frameworks are incorporated into the RACI tool the tool can be implemented. The implementation plan is a step-by-step approach to integrate the RACI framework into the project management of Trioliet. The plan exists of three phases, Start-up, Implementation and Adaptation. The start-up phase is focused on the understanding and distribution of the tool through a presentation and a demonstration. The implementation phase focuses on using the tool as an indication and mediator during project obstacles that occur during a project. The adaptation phase can be used to adapt the tool to other projects within Trioliet. The implementation manager is responsible for leading and assessing the implementation.

The first recommendation to Trioliet is to implement the RACI framework tool according to the implementation plan to resolve project obstacles. This strategy is custom-made for the RACI Framework Tool, Trioliet's characteristics and Trioliet's projects and will support Trioliet to provide a clear responsibility framework during projects. The second recommendation is to start an in-depth team discussion within the Triomatic and Solomix Stationary projects. The RACI framework will function as an indication of the responsibility- and workload of departments during projects. These in-depth discussions can lead to improved responsibility- and workload.

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List of Abbreviation

Bill Of Material	BOM
Category 1	C1
Enterprise Resource Planning	ERP
Individual Depth Interview	IDI
Managerial Problems-Solving Method	MPSM
Order Accept Committee	OAC
Project Parameter Composition	PPC
Research Question	RQ
Special Sales Request	SSR
Sub research Question	SQ
Systematic Literature Review	SLR

1. Trioliet Introduction

Trioliet is a manufacturer of feed wagons and sells them all over the world. It was founded in Purmerend in 1950 by the Liet brothers. The Company moved to Losser in 1958 and became famous with the Turbobuster TU, a silage cutter. This success boosted the innovation and development of new products. In 1997 Trioliet moved to Oldenzaal and Trioliet is still located there. Trioliet produces and assembles feeding machines for more than 70 years and is growing since. In all these years the company has grown into a big international provider of feeding machines and all other equipment in the livestock feeding industry. This massive growth has caused the evolution of Trioliet into a bigger and more complex company. Trioliet has 250 employees working in Oldenzaal and dealers all over the world on every continent. The annual turnover of 2021 is 84 million euros. In Oldenzaal there are three assembling buildings and one head office on a 6,5-hectare terrain.

Trioliet is a leading manufacturer of different kinds of feeding machine types in the livestock industry. It produces, assembles and sells feed mixers, self-loading feed mixers, self-propelled feed mixers, automatic feeding systems, silage cutters, self-loading silage feeders, silage grabbers, stationary feed mixers for silage, stationary feed mixers for biogas, weighing systems feed management systems and applicable accessories. In addition to hardware, Trioliet also sells technical support, spare parts, gives training to customers and dealers and owns multiple patents.

All these product types are divided into two categories. The first product category consists of standard models with add-ons from the catalogues. The add-ons are fully developed or exist conceptually. Some add-ons can be assembled without any development required because they are already fully developed and some add-ons are engineered on order. The second category consists of the SSR machines, Special Sales Request, these machines are customer-specific developed. The components of this category are not developed yet and there is no concept of it. These machines require a lot of components and semi-finished products. To keep track of these products and components, Trioliet uses an ERP system called INFOR. This system tracks the number, location and customer purpose of the components and products, stock levels, part lists, order dates, all price agreements with the suppliers, planning of the machines and all the other components and product information.

Customers can buy Trioliet's products at a dealer. These dealers take care of the installation and the after-sales of the products. Trioliet offers customer-specific products, but cannot accept all requests because of engineering and planning feasibility. This is why Trioliet has an OAC, the Order Acceptation Committee. This committee decides whether a Special Sales Request will be accepted based on their expertise and past experiences.

The massive growth of the past years has been realized by high-quality standards, market expertise and especially customer-specific products. Trioliet distinguishes itself by developing, designing, assembling and engineering customer-specific machines. This is the main reason why Trioliet is a leading competitor in the livestock industry.

1.1. Trioliet's situation

Trioliets' management predicts an increase in customer-specific machines that are developed or engineered and assembled on a project basis. A project is a temporary endeavour undertaken to create a unique product, service, or result (Project Management Institute, 2008). This customer-specific variability between machines/projects requires project management. Project management is the application of knowledge skills, tools, and techniques to project activities to meet the project acquirements (Project Management Institute, 2008). Trioliets' management expects the increase of focus on project management will result in future competitive advantage. The second motivation for the research is the low delivery reliability of 64% in 2021. This means that 64% of all Trioliet machines sold in 2021 are delivered on time. 21% of all the orders are delivered within two weeks after the agreed delivery date and 15% of all the orders are delivered more than two weeks later than agreed. Trioliet considers this reliability too low and expects to improve the reliability through project management. The research is focused on the Triomatic and Solomix Stationary projects. The Triomatic and Solomix Stationary machines are the only machines that are assembled on a project basis of all the eleven different machines Trioliet offers. This customer-specific variability demands more project management than machines that are assembled based on line production principles.

The Triomatic machines consist of a feeding kitchen and a self-propelled feeding robot. The feeding kitchen will provide the self-propelled feeding robot with fodder, which is food for livestock such as hay. The products can be seen in Figure 1 Triomatic. The self-propelled feeding robot consists of multiple models and add-on options. The models are distinguishable by their power supply and transport methods. The Triomatic can be powered through a battery or cables and the feeding robot can be transported over the ground with wheels or hanging from rails. The feeding kitchens consist of fodder storage bunkers, circular cutting knives and a conveyor belt. The models are distinguished by their mixing ability, size and loading mechanism. The feeding kitchen can be extended through add-ons, for example an extra mineral mixer.

Figure 1 Triomatic

The Solomix stationary projects consist of stationary mixers with multiple models and add-ons, see Figure 2 Solomix stationary. The number of mixing augers distinguishes the models. An example of add-on options is a dispensing unit, conveyor belt and dosing valve.

The self-propelled feeding robot of the Triomatic projects transports fodder through the stable. The customers of Trioliet have different stable sizes, ground types and measurements. The rails that provide the self-propelled feeding robot with energy will differ per customer and project in size, material and measurements. The feeding kitchens of the Triomatic projects also consist of feeding bunkers. These bunkers have standard models, but it depends on the customer, how much and how big the bunker needs to be. This results in a project assembling method. Like the Triomatic, the Solomix stationary is assembled on a project basis. All the Solomix stationary projects differ per customer because the machine is required to be designed and assembled to fit in the stable of that specific customer. The dispensing unit and conveyor belt consist of different sizes, measurements and dispensing methods depending on the customer. The remaining machine types of Trioliet have add-on options, but these do not differ per request/customer. These machines are assembled in a modular and line production method.

Figure 2 Solomix stationary

1.2. Problem Cluster

The fundament of the research will be one core problem. (Heerkens & van Winden, 2017) indicates that solving one core problem is more effective than dealing with several problems. A problem cluster is composed to determine the core problem. A problem cluster is a relatively easy model for indicating causally connected problems and bottlenecks (Heerkens & van Winden, 2017). A problem cluster is applied to map all problems along with their connections (Heerkens & van Winden, 2017). The problems for the problem cluster will be determined through preliminary research.

The preliminary research design is interviews with managers and key employees within the Triomatic and Solomix stationary projects. In Figure 3 Cross-functional Flowchart the cross-functional flowchart of the Triomatic and Solomix stationary projects is displayed. The cross-functional flowchart is constructed with the supervisors and displays the data flow and flow of goods of the standard steps taken within the Triomatic and Solomix stationary projects of Trioliet. The cross-functional flowchart provides a basic understanding of the project structure of Trioliet's projects. This basic understanding will function as the basis of the question submitted to the manager and key employees during the interviews.

The flowchart starts with the customer/dealer. The customer requests a machine at Trioliet or through the dealer. The sales department processes this request and compiles a Sales order. The sales department determines if the request is an SSR or a category 1 machine. An SSR must be approved by the Order Accepts Committee before development can design and engineer new customer-specific parts.

Planning will construct an assembly card for category 1 machines, in the cross-functional flow depicted as C1, and shares it with the assembly department. Furthermore, planning composes the planning for the order and shares this with the purchase department. The purchase department composes a purchase order, this order consists of raw materials, standard components and the Bill Of Material (BOM) that is composed by the development department. An example of components/materials in a purchase order are tubes, metal plates and engines. The purchase orders are sent to external suppliers.

The external suppliers deliver the required materials. The materials will be stored in the logistics department. The raw materials will be processed into semi-finished products at the internal suppliers. The internal suppliers are the welding-, powder coating-, and saw departments. The semi-finished products are checked for quality and put in stock. The standard components delivered by the external suppliers are directly transported to the quality department. The components are checked and if the quality is sufficient, the component will be sent in stock.

If the quality of the semi-finished product and/or standard components is insufficient, then a return order is composed and sent to the internal or external supplier depending on the origin of the damaged good. If the semi-finished products and/or the standard components have the desired quality, they will be assembled at the assembly department. The assembled machines/final product will be checked on quality and then sent to the customer.

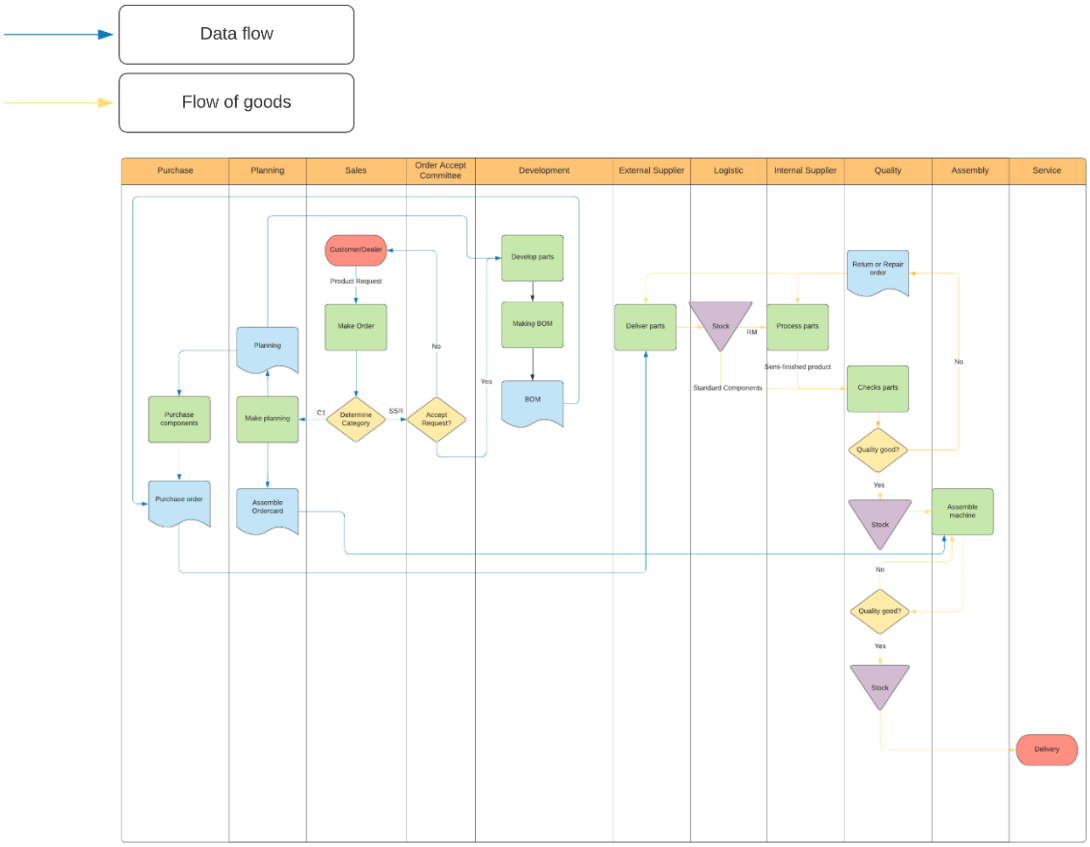


Figure 3 Cross-functional Flowchart

The interviews of the preliminary research are conducted with 15 managers and employees who fulfil a key role in the projects of the Triomatic and Solomix stationary projects. The conducted interviews are 7 hours and 8 minutes collectively. During and after the interviews it was clear that the Triomatic and Solomix stationary projects required some scrutiny. The interviewees confirmed that the research scope is rightly chosen and that improvement of the projects is needed.

The interviewees displayed and explained multiple improvements, situations and problems during the interviews. The interviewees answered the question from their point of view and their position within the Triomatic and Solomix stationary projects, this resulted in some disagreements between interviewees. Nevertheless, all the problems are taken seriously and documented unless the statement can be proven wrong by an interviewee. The biggest challenge during the interviews was to point out problems that affect the projects in an impactful way and not a specific department dysfunctionality. The interviewees are selected by the supervisors and based on the cross-functional flowchart. The findings of the interviews can be found in Appendix A: Preliminary research table.

The approach of the interviews is divided into five parts. The first part is the Introduction, this part is a general introduction about the objective of the interviews and the order of the interview. The second part is general questions about the employee, these questions are generic for every employee. The third part is job-specific questions, these questions are designed specifically for the interviewee. The fourth part is called professional advice, the objective of this part is to get a clear understanding of their opinion of the organizational/project structure and management. Moreover, the fourth part indicates which variables can and cannot be changed considering my research scope according to the interviewee. The fifth part is closing the interview and thanking the interviewee. This interview structure is created because it provides a wholesome understanding of the current problems.

Problem	Number of employees
Delayed delivery	5
Trioliet's assembly- and communication procedures are not fixed	5
Departments don't have insight in the progress of projects	2
Trioliet does not have a project manager	2
Incorrect INFOR information	2
Trioliet's products are too customer specific	2
Dealers are uneducated	2

Table 1 Problem Table

The objective of the interviews is to determine problems that could be relevant to the problem cluster. In Table 1 Problem Table. all the problems that are addressed by two or more employees are displayed. In Appendix A: Preliminary research table all the addressed problems are displayed. In the first column the problem is stated and in the second column, the number of employees that addressed the problem is displayed. The problems 'Delayed delivery' and 'Trioliet's assembly- and communication procedures are not fixed' are addressed most often. The problem 'Trioliet's products are too customer specific' will be excluded in the problem cluster, because Trioliet's management will be focusing on customer-specific products. All the other problems will be incorporated to construct a problem cluster and determine a core problem for the research.

The problem cluster is based on the problems of Table 1 Problem Table and displayed in Figure 4 Problem Cluster.

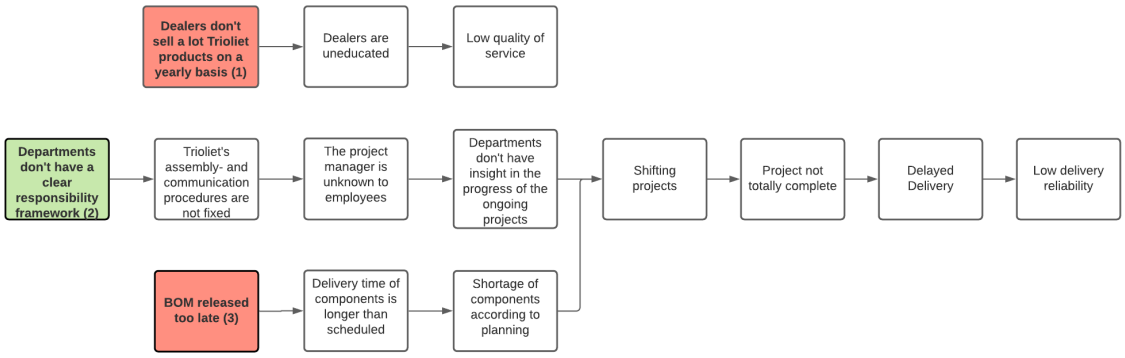


Figure 4 Problem Cluster

In this section, the problems addressed by more than two interviewees are explained and clarified. During the interviews, employees addressed the topic that dealers are not specialized in Trioliet machines because they don't sell a lot of them. Core problem 1 'Dealers don't sell a lot of Trioliet products every year is currently an unchangeable fact. Trioliet focuses on providing premium quality livestock machines and equipment specifically developed and assembled to fulfil the needs of customers all over the world. The machine types, customer demographic and company size, make it not possible to sell more products through a certain dealer. The relatively low number of Trioliet machines sold through certain dealers results in dealers that are uneducated about Trioliet products. The dealers are not familiar with the machines and often miss certain specialized skills/information about a customer-specific machine and this can result in lower quality of service. Furthermore, five employees addressed the problem that 'Trioliet's assembly and communication producers are not fixed'. It became clear during the interviews that this was the result of the absence of a responsibility framework. A responsibility framework displays the responsibility within and between Trioliet departments. The unfixed assembly- and communication procedures result in an unclear responsibility distribution of the project manager. The unclarity around the project manager's role within the projects results in a lack of communication between the project manager and departments which results in a lack of insight into the ongoing projects.

Development constructs a BOM and shares these with purchase and planning. This release can be later than planned. If the BOM is released later than planned, then the components will be ordered and placed in INFOR according to the late planning. This results in incorrect stock levels in INFOR because components are delivered too late. The planned projects have a shortage of components during assembling. Both core problems 2 and 3 eventually result in shifting projects because of a shortage of components or lack of knowledge of the ongoing projects. Shifting projects are projects in which the delivery date is moved up or down. The shifting projects create an urgency within the project processes, which results in incomplete delivery. If the delivery is incomplete, then the missing components need to be back-ordered. The entire order/machine is delivered late and the delivery reliability lowers.

The problem cluster defines three core problems. A core problem has to meet three requirements (Heerkens & van Winden, 2017). To ensure the quality of this problem cluster, all the core problems will be assessed to the three requirements. The first requirement is that the problem is identified as such. A problem should only be in the problem cluster if the problem is occurring. All the problems in the cluster are actual problems, this is ensured by the interviews and the threshold that a minimum of two employees should have addressed the problem. Besides the threshold, the supervisors of Trioliet confirmed the problems. A core problem doesn't have a cause, this is the second requirement for a core problem. The research should investigate root causes and not symptoms to ensure the effectiveness of the research. This requirement is met for all three core problems. Figure 4 Problem Cluster displays that the core problems don't have causes. The third requirement requires the core problem to influence

something. This requirement also ensures the effectiveness of the research. Solving a problem that doesn't influence something will not have an impact on the company. All the potential core problems displayed in Figure 4 Problem Cluster are connected with other problems addressed by employees through a cause-and-effect relation. Besides the requirements of MPSM, the problem cluster is also viewed and approved by the supervisors

The research of this thesis should solve one of the core problems. The chosen problem should have the greatest impact at the lowest costs (Heerkens & van Winden, 2017). In addition, the University imposes the condition that the problem is solvable in 10 weeks. The solution to core problems 1 and 3 will be focused on a single department. The solution to core problem 1 is presumably regarding the service department and core problem 3 is presumably regarding the development department. Core problem 2 will be focused on the entire company. Solving a problem for the entire company is more impactful in comparison to a department. All three core problems will have approximately the same implementation costs because the solution will lay in the organization/project management. The core problem of this research will be core problem 2: 'Departments don't have a clear responsibility framework'. The ratio between the impact and implementation costs will be the greatest. Successful organizations have written policies and procedures that define how responsibility, accountability, and authority work in the project management environment (PM4DEV, 2010). This indicates the importance of the policies, procedures and thus responsibility frameworks for organizations.

1.3. Research Objective

The core problem of the research is: 'Departments don't have a clear responsibility framework'. By clarifying the employees/departmental responsibilities using a framework, the departments get a clear overview of the departmental responsibilities and project manager ownership. This will result in a smoother, more efficient and clear communication between departments based on the problem cluster. This more efficient communication will result in fewer shifting projects, less incomplete delivery and higher deliver reliability. Thus, the research objective is to implement a responsibility framework regarding project management in Trioliet for the Triomatic and Solomix Stationary projects.

The word responsibility framework is multi-interpretable. This means that the definition differs between people. Throughout this research, a responsibility framework is a model that can be applied in multiple situations and clarifies the responsibility of entities during a process.

The research objective is to implement a responsibility framework regarding project management in Trioliet for the Triomatic and Solomix Stationary projects. This research objective can be accomplished by answering the following research question.

RQ – How can Trioliet implement a responsibility framework regarding project management for the Triomatic and Solomix Stationary projects?

The research question is answered by splitting up the research question into four sub-research questions. The answers to the sub-research questions will provide the required information to answer the research question.

> ***SQ 1*** *- What responsibility frameworks regarding project management are defined by literature?*

The objective of sub-research question 1 is to list all the available responsibility frameworks regarding project management. High-quality frameworks will be defined in literature. To answer this research question a Systematic Literature Review (SLR) will be conducted. By conducting an SLR, all available information on frameworks regarding project management will be found in an effective method. The academic articles selected by the SLR will be applied to list all the advantages and disadvantages of the frameworks.

> ***SQ 2*** *– Which responsibility framework is most suitable for Trioliet?*

The objective of sub-research question 2 is to choose the most suitable responsibility framework for Trioliet. The research objective and characteristics of Trioliet's project management will be matched with the advantages and disadvantages of the frameworks listed in the answer of sub-research question 1. The best match will be chosen as the most suitable responsibility framework.

> ***SQ 3*** *– What is the application of the responsibility framework regarding the Triomatic and Solomix Stationary projects?*

The objective of sub-research question 3 is to apply the responsibility framework to the Triomatic and Solomix stationary projects. This will provide insight into the responsibility distribution throughout the Triomatic and Solomix stationary projects. The information required to apply the responsibility frameworks will be gathered through interviews.

> ***SQ 4 –*** *How can Trioliet implement the responsibility framework?*

The objective of sub-research question 4 is to implement the applied responsibility framework. The responsibility framework will be implemented through an implementation strategy. The objective of the implementation strategy is to apply the responsibility framework during the projects of Trioliet. The strategy will consist of a step-by-step approach to apply the responsibility framework to other projects and future developments.

The research will determine the responsibility framework for the Triomatic and Solomix Stationary projects. This responsibility framework will be provided to Trioliet in the form of an application. This application will be one of the deliverables for this research. On top of that, an implementation strategy for this application will be constructed and provided t o Trioliet.

Trioliet produces and assembles feeding machines for more than 70 years, this growth causes an increase in the complexity of projects. In combination with the increased focus from Trioliets' management on customer-specific machines, Trioliet wants to improve its current project management. Using preliminary research in the form of interviews the core problem was determined as: 'Departments don't have a clear responsibility framework'. The research design is divided into four sub-research questions. The research methods applied to answer the sub-research questions are a literature review and interviews.

2. Literature Review

Chapter 1 determined the research questions. Chapter 2 builds on sub-research question 1 by conducting a Systematic Literature Review(SLR). The objective of chapter 2 is to list the responsibility frameworks regarding project management defined by literature. Literature will determine the advantages and disadvantages of the responsibility frameworks. These disadvantages and advantages will be used in chapter 3 to determine the most suitable framework for Trioliet.

The objective of the SLR is to answer sub-research question 1:

What responsibility frameworks regarding project management are defined by literature?

The steps and details of the SLR are placed in Appendix B: Literature Review. The SLR defined seven applicable articles, these articles define three responsibility frameworks. Thus, the answer to sub-research question 1 are the RACI, RASCI and ERAM Frameworks.

The RACI (Responsibility, Accountability, Consulted and Informed) is a matrix that clarifies who is responsible, accountable, consulted on, and informed about a task. (Costello, 2012). The responsibility role refers to the division of the RACI acronym, responsible, accountable, consulted and informed. Henceforth be known as responsibility role. The responsibility roles are assigned to the departments and/or employees within the organization that play a role in the project. The framework can be a starting point for in-depth team discussions (O'Connor & Mock, 2020) and can be applied for responsibility and accountability analyses to divide the tasks within the projects more fairly/efficiently. Table 2 RACI framework example shows a simple RACI model of a fictitious company. On the horizontal axis, the employees or departments of the company are listed and on the vertical axis, the tasks within the project are listed in semi-chronological order. The framework can be applied by filling in the acronym letters. In Table 2 RACI framework example, the project manager is accountable for task 1, purchase is responsible, development needs to be consulted and production will be informed.

Stage/Phase	Project manager	Purchase	Development	Production	Service
Task 1	A	R	C	I	
Task 1.1			RA	CI	
Task 2	A		R	CI	
Task 2.1	C		A	R	I
Task 2.2	A	C	C	CI	R

Table 2 RACI framework example

The second framework is the RASCI (Responsibility, Accountability, Support, Consulted and Informed). This is an adaption of the RACI framework and includes the Support responsibility role. The support responsibility role assists in completing a task. Unlike Consulted, who may provide input information to the activity (Mrzyglocka-Chojnacka, Kott, & Kott, 2019) Thus, the advantage of the RASCI framework in comparison with the RACI framework is the clarification of the supportive department that helps the responsible department with completing the task. Both frameworks have the same advantages and disadvantages in their application.

The ERAM (Extended Responsibility Assignment Matrix) is a matrix based on the RAM (Responsibility Assignment Matrix) model. The ERAM differs from the RAM because ERAM has an inner and outer structure. This inner and outer structure causes the matrix to extend the model to functional organizations instead of one activity per person like the RAM. This means that the ERAM can clarify responsibility across departments and the RAM model only does this for individual employees. The basic idea of the ERAM is to take pre-emptive action for a cross-functional problem (CFP). A CFP is a problem that occurs during a project, because of the independency of the various functions between departments. An example of a CFP is system costs, this problem affects multiple departments in the company. A CFP mostly happens downstream of the project, because projects get accepted and put into production/development before the departments downstream (later involved in the project) have the right specifications or accepted the feasibility of the project. Figure 5 ERAM example displays the full structure of an ERAM framework.

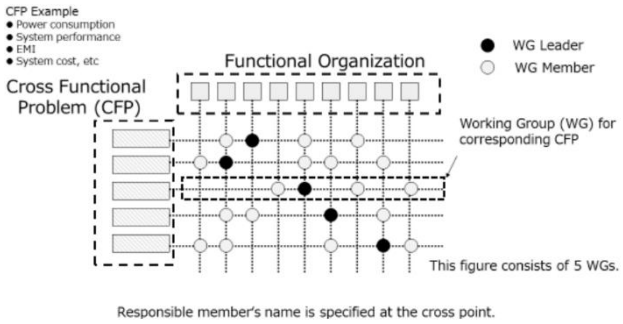


Figure 5 ERAM example

The ERAM applies an inner and outer structure to clarify the responsibility within companies. The inner structure is to clarify who works on which cross-functional problem. The outer structure clarifies who is responsible for which functional organization and working groups. Figure 6 Inner structure of ERAM displays the inner structure. The inner structure is a matrix with the CFP on the y-axis and the departments (functional organizations) on the x-axis. The inner structure clarifies who works in which working group (WG) and from which department they are selected. A working group (WG) is a group of employees selected to tackle a CFP. The employees are formed from functional organizations. The structure also clarifies who is the leader within the WG, this employee is marked by a black circle instead of a white one.

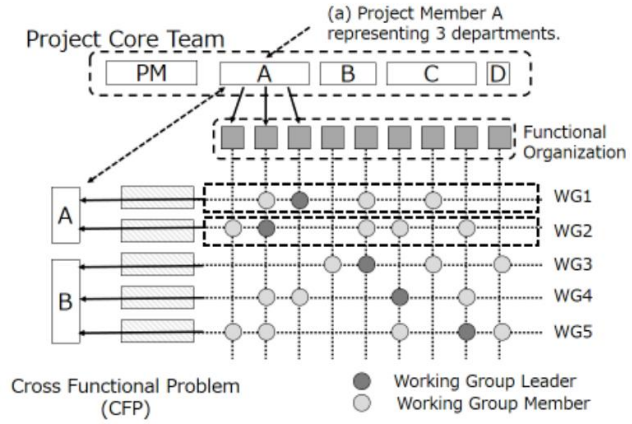


Figure 6 Inner structure of ERAM

The outer structure is a matrix in the ERAM, which clarifies who is responsible for the departments and CFPs. On both axis the project core team is placed. The project core team is a team of employees that manage a department and CFPs/WGs. As a member of the project core team, the employee is representing one or multiple departments and is managing one or multiple CFPs/WGs. The outer structure of the ERAM is depicted in Figure 7 Outer structure of ERAM.

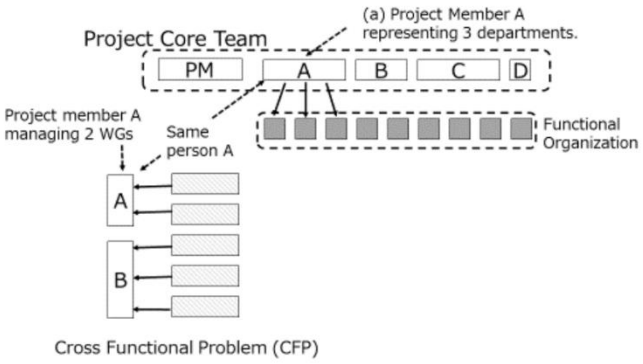


Figure 7 Outer structure of ERAM

Figure 8 ERAM example of a fictitious company shows an ERAM of a fictitious company. With a project core team of 2 employees, A and B. The company exists of four departments and three CFPs and WGs. Project core team member A represents departments 1 to 3 and manages WG1. The employee from department 3 involved in WG1 is the leader of WG1. WG3 exist of employee originating out of department 1 and 4. The employee of department 1 is the leader of the WG. The WG is managed by Project core team member B.

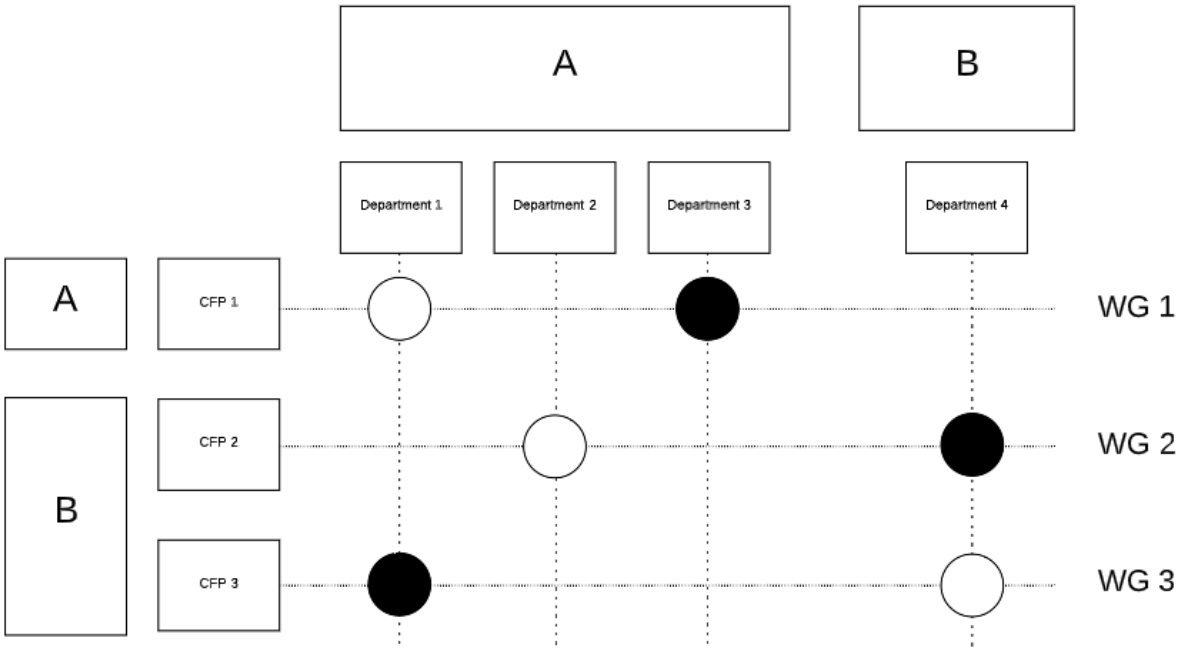


Figure 8 ERAM example of a fictitious company

The advantages and disadvantages of both frameworks will be listed to determine the most suitable framework for Trioliet. The articles found in this section will be applied to determine the advantages and disadvantages of RACI and ERAM.

The first advantage of the RACI framework is the **ease of applying**. The RACI Framework is intuitive, can be explained easily and is readily understood by people with no prior familiarity with the RACI Framework (Hirmer, George-Williams, Rhys, McNicholl, & McCulloch, 2021). The second advantage is the **flexibility** of the framework. Recommended RACI assignments are intended as a starting point for in-depth team discussions – not a definitive listing never to be altered (O'Connor & Mock, 2020). RACI allows the business process designer to allocate actors' responsibility on every business process vary from each other according to the needs of the business process (Sandfreni & Kridanto Surendro, 2016). The third advantage of the RACI framework is the possibility of **optimizing the responsibility and workload**. RACI can also identify if there is an overload of work on an actor, so the distribution of responsibility can be optimized (Sandfreni & Kridanto Surendro, 2016). The disadvantage of the RACI framework is the **limitation to projects carried out within one organization** (Mrzyglocka-Chojnacka, Kott, & Kott, 2019).

The ERAM affects two problems. The first problem is delegating the cross-functional problems because of the independency of the functions (e.g. mechanical, electrical and software). This means that the problems that occur during the projects are given to the department/employees low/lowest in the hierarchical organization structure because they have the right skills and knowledge to fix them. **The ERAM will clarify the leader who is responsible for fixing the cross-functional problem.** The second problem is that the management power of the managers of a functional organization is stronger than that of the project manager. The project manager struggles to establish a project team structure across the functional organizations (Yokemura & Inoue, 2019). **The ERAM framework will establish the project structure across functional organizations.** By clarifying the project structure across functional organizations, the system design and the function design, it becomes very convenient in **ironing out opinions among various organizations.** The disadvantage of the ERAM framework is **the lack of quantitative data to show the effectiveness of the framework** (Yokemura & Inoue, 2019)**.**

Chapter 2 answers sub-research question 1 by conducting a Systematic Literature Review to determine the available responsibility framework regarding project management. The responsibility frameworks regarding project management are RASCI, RACI and ERAM. The most suitable responsibility framework is determined by matching the disadvantages and advantages of the frameworks with the organization structure of Trioliet. The disadvantages and advantages are listed in Table 3 RA(S)CI and ERAM (dis)advantages table.

RA(S)CI	ERAM
Advantages	Advantages
Ease of application	Clarification of the responsible leader and members of cross-functional problems.
Flexible	Clarification of the project structure across the functional organizations.
Optimizing the responsibility	The ease of ironing out opinions among various organizations
Disadvantages	Disadvantages
Limited to projects within one organization	Lack of quantitative data to show the effectiveness of the ERAM model

Table 3 RA(S)CI and ERAM (dis)advantages table

3. Most suitable responsibility framework for Trioliet

The objective of Chapter 3 is to answer sub-research question 2 and determines the most suitable responsibility framework for Trioliet. In Chapter 2 the advantages and disadvantages of the responsibility framework defined by literature are listed, these advantages and disadvantages are matched with the organization structure of Trioliet and the project characteristics of the Triomatic and Solomix Stationary projects to determine the most suitable responsibility framework. Section 3.1 provides an introduction and explanation of organization structure matrixes. The organization structure of Trioliet is determined in section 3.2 based on the project characteristics of the Triomatic and Solomix Stationary projects. This organization structure is used in section 3.3 to determine the most suitable responsibility framework for Troliet and the Triomatic and Solomix Stationary projects.

3.1. Organization structure matrix

Organizations have different structures based on project characteristics. The project characteristics applied to determine the organization structure (Project Management Institute, 2008) are the Project manager's Authority, Resources availability for the projects, the manager controlling the project's budget, the project manager's role in general and project management administrative staff. The project management administrative staff are the employees involved in the project, these employees can work full or part-time on the project, see Table 4 Organization Structure Matrix.

The first organization structure is the functional organization. This organization type is a hierarchy where each employee has a clear superior and staff members are grouped by specialities. The second matrix is the weak matrix, this matrix maintains many characteristics of the functional organization. The main difference between a functional and weak matrix is the project manager's role. The project manager role is defined as a coordinator or expediter instead of a project manager. The daily task of the project manager in a weak matrix organization structure is to monitor the project. The balanced matrix organization recognized the need for a project manager but does not provide the project manager with full authority over the projects. The strong matrix organization provides the project manager with considerable authority and full-time project administrative staff. The last matrix is the projectized organization. This structure applies the resources for project work and the project managers have a great deal of independence and authority.

Organization Structure / Project Characteristics	Functional	*Matrix*			Projectized
		Weak Matrix	Balanced Matrix	Strong Matrix	
Project Manager's Authority	Little or None	Limited	Low to Moderate	Moderate to High	High to Almost Total
Resource Availability	Little or None	Limited	Low to Moderate	Moderate to High	High to Almost Total
Who controls the project budget	Functional Manager	Functional Manager	Mixed	Project Manager	Project Manager
Project Manager's Role	Part-time	Part-time	Full-time	Full-time	Full-time
Project Management Administrative Staff	Part-time	Part-time	Part-time	Full-time	Full-time

Table 4 Organization Structure Matrix

3.2. The organization structure of Trioliet

Trioliet does not have a project manager, there is a project coordinator. This results in the project characteristics of the project manager's authority, project budget, and project manager role can be categorized in a weak matrix organization structure (Project Management Institute, 2008). The project coordinator has limited authority over the project. The project coordinator has authority over the acquirement and assembling of the projects. The sales, development and service are not included in the authority according to the preliminary research. The company's budget is managed by strategic

management and divides this among the functional managers. The project coordinator's role is part-time because the project coordinator focuses primarily on the assembling of the projects.

Trioliet produces more machine types than the Triomatic and Solomix stationary. Nine of the eleven machine types of Trioliet are assembled applying line production principles when assembling a category 1 machine. Only the Triomatic and the Solomix stationary require project-based assembling during a category 1 project. This means that only 18% of the machine types of category 1 require project-based assembling and the SSR requests make up for 5% of all the requests of all the machine types. These statistics can conclude that Trioliet's resource availability for projects is limited. The project management Administrative staff are the employees around the projects. The employees involved in the Triomatic and Solomix stationary projects are mostly part-time involved with the projects.

Organization Structure / Project characteristics	Functional	*Matrix*			Projectized
		Weak Matrix	Balanced Matrix	Strong Matrix	
Project Manager's Authority	Little or none	Limited	Low to moderate	Moderate to High	High to Almost Total
Resource Availability	Little or none	Limited	Low to moderate	Moderate to High	High to Almost Total
Who controls the project budget	Functional Manager	Functional Manager	Mixed	Project Manager	Project Manager
Project Manager's Role	Part-time	Part-time	Full-time	Full-time	Full-time
Project Management Administrative Staff	Part-time	Part-time	Part-time	Full-time	Full-time

Table 5 Organization structure matrix of Trioliet

Table 5 Organization structure matrix of Trioliet schematically displays the project characteristics of Trioliet. The grey boxes are the selected project characteristics of Trioliet. The project characteristics point to a weak organization structure. Trioliet is categorized as a weak matrix organization structure because the project characterises of the weak matrix organization structure resonates with the organizational structure of Trioliet.

Figure 9 Weak matrix organization displays the organization chart of a weak matrix organization. The organization chart of the weak matrix clarifies that the project coordination or project team consist of staff members that have a functional manager as their superior. The figure also shows that the project coordination consults and/or informs other employees that are not in the project coordination. The figure displays that the project coordination does not have project management, this resonates with the project structure of Trioliet. The projects of Trioliet consist of a project coordinator. The organization chart of Trioliet can be found in.

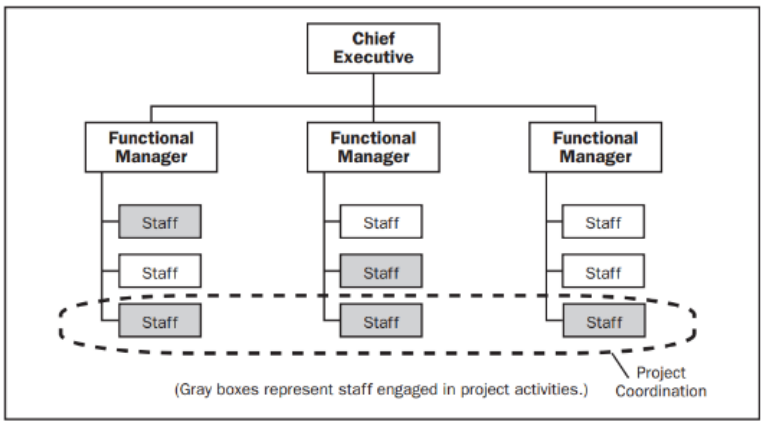


Figure 9 Weak matrix organization

The organization chart of Trioliet displays the similarities between the weak organization matrix structure and the organization structure of the Trioliet projects. The staff in the project coordination has a functional manager as supervisor just as in the weak matrix. The Triomatic and Solomix stationary projects have overlapping employees, the project coordinator and the sales manager depending on the region. Figure 10 Matrix organisation Trioliet displays not all the departments with employees in the project coordination of the Triomatic or Solomix stationary projects. The other departments, purchase, logistics, internal supplier and quality are excluded from the organization chart of Trioliet because these departments perform operational work. Operational work is ongoing and produces repetitive products, services, or results. This type of work is not related to a certain project. In comparison with projects is operations work ongoing and has no clear end/deadline (Project Management Institute, 2008). For Example, the purchase department purchases components unrelated to a certain project. The purchase department is divided based on the kind of component and not on projects. Thus, the purchase department purchases components for all the upcoming machines and projects. This process is ongoing and sustains the organization over time. In this example, purchase of produces is a repetitive service.

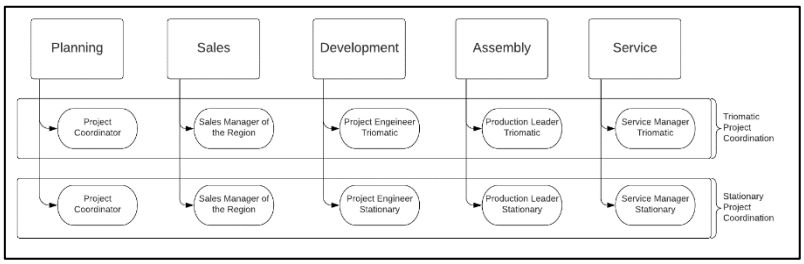


Figure 10 Matrix organisation Trioliet

3.3. Most suitable framework

The objective of the research is to implement a responsibility framework regarding project management in Trioliet for the Triomatic and Solomix Stationary projects. The advantages and disadvantages of the RA(S)CI and ERAM frameworks are depicted in Table 3 RA(S)CI and ERAM (dis)advantages table. All three responsibility frameworks will solve the core problem: 'Departments don't have a clear responsibility Framework', but the most suitable framework is applied to ensure the effectiveness of the implementation. This section will determine the most suitable responsibility framework for the Triomatic and Solomix stationary project of Trioliet based on the matrix organization structure of Trioliet and the advantages and disadvantages of the responsibility frameworks.

The RA(S)CI framework is easy to apply. This advantage is applicable to the research because the framework is easy to use for people that have no prior familiarity with the RA(S)CI model. The objective of the research is to compose and implement a responsibility framework. This will be helpful when implementing the framework. The RA(S)CI framework is flexible and can be adapted to a change of process or responsibility. The management power of the functional manager in a weak matrix organization is stronger than the management power of the project coordinator, thus procedures, processes, and responsibilities can be altered if the functional manager decides so. Besides the management power is Trioliet focused on assembling and developing premium quality livestock machines and equipment specifically to fulfil the needs of customers all over the world. This strategy results in an agile project process that changes every year. Thus, flexibility applies to the research. The third advantage of the RA(S)CI framework is the optimization of the responsibility distribution is not applicable. The objective of the research is to compose and implement a responsibility framework of the current responsibility distribution. The optimization of the responsibility distribution is not applicable to the research. The disadvantage of the RA(S)CI framework is the limitation to projects within one organization. The disadvantage of the RA(S)CI framework is a limitation that does not apply to Trioliet. Trioliet has cross-functional projects between departments, not organizations, thus the disadvantage does not apply to the research.

An advantage of the ERAM is the clarification of the responsible leader and members of cross-functional problems. The members involved during the projects are clear because most of the involved functional organizations that do not perform operations work have sub-functional organizations/specialized employees to perform the Triomatic and Solomix stationary projects. This advantage is not applicable to the Triomatic and Solomix stationary projects, because the responsibility within departments is clear. The struggle is the responsibility between departments. Thus, the clarification of the responsible leader of cross-functional problems is not applicable to the research. The second advantage of ERAM is the clarification of the project structure across functional organizations. The project structure across functional organizations is not clear and is one of the main incentives for the research. Functional organizations don't know who is responsible for what during the Triomatic and Solomix stationary projects. The problem of the projects is the responsibility framework and thus the structure between departments. Thus, this advantage does apply to the research. The third advantage is the ease of ironing out opinions among various organizations and the clarification of the communication between organizations. The scope of the research are the Triomatic and Solomix stationary projects. These projects are developed and assembled within Trioliet. Thus, these advantages do not add value to the situation at Trioliet. The disadvantage of the ERAM applies to Trioliet, the effectiveness of the matrix is not quantitatively proven. This implies that the effectiveness of the model is not proven. Implementing a matrix that is not proven effective is applicable to the research.

The RA(S)CI model has two applicable advantages and zero applicable disadvantages regarding the organization matrix structure and the research objective. The ERAM has one applicable advantage and one applicable disadvantage. For this research, the RA(S)CI framework is more applicable, because it is easy to apply and flexible. Both advantages match with Trioliet's project's characteristics and research objective. Literature about RA(S)CI does not define disadvantages applicable to Trioliet's projects. Literature about ERAM defines one disadvantage that could affect the effectiveness of the matrix, which could affect the effectiveness of the implementation of the framework. Thus, RA(S)CI is the most suitable responsibility Framework for Trioliet.

The advantages and disadvantages of the RACI and RASCI framework are comparable because the frameworks have the same matrix setup. The only difference between the RACI and RASCI framework is the support responsibility role. The support responsibility role is the department that supports the responsible department with the task. The support responsibility role can be applicable if the responsibility department does not have the information or tools required to perform the task and need the support department to support them with the right information or tools. (Mrzyglocka-Chojnacka, Kott, & Kott, 2019) based their choice of applying the RASCI model instead of the RACI Framework on the structure of the tasks. If tasks require to be passed on to other departments to be completed, then the RASCI Framework is more optimal than the RACI Framework. Weak matrix organizations are mostly focused on departments' functionality instead of projects going through these departments. Figure 3 Cross-functional Flowchart confirms this focus on the departments. Documents and materials are passed to other employees/departments when they are finalized by the handling department. This makes most tasks interchangeable between employees/departments. This concludes that the RACI Framework is the most suitable responsibility Framework for Trioliet. Thus, the answer to sub-research question 2 is the RACI Framework.

The objective of Chapter 3 is to determine the most suitable responsibility framework for Trioliet. This is conducted by matching the advantages and disadvantages of the responsibility frameworks of Chapter 2 with the organization structure of Trioliet. Trioliet has a weak matrix structure, this indicates that the project characteristics like project manager's authority, resource availability, controller of project budget, project manager role and project administrative staff are limited or parttime focussed on projects. If we compare the advantages and disadvantages of the responsibility frameworks with the weak organization structure of Trioliet and the objective of the research, the RACI framework is the most suitable framework for Trioliet.

4. The responsibility framework for Trioliet

The objective of chapter 4 is to determine the application of the RACI framework with the Triomatic and Solomix Stationary projects. The application of the RACI framework refers to filling in the acronym letters in the framework. Section 4.1 describes the six steps of the interviews to retrieve the required data to apply the RACI framework. The results of the interviews are listed in section 4.2. The results are dismantled to create the RACI frameworks. In addition, section 4.3 explains the tool with which these RACI frameworks are integrated.

4.1. Research method

The RACI Framework is based on the tasks within a project and the different responsibility roles of the stakeholders. Thus, the data required to construct a RACI Framework for Trioliet are the involved stakeholders, the tasks during the Triomatic and Solomix stationary projects and the responsibility role of the stakeholder during the tasks.

Trioliet's projects are customer specific and differ from each other. Defining standard tasks, steps and/or phases within these projects is difficult and managerial/departmental-specific. Requiring managerial/departmental information can be efficiently gathered through Individual Depth Interviews (Cooper & Schindler, 2014). The IDIs are conducted to gather the required information for the RACI Framework. The objective of the IDIs is to determine all the activities during projects and what responsible role employees/departments have during the projects.

The Individual Depth interviews will use (Boyce & Neale, 2006) as a guideline for the interview design. The article describes a method on how to conduct In-Depth Interviews.
The article describes six steps for conducting an IDI.

1. Plan
2. Develop Instruments
3. Train Data Collectors
4. Collect Data
5. Analyse data
6. Disseminate Findings

The first step is to form a **plan** by identifying the stakeholders and determining what information is required from them. Furthermore, the personal and professional information of the interviewee is listed. The second step of the process is to **develop instruments.** The instruments are the instructions that are followed for each interview, to ensure consistency between interviews. The **Train Data Collectors** step reviews the previous steps. The data collection techniques, instruments, ethical issues and interpersonal communication is scrutinized. The 'train data collectors' step trains the data collector, in this case, the interviewer, to collect the data efficiently and effectively. Training could be done in several ways, in this section is described how the data collector is trained for the interviews. **Collecting the data** is the fourth step of the interview method. In this step the interview is conducted and the pre-composed structure is persevered. The main action during and after the interview is to summarize key data and verify the given information of the interviewee. After collecting the data, the **data** will be **analysed**. A transcribe will be generated and analysed on key findings. The key findings are required to **disseminate the findings**. Disseminating includes finalizing, summarizing and revising the results.

The methodology of the Individual Depth Interviews is based on the research framework for RACI Framework from (Lee, Lee, Jin, & Hyun, 2021), see Figure 11 Research Framework for RACI Model. The article defines three stages of constructing a RACI Framework. The first stage is the Identification of process stage. The stage defines the processes and tasks during Trioliet's projects. The second stage is the identification of stakeholders stage. In this stage, the stakeholders involved during the tasks are defined. The interviewees are asked about the procedures of the tasks determined in stage 1 to define the involved stakeholders. The result of the second stage is an overview of the stakeholders that participate in a certain task and the relationship between the interviewee or associated department with the involved stakeholder department. The third and last stage is the RACI Framework stage. The third stage is to develop the RACI Framework by mapping the roles and responsibilities for each activity. The information required to model the RACI Framework can partly be determined in stage two but is elaborated on in stage three.

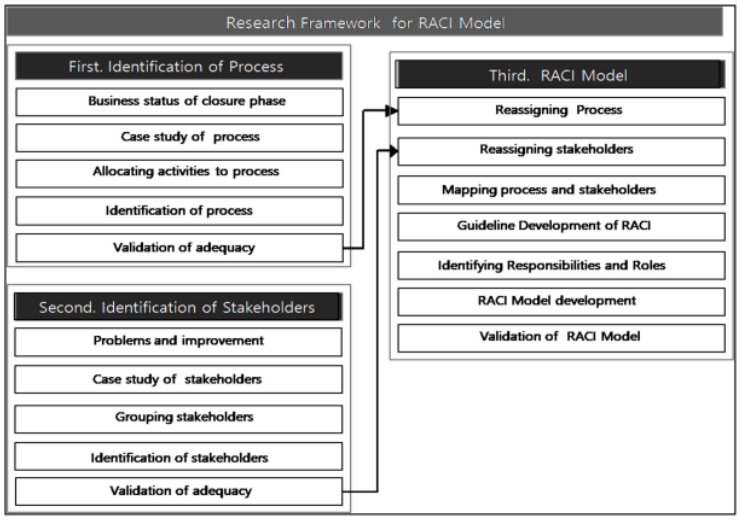


Figure 11 Research Framework for RACI Model

The stakeholders for the interviews can be derived from Figure 3 Cross-functional Flowchart. The stakeholders during the creation of the RACI Framework and the IDIs are the departments and a few key managers. In Table 6 Stakeholder departments the name and main activity of the departments are presented.

Department Name	Stakeholder Job Description
Sales	Sales Manager Export
Internal Sales	Head of Internal Sales
Planning	Project Coordinator
Purchase	Head of Purchase
Software	Software Developer
Development	Head of Development
Quality	Head of Quality
Assembly	Production Leader Triomatic & Production Leader Stationary
Service	Service Manager

Table 6 Stakeholder departments

Furthermore, key employees are defined. The defined key employees can be found in Table 7 Key employees. Key Employees have a specific responsibility during projects. This construction will provide a clearer overview of the RACI Framework because the employees will have particular responsibility roles within projects. Table 7 Key employees consist of the job descriptions and the department where the employee is stationed.

Job Description	Department
Project Coordinator	Planning
Project Engineer	Engineering

Table 7 Key employees

Steps two through four are placed in Appendix C: Interview Setup.

4.2. Interviews results

The fifth step of (Boyce & Neale, 2006) is to analyse the data. The Trioliet Interview Template of Appendix D: Trioliet Interview Template is analysed and taken as primary input data. The objective of this section is to determine the application of the RACI framework for the Triomatic and Solomix Stationary projects. To apply the framework interviewees are interviewed, the details of the interview can be found in Appendix C: Interview Setup. An important distinction during these interviews were the terms responsibility and accountability. To correctly interpret the framework, the distinction between these terms are important. In these RACI frameworks, the definition of (McGrath & Whitty, 2018) will be applied. This article describes responsibility as the obligation to satisfactorily perform a task. The liability to ensure that the task is satisfactorily done is accountability. In the case of the RACI Framework, a responsible department is obligated to perform the task and the department accountable needs to direct the responsible department.

The applications of the RACI framework were determined by a couple of steps. The first step was to combine the Trioliet Interview Templates. This created a long list of tasks and the distribution of the RACI acronym according to the interviewees. This long list of tasks was filtered on duplicates. Some of the duplicate tasks had a different application but had different responsibility roles. This was the case for two tasks. This implies that the interviewees have a different view on the responsibility of that tasks. In both cases the interviewees were the project coordinator and the project engineer. This conflict was solved by discussing the conflict with both interviewees and determining the correct responsibility role distribution. The second filtering was that the task should comply with these two requirements. The first requirement is the variation in responsibility. To represent the reality in the RACI Framework, the labour intensiveness and responsibility load require to be evenly distributed over all the tasks within one project. To ensure this even distribution, all the tasks satisfy one or two of the following two requirements. The first requirement is the difference in the responsibility role distribution. If there is a task that has a different responsibility role distribution than the previous task, then the task is placed in the RACI framework. The second requirement is the degree of cruciality of the task for the outcome of the project. If a task consists of actions that are crucial to the outcome of the project, the task is placed in the RACI framework even if the responsibility role distribution is the same as the previous task. This requirement is applied to ensure that all the crucial tasks are described in the RACI Framework.

Analysing the application of the RACI frameworks and the tasks within the framework, a remarkable finding was done. The remarkable finding are the project parameters. The Triomatic and Solomix stationary projects are engineered and assembled based on project principles but can be categorized by project parameters. These project parameters group the projects based on the comparable tasks during the projects. These projects do not have the same end product but have similar tasks in the production of the projects. The first project parameter is the project type. The project type of the research is related to the research scope. The research scope is limited to the Triomatic and Solomix stationary projects. Thus, the project type is the Triomatic or the Solomix stationary projects. The conducted tasks differ

depending on the project type. This project parameter is the first and most impactful project parameter because the tasks undertaken have the biggest differences in comparison with the other project parameters. The second project parameter is the category. As mentioned in the introduction, Trioliet develops and assembles two categories. Category 1 consists of standard models with add-ons out of the catalogue. The add-ons are fully developed or exist conceptual. Some add-ons can be assembled without any development required because there are already fully developed and some add-ons are engineered on order. The second category is the SSR projects. These machines are customer-specific developed. Part of the machine's components are not developed yet and will be developed at the customer's request. The third project parameter is the extra delivery of spare parts. The spare parts project parameter is determined during the interviews. Spare parts are parts that the customer or dealer can order extra besides the project components. The spare parts are mentioned in three IDIs. The spare parts are often worn sensitive parts that can be worn out before the other parts are worn out. The customer can use the spare parts to fix a component of the project if it is worn out. The tasks within a RACI Framework change when spare parts are ordered with the project. The fourth project parameter is the support activities. In addition to the spare parts, the support activities emerged during the interview. These support activities are not directly related to a certain project and are not conducted for a specific project or customer request. The support activities are carried out continuously and don't depend on projects. The support activities are the Development of new projects, the Development of New Software, the Entree Inspection and the Purchase process.

The support activity Development of new projects is the RACI Framework in which the tasks of creating a new machine type are displayed. This support activity displays the development process from selecting the project that will be developed till the project is added to the catalogues. The support activity development of New Software is the process of developing new software for the current or new machines/projects. The software directs robots and components of the project. The support activity Entrée Inspection is regarding the quality inspection of ordered components. Ordered components are inspected on a sample basis. The support activity describes the tasks from receiving the components to the release of the components to the right owner. The last support activity is the Purchase process. Components are ordered for multiple projects, thus this is a support activity for every project. The support activity RACI framework depicts the process from releasing the BOM into the ERP system to the completion of the purchase of the components.

Knowing all the different project parameters, the projects can be categorized into 40 different Project Parameter Compositions. Henceforth PPC. The PPCs refer to projects with the same project parameters and thus similar tasks during the production of the projects. These PPCs have similar tasks, but do not have the same end product, see Figure 12 PPCs. For example, PPC 1 is a Triomatic Category 1 project with spare parts and no support activities. The tasks performed during these projects are similar, but the details of the tasks differ. For example, both projects have to configure the BOM, but the number of rails parts, feeding bunker material and mineral mixers differs per project.

PPC	Type	Category	Spare Parts	Support Activitiy
1	Triomatic	Category 1	Yes	None
2	Triomatic	Category 1	No	None
3	Triomatic	SSR	Yes	None
4	Triomatic	SSR	No	None
5	Triomatic	Category 1	Yes	Dev new pro
6	Triomatic	Category 1	Yes	Dev new soft
7	Triomatic	Category 1	Yes	Entrée inspection
8	Triomatic	Category 1	Yes	Purchase Process
9	Triomatic	SSR	Yes	Dev new pro
10	Triomatic	SSR	Yes	Dev new soft
11	Triomatic	SSR	Yes	Entrée inspection
12	Triomatic	SSR	Yes	Purchase Process
13	Triomatic	Category 1	No	Dev new pro
14	Triomatic	Category 1	No	Dev new soft
15	Triomatic	Category 1	No	Entrée inspection
16	Triomatic	Category 1	No	Purchase Process
17	Triomatic	SSR	No	Dev new pro
18	Triomatic	SSR	No	Dev new soft
19	Triomatic	SSR	No	Entrée inspection
20	Triomatic	SSR	No	Purchase Process

PPC	Type	Category	Spare Parts	Support Activitiy
21	Solomix	Category 1	Yes	None
22	Solomix	Category 1	No	None
23	Solomix	SSR	Yes	None
24	Solomix	SSR	No	None
25	Solomix	Category 1	Yes	Dev new pro
26	Solomix	Category 1	Yes	Dev new soft
27	Solomix	Category 1	Yes	Entrée inspection
28	Solomix	Category 1	Yes	Purchase Process
29	Solomix	SSR	Yes	Dev new pro
30	Solomix	SSR	Yes	Dev new soft
31	Solomix	SSR	Yes	Entrée inspection
32	Solomix	SSR	Yes	Purchase Process
33	Solomix	Category 1	No	Dev new pro
34	Solomix	Category 1	No	Dev new soft
35	Solomix	Category 1	No	Entrée inspection
36	Solomix	Category 1	No	Purchase Process
37	Solomix	SSR	No	Dev new pro
38	Solomix	SSR	No	Dev new soft
39	Solomix	SSR	No	Entrée inspection
40	Solomix	SSR	No	Purchase Process

Figure 12 PPCs

4.3. RACI framework tool

This section will elaborate on the sixth step of (Boyce & Neale, 2006), disseminate the findings. This step includes finalizing and summarizing the results, this is done by creating a RACI framework tool that displays all the PPCs. The objective of the RACI tool is to create an insightful framework for the different PPCs. The tool has to be easy to use and adjustable to multiple projects within Trioliet. The tool should be easy to use for the employees of Trioliet. The tool should support the employees in the insight of their responsibility role during projects. The RACI framework provides employees with insight into their responsibility though the Triomatic and Solomix Stationary projects. The RACI framework should be adjustable for multiple projects within Trioliet, so Trioliet can adjust the framework to other projects and have insight into those responsibility distributions.

RACI Frameworks

The PPCs all have the same RACI framework setup. The title of the framework is placed on the top of the RACI framework and is the name of the project defined by the PCCs. The RACI framework has the universal setup, on the vertical axis the tasks are depicted in semi-chronological order and the departments are depicted on the horizontal axis. An addition to the tasks, phases are added. (Project Management Institute, 2008) define four phases of every project: starting the project, organizing and preparing, carrying out the work and closing the project.

Figure 13 Example RACI framework shows the application of the RACI framework of a Triomatic project. The framework shows the letters R,A,C and I placed in the framework and combinations of letters. An example of this is RA, AC and IC. This means that a department has multiple responsibility roles during this task. E.g. RA, means that a department is responsible and accountable for the task. All these features are depicted in

	Triomatic Category 1 + Spare Parts Project													
		Customer / Dealer	Sales OAC	Development	Purchase	Project coordinator	Project Engineer	Assembly	Service	Logistic	Supplier	Ex. Software Developer	Internal Sales	Software Quality
Starting	Order request	RA	C				I							
	Check the feasibility	I	RA											
	Composing Quotation		RA											
Preparing	Determining the Delivery date/time					A					C		R	
	Checking Technical Drawings (Engineering)		A				R							
	Convert the project to the stable drawing	C				I	RA							
	Contract Signing + Approving the technical drawing	R	A											
Carrying Out	Compiling the Ordercard					I	C						RA	
	Compile Spare Parts Ordercard		C			I	RA		C					
	Configure Order / BOM	C	I			I	RA							
	Composing Production Planning					RA	C							
	Releasing the BOM in INFOR				I	RA		I		I				
	Collecting the material of the bunkers					AC		I		R				
	Delivering raw material and semi-finished products to Assembly department					AC		I						
	Collecting and Delivering the Spare Parts					A		I		R				
	Assembling the feeding kitchen					A		R						
	Assembling the automatic feeding robot					A		R						
	Prepare and supply the mechanics with information						RA		CI					
	Communicating Delivery time and Mechanic planning with customer		I			C	C		RA					
	Determine / Compile software configuration					I								RA
	Picking the Order (Machine + Spare Parts)					A		I		R				
	Visual inspection of the Machine							C		I				RA
Closing	Planning the mechanics													
	Mounting the project at customer					C			RA	I		R		
	Startup of the project								RA					
	Explaining the project specifics to the customer and dealer								RA					

Figure 13 Example RACI framework

RACI framework tool

The RACI frameworks applications of the Triomatic and Solomix stationary projects are composed in excel. The projects are categorized through project parameters that create PPCs. In this section, the composition of the RACI frameworks and the RACI tool is explained. The tool displays the RACI framework, henceforth known as the RACI framework tool or tool. To create a RACI framework, the project parameters need to be filled in. The project parameters can be filled in by clicking on the 'RACI Framework' button. This button creates a User form, see Figure 14 Parameter userform.

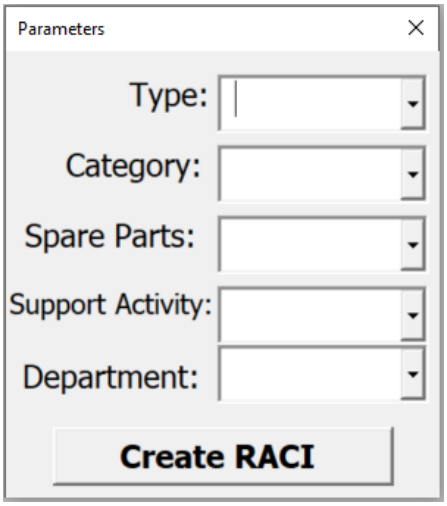
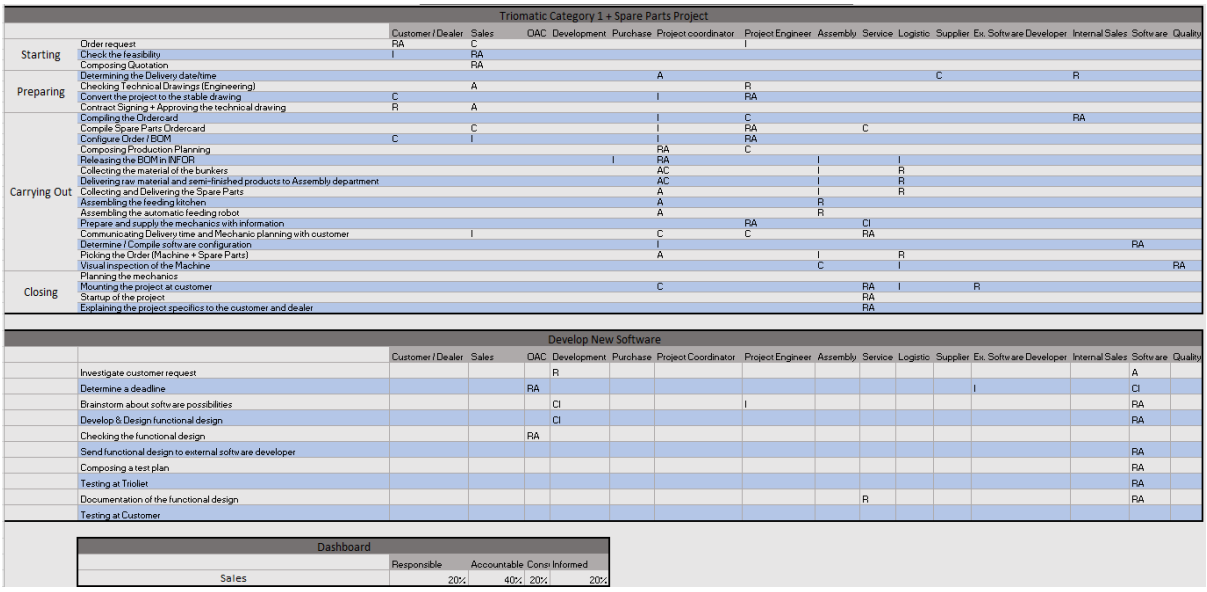


Figure 14 Parameter userform

The userform shows the four project parameters and the department box. The department box will be discussed later in this section. The project parameters can be filled in, according to the corresponding project. After clicking on the 'Create RACI' button, the RACI Framework will appear in the form of Figure 15 Example RACI Framework Tool.



Triomatic Category 1 + Spare Parts Project

		Customer / Dealer	Sales	OAC	Development	Purchase	Project coordinator	Project Engineer	Assembly	Service	Logistic	Supplier	Ex. Software Developer	Internal Sales	Software	Quality
Starting	Order request	RA	C					I								
	Check the feasibility	I	RA													
	Composing Quotation		RA													
Preparing	Determining the Delivery date/time						A					C		R		
	Checking Technical Drawings (Engineering)		A					R								
	Convert the project to the stable drawing	C					I	RA								
	Contract Signing + Approving the technical drawing	R	A													
Carrying Out	Compiling the Ordercard						I	C						RA		
	Compile Spare Parts Ordercard		C				I	RA		C						
	Configure Order / BOM	C	I				I	RA								
	Composing Production Planning						RA	C								
	Releasing the BOM in INFOR					I	RA		I		I					
	Collecting the material of the bunkers						AC		I		R					
	Delivering raw material and semi-finished products to Assembly department						AC		I		R					
	Collecting and Delivering the Spare Parts						A		I		R					
	Assembling the feeding kitchen						A		R							
	Assembling the automatic feeding robot						A		R							
	Prepare and supply the mechanics with information							RA		CI						
	Communicating Delivery time and Mechanic planning with customer		I				C	C		RA						
	Determine / Compile software configuration						I								RA	
	Picking the Order (Machine + Spare Parts)						A		I		R					
	Visual inspection of the Machine								C		I					RA
Closing	Planning the mechanics															
	Mounting the project at customer						C			RA	I		R			
	Startup of the project									RA						
	Explaining the project specifics to the customer and dealer									RA						

Develop New Software

		Customer / Dealer	Sales	OAC	Development	Purchase	Project Coordinator	Project Engineer	Assembly	Service	Logistic	Supplier	Ex. Software Developer	Internal Sales	Software	Quality
	Investigate customer request				R										A	
	Determine a deadline			RA									I		CI	
	Brainstorm about software possibilities				CI			I							RA	
	Develop & Design functional design				CI										RA	
	Checking the functional design			RA												
	Send functional design to external software developer														RA	
	Composing a test plan														RA	
	Testing at Triolet														RA	
	Documentation of the functional design									R					RA	
	Testing at Customer															

Dashboard

	Responsible	Accountable	Cons	Informed
Sales	20%	40%	20%	20%

Figure 15 Example RACI Framework Tool

Figure 15 Example RACI Framework Tool shows the RACI framework plus a dashboard. This dashboard is placed in the lower left corner. This dashboard shows the responsibility role distribution for a department. In the example of figure 11, the Sales department is accountable for 40% of the tasks done by the Sales department during the project.

This dashboard is created by filling in the userform, see Figure 14 Parameter userform. When a department is selected, a dashboard will be created for that department regarding the responsibility role it fulfils in the project, see Figure 16 Dashboard Calculations.

Dashboard				
	Responsible	Accountable	Consulted	Informed
Sales	20%	40%	20%	20%

x = *The department or key manager selected in the parameters*

$total$ = *Number of responsibility role x has assigned during a project*

$R\#$ = *The number of task x is responsible for*

$A\#$ = *The number of task x is accountable for*

$C\#$ = *The number of task x is consulted on*

$I\#$ = *The number of task x is informed about*

$$total = R\# + A\# + C\# + I\#$$

$R\%$ = *The percentage of responsibility during the project for x*

$A\%$ = *The percentage of accountability during the project for x*

$C\%$ = *The percentage of consultancy during the project for x*

$I\%$ = *The percentage of informed during the project for x*

$$R\% = \frac{R\#}{total} \times 100$$

$$A\% = \frac{A\#}{total} \times 100$$

$$C\% = \frac{C\#}{total} \times 100$$

$$I\% = \frac{I\#}{total} \times 100$$

Dashboard				
	Responsible	Accountable	Consulted	Informed
Sales	R%	A%	C%	I%

Figure 16 Dashboard Calculations

The dashboard functions as an indication of the responsibility role of the department. The RACI framework is a detailed display of the responsibility roles per task and the dashboard is a global indication of the responsibility role distribution during the project.

The application of the RACI framework regarding project management refers to placing the acronym letters in the framework. To determine the application of the different projects, production/assembly steps and responsibility distribution during the projects need to be determined. This information is acquired through interviews with (key)employees. The results of the interviews are production/assembly steps, responsibility distribution and project parameters(these are the properties that categorize the projects).To display the application and thus the distribution of the acronym, a RACI tool is made. The RACI tool requires the user to fill in the project parameters and then a RACI framework for the project is created. In addition to that, a dashboard shows the responsibility role in percentages for a department during that project.

5. Implementation

The objective of this chapter is to construct an implementation strategy that can implement the RACI framework tool of the previous chapter effectively. The steps of the implementation strategy are described in section 5.1. The implementation strategy is adjusted to Trioliet and the Triomatic and Solomix Stationary projects in section 5.2.

5.1. Implementation strategy

The RACI Framework Tool is useful for Trioliet to implement and clarify the responsibility role distribution within the Triomatic and Solomix stationary projects. To utilize the RACI Framework Tool optimally, an implementation strategy is constructed. The implementation plan answers the fourth research question: *How can Trioliet implement the Responsibility Framework?*

The implementation strategy is based on the implementation plan steps of (Eby, 2017). The implementation strategy provides fundamental elements of a strategic implementation process. These fundamental components will be modified to an implementation strategy for Trioliet and the implementation of a tool. This way the culture of Trioliet and the tool can be taken into account in the strategy.

The components of an implementation plan according to (Eby, 2017) are:

1. Introduction
2. Management Overview
3. Major Tasks
4. Implementation Schedule
5. Security and Privacy
6. Implementation support/resource list
7. Documentation
8. Monitoring Performance

Besides the components listed above, (Eby, 2017) also describes a couple other steps that will be excluded in this implementation plan. The implementation plan describes the steps ‘Acceptance Criteria’ and ‘Project Approval’. These sections describe how the implementation should be bought in by management and how to get approval for the plan. Both steps are not relevant to this implementation plan, because the implementation plan is advised to Trioliet. The implementation plan describes the steps ‘Glossary’ and ‘References’. The implementation plan will exclude its own glossary and references section because they are included in the research paper.

5.2. Application of the implementation strategy

Introduction

The objective of the implementation strategy is to generalize the knowledge of the responsibility distribution across all heads of departments displayed in the RACI framework tool. This will result in a mutual understanding of the responsibility distribution across the projects. All the heads of departments are chosen because the heads of departments have stronger management power in a weak matrix organisation. All the departments are listed in Table 6 Stakeholder departments.

Management Overview

The management overview describes the employees and their role during the implementation of the tool. The implementation manager of the tool is one of the supervisors of Trioliet, the project coordinator of the Triomatic and Solomix Stationary projects. These project coordinators are

responsible for the distribution and implementation of the tool. They are involved in every step of the implementation plan.

Major Tasks

This section discusses the tasks undertaken by the implementation manager to implement the RACI framework tool. The objective, actions and resources are described in this section.

Start-up:

Task 1: Presentation of the research to the involved stakeholders

This task will be the kick-off of the implementation of the RACI framework tool. The presentation introduces the tool to the involved stakeholders and future users. The task can be labelled as complete when the involved stakeholders understand the basic concepts of a RACI framework and the objective of the tool.

Task 2: Demonstrations of the tool

Demonstrating a tool will increase the understanding of the tool for the involved stakeholders. The presentation will explain the tool and show how to use the tool. If involved stakeholders can apply and work with the RACI Framework Tool, then the task is complete.

The Start-up phase will take around 1 month.

Implementation:

Task 3: Applying the RACI framework tool during project obstacles.

The third task is applying the RACI framework tool during project obstacles. A project obstacle can be a conflict between departments or unclarity of proceeding steps in a project. The RACI framework tool can resolve these obstacles by acting as a mediator. This task can be labelled complete when the RACI framework tool is applied in three instances and situations regarding the Triomatic and Solomix stationary Projects.

The implementation phase will take around 4 months, this time will depend on the number of obstacles occurring during projects.

Adaptation:

Task 4: Adaptation of the RACI framework tool to other project types

The objective of the RACI framework tool is to clarify the responsibility role distribution between departments during a project of Trioliet. The RACI Framework Tool is set up for the Triomatic and Solomix stationary projects. The RACI Framework Tool can be applied to all the projects within Trioliet. Tasks 1 to 4 ensured the understanding of the tool and provided explanations and demonstrations to develop skills required to use the tool. Task 5 will adapt and convert the tool to other projects within Trioliet. The adaption and conversion will be conducted by the OAC or all the functional managers of Trioliet. Not every other machine type within Trioliet has a project coordinator/manager, thus to apply a RACI Framework all the functional manager's knowledge is required. The task is complete when the RACI Framework Tool is adapted to at least one other machine type.

Task 5: Documentation of the protocols for adding new project types

The objective of task 5 is to adapt and convert the tool to other projects within Trioliet. Task 6 is an extension of task 5. Task 6 will integrate the tool into the extension protocol of the machine types. This means that the RACI Framework Tool is documented in the existing adding machine types protocol. The task will be labelled as complete when the adding protocol has the RACI Framework Tool documented in it.

Implementation schedule

The objective of this section is to explain and display the schedule in which the tasks are conducted. This implementation plan of the research is not based on a schedule that involves dates and deadlines, but rather on phases in which the implementation can take place. This schedule tactic is selected because Trioliet is a versatile company and requires to be flexible. Besides the versatility of Trioliet, the implementation of a tool is hard to predict, because the objective is to get department heads familiar with the tool. The speed at which someone understands a tool differs per employee and because of the versatility of Trioliet, a prediction about the amount of energy and time put into the implementation and integration of the tool until it is completed is hard. This is the main reason for the phase-based schedule instead of a date- and deadline-based schedule. The phases can be seen above the tasks in the 'major tasks' section. The tasks and time per phase are depicted in Figure 13 Implementation Strategy. The estimation is that the RACI framework can be fully implemented and integrated within Trioliet's processes within 7 months.

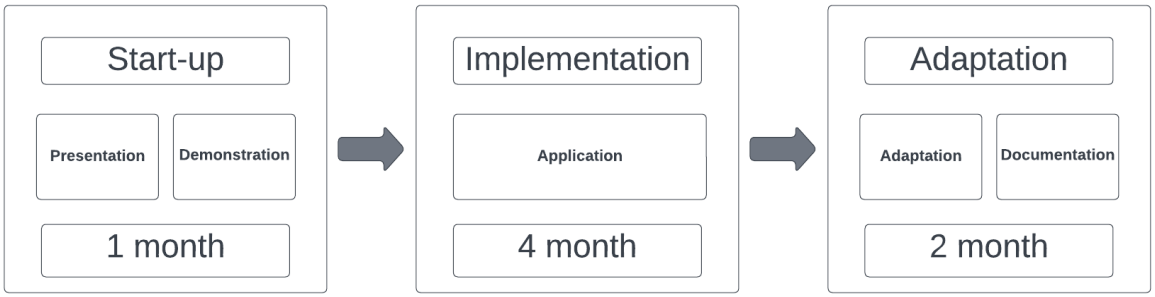


Figure 13 Implementation Strategy

Security and privacy

The next component is security and privacy during the implementation. Privacy is not applicable for the tool. The tool only depicts department names, the project coordinator and the project engineer, these job descriptions do not consist of privacy-sensitive information about employees. The RACI Framework Tool is distributed through the email system of Trioliet. This system is secured and only available for Trioliet employees. Besides the secure mail system, the RACI Framework Tool is protected with a password that is distributed through the mail. This extra protection layer will protect the tool from leaks and/or hacks.

Implementation support

This section describes the hardware, software, facilities and materials required for the implementation, along with documentation, necessary personnel and training requirements. The implementation of the RACI framework Tool requires a computer and/or laptop equipment to run the software Microsoft Excel in which the tool is developed and programmed. The involved stakeholders to which the RACI Framework tool will be distributed have access to a personal computer and the Microsoft Excel software

Documentation

This section provides the documents required to complete the implementation plan. The document required for the implementation is the RACI Framework Tool. The tasks and phases described in the sections above only require the RACI Framework tool.

Performance monitoring

The final component of this implementation strategy is the performance monitoring component. This component describes the metrics by which the implementation's performance is measured and when the implementation is assessed.

The performance of the RACI framework tool will be assessed after every implementation phase. The implementation acknowledges three phases and the implementation manager decides when a phase is completed. The completion of a phase is described in the section Major Tasks.

The implementation manager can assess the entire performance of the RACI framework tool after the third phase according to the number of project obstacles the RACI framework tool effectively help resolve and how other projects within Trioliet the RACI framework tool is adapted.

To utilize the RACI Framework tool optimally, an implementation strategy is constructed. Constructing an implementation plan is based on the eight components described in (Eby, 2017) The implementation exists out of five consecutive major steps that should be executed by the implementation manager. The phases of the implementation plan can be executed within 7 months.

6. Recommendation and future research

This chapter includes recommendations, future research suggestions and the discussion of the research. Section 6.1 describe the recommendation for Trioliet regarding the RACI tool and the corresponding implementation strategy. The recommendations are followed by suggestions for future research regarding the research in section 6.2. Finally, the discussion of the research is described in section 6.3.

6.1. Recommendation

The first recommendation for Trioliet is to implement the RACI Framework Tool according to the implementation strategy constructed in Chapter 5. This strategy is custom-made for the RACI Framework Tool, Trioliet's characteristics and Trioliet's projects. Applying the implementation strategy will increase the effectiveness of the implementation and will clarify the responsibility within the projects. As mentioned before, the RACI Framework will provide departments with a clear responsibility framework during Triomatic and Solomix stationary projects.

The second recommendation is to apply the RACI Framework Tool to discuss the responsibility load between the departments. (O'Connor & Mock, 2020) states that the RACI Framework is intended as a starting point for in-depth team discussions. The RACI Frameworks and the dashboards within them can be taken as an indication of the responsibility- and workload of departments during projects. Trioliet can apply the RACI Framework Tool to discuss the responsibility- and workload per department to optimize the distribution.

6.2. Future research

Future research could investigate the possibility of analysis on the RACI Framework Tool. This could be conducted with a quantitative method, by expressing percentages and ratio's between certain RACI acronym frequencies and/or combinations. Future research could also investigate possibilities for qualitative analyses. For Example, an observational analysis that investigates the placements of the responsibility roles and links between the responsibility roles. Additionally, the work- and responsibility load of the tasks could be investigated. The research could analyse the work- and responsibility load per task and distribute this load evenly over the tasks.

The RACI framework displays the tasks during complex projects. This standardization can be applied to develop fixed assembly- and communication procedures. These standardization / fixed procedures could result in an efficient way of working.

The RACI Framework Tool provides a percentual distribution of the responsibility roles for the selected dashboard. The dashboard functions as an indication of the responsibility role of the selected department. This dashboard could be expanded with multiple variables and indicators. The expanded dashboard could help departments get even more insight into their responsibilities during projects.

6.3. Discussion

The input of the preliminary research, the core problem and the RACI Framework Tool are based on the expertise of the supervisors and interviews with the heads of departments and key employees. The interviewer determines key findings from the interviews. The answers of the interviewees can be subjective and it is the task of the interview to evaluate the answers and determine the objective key findings of the interviews. The accuracy and quality of the research depend on the translation of the subjective interviewees' input into objective input. This translation from subjective input to objective input can jeopardise the accuracy and quality of the research. However, this subjectivity is tackled as

much as possible by applying 2 requirements to filter the data used for the RACI tool. In addition to the requirements obligates the interview methodology from (Boyce & Neale, 2006) to apply objective interview setups and instruments to generate objective results.

The implementation strategy provides fundamental elements of a strategic implementation process (Eby, 2017). This implementation strategy provides a general step-by-step approach to implement different kind of changes within companies. The generality of the implementation strategy could result in a less effective implementation of the tool in comparison with implementation strategies specially designed for tools. However, the implementation strategy has been chosen because the implementation is not only focused on the implementation of the tool, but is also focused on project obstacles and other project management-related topics. The expectation is that an implementation strategy that provides the fundamentals of implementation strategy can apply these topics more effective.

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Appendix

Appendix A: Preliminary research table

Problem	Number of employees
Delayed delivery	5
Trioliet's procedures and communication are not fixed	5
Departments don’t have insight into the progress of projects	2
Trioliet don't have a project manager	2
Incorrect INFOR information	2
Trioliet's products are too customer specific	2
Dealers are uneducated	2
16 weeks is too little time to deliver	1
OAC accepts too many projects	1
After Sales are of poor quality	1
Shifting Projects	1

Appendix B: Literature Review

The objective of Chapter 3 is to list responsibility frameworks regarding project management defined by literature. In Chapter 2 the research questions are determined. Chapter 3 builds on sub-research question 1 by conducting a Systematic Literature Review (SLR).

A Systematic Literature Review, henceforth SLR, is a systematic, explicit and reproducible method for identifying, evaluating, and synthesizing the existing body of completed and recorded work produced by researchers, scholars, and practitioners (Okoli & Schabram, 2010).

The SLR exists of eight steps according to (Okoli & Schabram, 2010):

1. Purpose of the literature
2. Protocol and training
3. Searching for the literature
4. Practical screen
5. Quality appraisal
6. Data extraction
7. Synthesis of studies
8. Writing the review

These steps will be applied as guidelines for the SLR.

The first step is the purpose of the literature review. The objective of the SLR is to define and investigate responsibility frameworks regarding project management. These responsibility frameworks are applied to determine the most suitable framework for Trioliet. The knowledge problem is the lack of knowledge about responsibility frameworks regarding project management. To compose and implement a framework, the available framework needs to be defined before the implementation can be conducted. This results in the sub-research question:

What responsibility frameworks regarding project management are defined by literature?

The second step is the protocols and training. The protocols ensure consistency in the execution of the review (Okoli & Schabram, 2010). The first part is the database applied during the SLR. The databases applied to answer the research question are Scopus and Web of Science. The responsibility framework is regarding project management because Trioliet assembles the Triomatic and Solomix stationary machines on a project basis. Project management is relevant in all sorts of disciplines, thus multidisciplinary databases are required to provide a total overview of all responsibility frameworks available.

The third part is searching for literature, in this part the details of the search are described. The concepts for the databases are set up and based on sub-research question 1. The objective of sub-research question 1 is to list all the available responsibility frameworks regarding project management, therefore the concepts 'Responsibility' and 'Framework' are included in the SLR. Synonyms for 'Framework' will be included in the concepts to increase the search orientation's quality and effectiveness. The synonyms are 'Model' and 'Plan'. Sub-research question 1 is focused on responsibility frameworks regarding project management, thus the concept of 'project' is included in the SLR. The concept of ‘management’ is excluded to broaden the search scope.

(Project Management Institute, 2008) defines the RACI (responsibility, Accountability, consulted and Informed) model and RAM (Responsibility Assignment Matrix). This model and matrix will be investigated further in the SLR.
The most commonly applied framework regarding responsibility in business and IT is the RACI Framework (Costello, 2012). The RACI Framework is also known as ARCI and RASCI Framework. This Framework will be investigated further and will be included in the concepts. The RACI Framework is a Framework or matrix to assign the responsibility of tasks to roles within a company. The model clarifies who is responsible and accountable for, consulted on, and informed about a task. (Costello, 2012).

The roles and responsibilities of a project manager are generally very important but they differ significantly from one project to another. The applied area The Responsibility Assignment Matrix (RAM) is often used in the direction of drawing up roles and responsibilities linked to the goal of the project (melnic, 2011). The RAM is a reputable responsibility framework and is included in the concepts.

The concepts are composed into search strings for the databases. These are the search strings:

1. “Responsibility* Framework” OR “Responsibility* Model” OR “Responsibility* Plan” AND Project
2. (RACI OR ARCI OR RASCI) AND (Framework OR Model OR Plan) AND Project
3. “Responsibility Assignment Matrix” AND Project

The fourth and fifth steps are the practical screen & quality appraisal steps. This step requires the reviewer to be explicit about what studies were considered for review and which ones were eliminated without further examination and which articles are of insufficient quality to be included in the review synthesis (Okoli & Schabram, 2010). These steps are implemented through criteria.

The criteria provide a filter for the articles that are not applicable and/or relevant to the research question. The criteria functions as an including and excluding filter. An excluding filter excludes articles that satisfy the criterion and an including filter includes the articles that satisfy the criterion. The criteria can be found in Table 8 Criteria table.

Nr.	Criteria	Inclusion (In) or Exclusion (Ex)	Explanation
1	Articles published before 1990	Ex	Responsibility in project management are recent developments. Therefore pre 1990-articles are not relevant
2	Articles focused on software or IT	Ex	Trioliet uses INFOR as ERP system. The articles are expected to be irrelevant.
3	Articles in which RACI doesn't represents Responsibility, Accountability, Consulted and Informed	Ex	The research is focused on the responsibility RACI-model
4	Articles focused on corporate environmental or social responsibility.	Ex	Responsibility is a broad concept. In the research, responsibility is focused on project management responsibility and not environmental or social responsibility.
5	Articles focused on project structures	In	Articles can consist of relevant information for responsibility frameworks.

Table 8 Criteria table

The search strings are applied on Scopus and Web of Science and the results can be found in Table 9 Result table. The total amount of articles found with the concepts is 328. After removing duplicates, applying the criterion and reading parts of the articles, 7 applicable articles can be used for the research.

Scopus				
Search String	Scope	Search Date	Date Range	Number of results
"Responsibility* Framework" OR "Responsibility* Model" OR "Responsibility* Plan" AND Project	Article title, Abstract, keywords	18-11-2021	1990 - Present	35
(RACI OR ARCI OR RASCI) AND (Framework OR Model OR Plan) AND Project	Article title, Abstract, keywords	18-11-2021	1990 - Present	17
"Responsibility Assignment Matrix" AND Project	Article title, Abstract, keywords	18-11-2021	1990 - Present	14
Web of Science				
Search String	Scope	Search Date	Date Range	Number of results
"Responsibility* Framework" OR "Responsibility* Model" OR "Responsibility* Plan" AND Project	Topic (title, abstract, author keywords)	18-11-2021	1990 - Present	241
(RACI OR ARCI OR RASCI) AND (Framework OR Model OR Plan) AND Project	Topic (title, abstract, author keywords)	18-11-2021	1990 - Present	17
"Responsibility Assignment Matrix" AND Project	Topic (title, abstract, author keywords)	18-11-2021	1990 - Present	4
Total articles				328
Removed duplicates				97
Removed based on criteria				175
Removed after reading the abstract				41
Removed after reading the article				4
Included as an exemption				4
Total applicable articles				7

Table 9 Result table

The fifth and sixth steps are the data extraction and synthesis of studies step. In these steps, the applicable information from each study is extracted and combining the extracted facts.

The SLR has defined 7 articles applicable to answering sub-research question 1. The objective of the SLR is to find out what responsibility frameworks regarding project management are defined by previous research and literature. The articles and relevant findings can be found in Table 10 Article matrix.

Article Title	Authors	Published Date	Relevant findings **Conclusion:**
Stakeholder decision-making: Understanding Sierra Leone's energy sector	S.A. Hirmer, H. George-Williams, J. Rhys, D.Mcnicholl, M. McCulloch	07-04-2021	A RACI matrix for decision-making. The article further explains a plan to identify actors in the project. **RACI-model**
Development of the RACI Framework for processes of the closure phase in construction programs	Woo-yeon Lee, Seung-hoon Lee, chengquan Jin, Chang-taek Hyun.	07-02-2021	Provides a research framework for the RACI model. **RACI-model**
Responsibilities and accountabilities for industrial facility commissioning and startup activities	James T. O'Connor, Brant Mock	22-04-2020	Defines the RACI model and a step-by-step approach to analyse the model. **RACI-model**
Accountability and responsibility defined	Stephen Keith McGrath, Stephen Jonathan Whitty	14-12-2017	Defines accountability and responsibility **RACI-model**
Requirements engineering model: Role based goal-oriented model	S. SI Sandfreni, Kridanto Surendro	11-04-2016	Provides a step-by-step strategy to construct a RACI-model **RACI-Model**
Communication Management Model-Case Study in the Project of Energy Efficiency Improvement Using the RASCI Matrix	Jagoda Mrzyglocka-Chojnacka, Joanna Kott, Marek Kott	14-11-2019	Defines the RASCI-model and communication schemes **RASCI-model**
Extended Responsibility Assignment Matrix (ERAM)	Taketoshi Yokemure, Masahiro Inoue	29-04-2019	Defines the ERAM and RAMP. **ERAM**

Table 10 Article matrix

Appendix C: Interview Setup

The objective of the develop instrument step is to develop an interview protocol. This protocol is applied as a guideline for every interview to ensure consistency between interviews. The interview protocol is divided between the opening, questions and closing.

The opening makes the objective and structure of the interview clear to the interviewee. The Introduction key components of (Boyce & Neale, 2006) will be discussed in the section: Thank you, your name, purpose, confidentiality, duration, how the interview will be conducted, an opportunity for questions and signature of consent. The signature of consent is deliberately excluded from the interview protocol. The interviewee will give recorded verbal consent.

The opening for all the interviews: *Welcome the interviewee. The interviewee is thanked for their time and informed about the interviewer, the scope, objective and previously conducted research. The interviewee is given the possibility to ask questions about the interview regarding the research. Furthermore, the interviewer will explain the objective of the interview and the reason why the interviewee is selected. The reasoning is followed up by notifying the interviewee of the recording of the interview and is asked for permission to record the interview in audio form. The recording is started. The confidentiality of the interview is submitted to the interviewee. The name will not be shared with third parties. The interviewee is encouraged to be honest, this is explicitly mentioned before the interview. The interview records are only available for the data collector.*

The interview guide is simply a list of the high-level topics that you plan on covering in the interview with the high-level questions that you want to answer under each topic (C. Bird, 2016). The questions should not exceed 15, be factual and have the appropriate probes (Boyce & Neale, 2006). The Interview Guide is divided into three question stages based on the research framework for the RACI Framework of (Lee, Lee, Jin, & Hyun, 2021). The three stages are the identification of process, the identification of stakeholders and the RACI framework.

The questions are divided between the three stages of the interview. Some questions have an elaboration under the question. The elaboration is stated in italics at questions whereby the objective of the question cannot be related to the RACI Framework or the objective of the stage.

The questions for all the interviews:
Question stage 1: Identification of process
In this stage, the processes and tasks during the Triomatic and Solomix stationary projects are defined.

1. Can you name your name, job description and main activity within Trioliet?
2. What are the 'standard' tasks during the Triomatic and Solomix stationary projects regarding your function and department?
3. What are the differences between tasks from the Triomatic and Solomix stationary projects?
   3.1. Are there other tasks?
   3.2. Do the tasks differ depending on the project's kind?
4. What are the differences between tasks for the SSR and Category 1 projects?
5. Are there any tasks that the department conducts, but are not discussed yet?
6. Can you explain to me how task X is conducted?
7. Are there tasks conducted solely in preparation for the next department in the project?
   This question is asked because it can identify unclear involved stakeholders and clarify responsibility roles. The question is submitted in stage 1 because the task order is fresh in the head of the interviewee.

Question Stage 2: Identification of Stakeholders
In this stage, the stakeholders and the relations between them during task X are defined.

1. Can you list the departments/employees you work with during task x?
   1.1. What is the relation basis of the collaboration?
2. Are there tasks that are cross-functional between departments?
   This question is asked because it can identify a stakeholder and their responsibility role within a certain task. The question is asked in this stage because the question identifies a stakeholder and their role.
3. Who communicates with the other departments that certain tasks are completed or that another department can start a certain task?

Stage 3: RACI Framework
In this stage, the responsibility distribution is constructed.

1. How do you define responsibility and accountability?
   This question is asked because there can be confusion about the definition of responsibility and accountability. The definition of responsibility and accountability in Dutch can be confused with each other. By asking the interviewee of his/her's definition of the word, the interviewer can compare this with the definition applied during the research. With this method the interviewee is not misinterpreted.
2. What do you think is the responsibility within your department of projects?
3. How is the responsibility divided during the project?
   3.1. Who is the head of the department?
   3.2. Who is the head of the project?
   3.3. Can you give an example of how this appears in practice?
4. If there is a problem during a certain task, who is responsible for fixing the problem?

The closing makes the interviewee aware of the ending of the interview and summarizes the key findings. The Closing Key Components of (Boyce & Neale, 2006) will be discussed in this section: Additional comments, next steps and thanking.

The closing of all the interviews: Explaining that this is the last section of the interview. The interviewee is asked if they have something to add or have any questions for the interviewer. Furthermore, the key concepts of the interview will be revised and repeated to the interviewee. The interviewee is asked to approve the repeated key concept to ensure the quality and accuracy of the interview. If this is not the case or all the questions are answered, the interviewee will be thanked for their time, the recording will be stopped and the interview will be closed.

The interview protocol does not only exist of questions. IDIs have other instruments that require to be consistent to ensure the quality of the output of the interviews. The other instrument discussed in this section is language, interview environment, duration, recording method and note template.

The interviews are conducted in Dutch because all the interviewees are Dutch. The local language can be used during the interview if necessary (Boyce & Neale, 2006). The key findings and RACI Framework are translated into English after the interview. The interview approach is semi-structured. This approach allows the interviewer and the interviewee to discuss other subjects and questions than planned. This approach is selected because the responsibility structure of a task can be derived from deviated subjects. The deviated subjects and questions can be convenient for constructing the RACI Framework. The interviews are conducted in closed-off rooms. The interviewer encourages the interviewee to be honest and explain the situation based on their experience. This encouragement is amplified by the privacy a closed-off room provides. The interviewee is informed about the duration of the interview before the interview. The interview's duration is aimed at an hour. To ensure the accuracy of the conducted interviews, the interviews are recorded. The interviews are not transcribed. The recordings are used to construct the RACI Framework and will be destroyed appropriately.

The note template can be found in Appendix D: Trioliet interview template. This form is applied during the interviews to document as much as possible. The template notes the name, job description and department of the interviewee. In stage 1 the defined tasks and a short description of them are noted. Stages 1 and 2 have a notes column, this column is used to note applicable information during the interview regarding that task or stakeholder. The template for stage 2 is displayed on page 2. The stakeholders and their relations with the interviewee or associated department are noted. In stage three the responsibility roles of the tasks are noted. The involved stakeholder is assigned a task and responsibility role. The last page is added to take extra notes, these notes are not directly related to a task. The stakeholder of the RACI Framework will be documented in the extra notes section. This section is mainly applied to questions 1.7, 2.2 and 3.1 where the first number represents the stage and the second number represents the question number of that stage.

(Boyce & Neale, 2006) describes the third step as training data collector. The objective of this step is to identify and train the interviewer. All the interviews are conducted by Delano Leonardo Alberto. This interviewer is the main researcher during the complete research and will be conducting all the interviews.

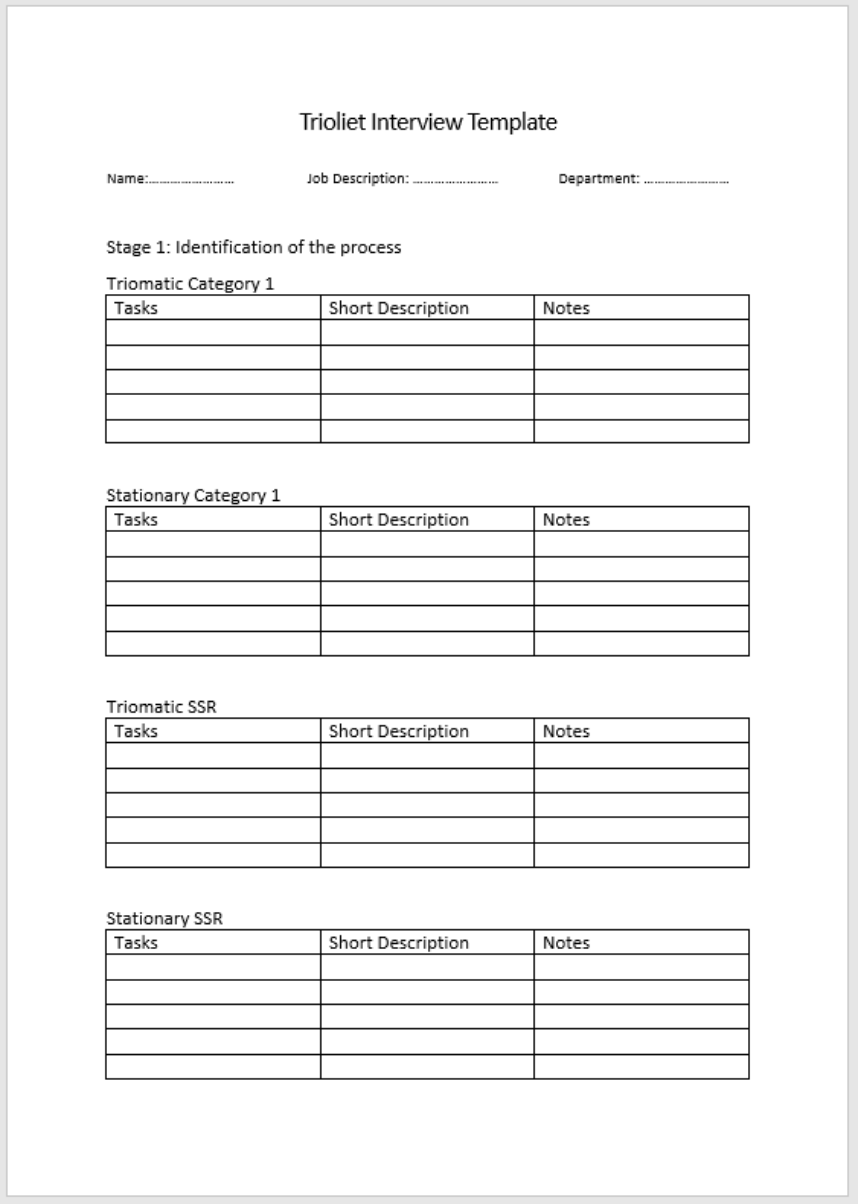
(Boyce & Neale, 2006) describes the six training aspects that should be included in the training:

- an introduction to the evaluation objectives
- A review of data collection techniques
- A thorough review of the data collection items and instruments
- Practise in the use of the instruments
- Skill-building exercises on interviewing and interpersonal communication
- Discussion of ethical issues

The evaluation and training of the interviewer took 5 hours collectively. The evaluation objective is the Trioliet Interview Template in Appendix D. This provides a clear overview of the required information of the interviewee. The data collection techniques, items and instruments are reviewed by the interviewer and the supervisors of Trioliet. Applying the method of (Boyce & Neale, 2006) and reviewing the techniques, items and instruments of the interview design increases the quality of the interviews. (Boyce & Neale, 2006) describes the need of practising the use of the instruments, the skill-building exercise and interpersonal communication for the interviewer. The interviewer practised the instruments and communication by conducting three practice interviews. This resulted in familiarity of the interviewer with the instruments. Possible ethical issues are discussed with the supervisors and the ethics committee of the faculty Behavioural, Management and Social sciences (BMS) of the University of Twente has approved the research design. During all the steps my supervisors have provided feedback.

The fourth step of (Boyce & Neale, 2006) is to collect data in the form of conducting interviews. The IDIs have collected voice memos of 10:19:26 hours. With an average length of 51:37 minutes per interview. The interviewees are cooperative and none of the interviewees objected to the recording of the interview. This increased the accuracy and quality of the collected data. The memos are not published, because of the interviewee's privacy.

Appendix D: Trioliet interview template



Trioliet Interview Template

Name:..... Job Description: ..... Department: .....

Stage 1: Identification of the process

Triomatic Category 1

Tasks	Short Description	Notes

Stationary Category 1

Tasks	Short Description	Notes

Triomatic SSR

Tasks	Short Description	Notes

Stationary SSR

Tasks	Short Description	Notes

Stage 2: Identification of the Stakeholders

Triomatic Category 1

Stakeholder	Relation	Notes

Stationary Category 1

Stakeholder	Relation	Notes

Triomatic SSR

Stakeholder	Relation	Notes

Stationary Category 1

Stakeholder	Relation	Notes

Stage 3: RACI model

Triomatic Category 1

Tasks	Responsible	Accountable	Consulted	Informed

Stationary Category 1

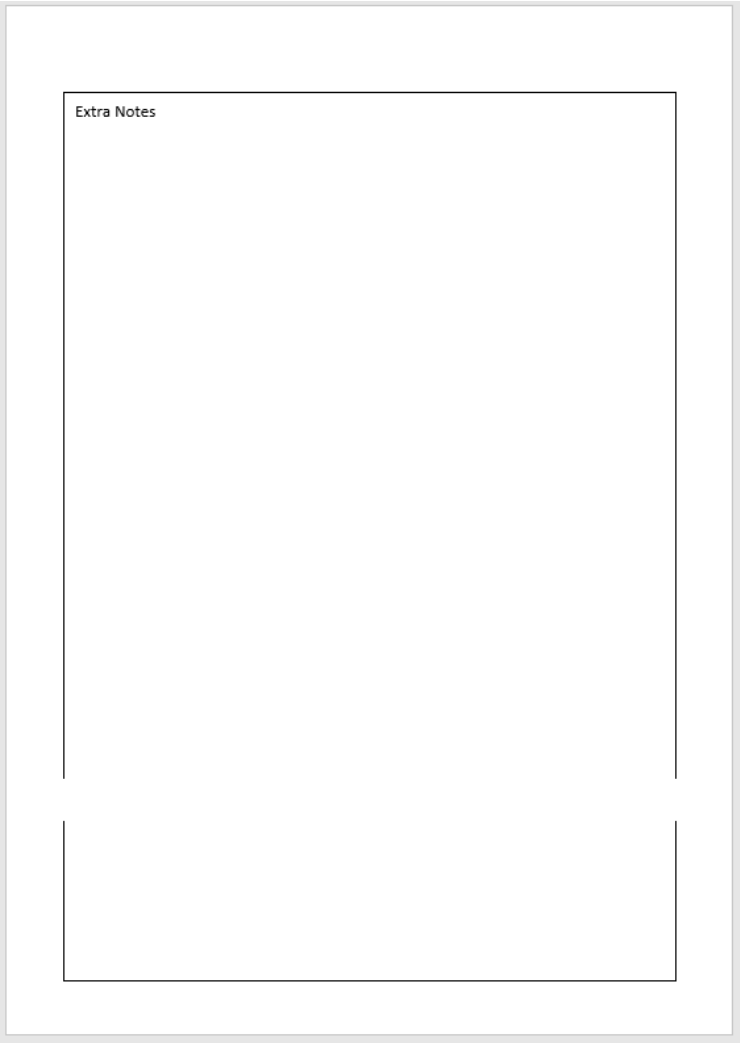
Tasks	Responsible	Accountable	Consulted	Informed

Triomatic SSR

Tasks	Responsible	Accountable	Consulted	Informed

Stationary SSR

Tasks	Responsible	Accountable	Consulted	Informed


Extra Notes