PROJETO DE GRADUAÇÃO

TAILORING APLICADO À GESTÃO DE PORTFÓLIOS, PROGRAMAS E PROJETOS DE UM SISTEMA COMPLEXO

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Brasília, 02 de julho de 2024.

UNIVERSIDADE DE BRASÍLIA

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DEPARTAMENTO DE ENGENHARIA DE PRODUÇÃO

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Relatório submetido como requisito parcial para obtenção
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FINAL PAPER

TAILORING PORTFOLIO, PROGRAM, AND PROJECT MANAGEMENT TO A COMPLEX SYSTEM

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Brasília, July 2nd, 2024.

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Final paper submitted as a partial requirement
to obtain the Production Engineer degree.

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Brasília, July 2nd, 2024.

'Remember, always, that everything you know, and everything everyone knows, is only a model. Get your model out there where it can be viewed. Invite others to challenge your assumptions and add their own.'

Donella H. Meadows (1941-2001), environmental scientist, educator, and writer.

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It is with deep gratitude and satisfaction that I conclude this important stage in my academic and professional journey. This bachelor's degree in Production Engineering from University of Brasília gave me knowledge, skills and experiences that I consider crucial for my life. I am excited to leverage this foundation to make a positive impact in the organizations in which I participate or will participate in the future.

I would like to thank my parents, friends and family, who always believed in me and encouraged me to improve every day. This journey wouldn't have been possible without the unwavering support of all of you.

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To my fellow students and colleagues, especially Luiza Cardoso, Mateus Halbe, Yasmim Bezerra, Pedro Prazeres, Thiago Barreto, Isabel Souza, Victor Brito, and all UnB PMO members, thank you for making the *Global Students SDG Challenge* and the *Egalitarian* initiatives possible. And to Grupo Gestão, the best Brazilian junior enterprise, I will always be grateful for the tremendous impact you have had on me over the past few years.

As I embark on the next chapter of my career, I am confident that the knowledge and skills gained from these experiences will empower me to make significant contributions in the academic and professional ecosystems.

RESUMO

Gerenciar um portfólio complexo de projetos requer uma estrutura madura que considere padrões e melhores práticas de gerenciamento de portfólios, programas e projetos adaptados ao sistema específico. Este projeto de graduação fornece um framework para o desenvolvimento e implementação de um modelo de gestão para um portfólio complexo – a iniciativa Erasmus+ denominada *Egalitarian*. A pesquisa tem natureza aplicada e utiliza a estratégia de pesquisa-ação com abordagem qualitativa. Com base em revisão bibliográfica e observação, o trabalho analisa a estrutura de gestão do portfólio do *Global Students SDG Challenge* e adapta o framework para um modelo de gestão atualizado. A partir da implementação inicial do framework, também apresenta feedbacks e lições aprendidas para orientar os próximos passos.

Palavras-chave: Gerenciamento de Portfólios; Gerenciamento de Programas; Gerenciamento de Projetos; Sistema Complexo; Tailoring; Framework.

ABSTRACT

Managing a complex portfolio of projects requires a mature structure that considers portfolio, program, and project management standards and best practices tailored to the specific system. This final paper provides a framework for the development and implementation of a management model for a complex portfolio – the Erasmus+ initiative called *Egalitarian*. The research has an applied nature and utilizes an action research strategy with a qualitative approach. Based on a bibliographic review and observation, the paper analyses the portfolio management structure of the *Global Students SDG Challenge* and tailors a framework for an updated management model. From the initial implementation of the framework, it also presents feedbacks and lessons learned to guide next steps.

Keywords: Portfolio Management; Program Management; Project Management; Complex System; Tailoring; Framework.

SUMMARY

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1 INTRODUCTION

To prepare an engineering student for the job market, universities must develop not only technical skills but also transversal skills such as teamwork, leadership, communication, adaptability, and project management (Monteiro *et al.*, 2012). Problem-Based Learning (PBL) and Project-Based Learning (PjBL) are a good way for students to work in interdisciplinary teams and on real-world problems, achieving the competencies mentioned above (Pedersen *et al.*, 2020).

Educational programs use projects, from short, subject-specific ones to year-long capstones, to test students' ability to apply knowledge, solve problems, and keep up with current advancements. These major projects, requiring deep dives across disciplines and faculty guidance, are simulations of professional work, preparing students for the industry or research world. As a core element of some educational programs, these projects carry significant weight and are becoming even more crucial as educational institutions focus on achieving specific learning outcomes. (Bhatia *et al.*, 2020)

Initiatives that promote international and interdisciplinary student projects bring another level of cooperation, insights, and complexity, requiring a careful project design to ensure that the students can collaborate and yet fulfill the requirements and learning objectives of their home universities (Pedersen *et al.*, 2020). The *Global Students SDG Challenge* and now *Egalitarian* are two of these initiatives. *Egalitarian* is an Erasmus+ initiative co-funded by the European Union, and it has more than 27 teams working on approximately 6 programs each semester, involving students from 8 different courses from Brazilian and European universities. Managing such a complex portfolio of projects requires a mature structure that considers portfolio, program, and project management standards and best practices.

As stated by Hadjinicolaou *et al.* (2022), project portfolios group together various initiatives, from individual projects to ongoing operations, all working towards an organization's strategic goals. Portfolio management is a method to ensure these efforts translate to real value for the organization. By strategically selecting projects, it helps optimize resource allocation, manage risks across the portfolio, and ultimately increase project success rates.

This work's main objective is to provide a guide for the development and implementation of a management model for a complex portfolio. Its specific objectives are (i) to analyze the model used for managing the *Global Students SDG Challenge* portfolio, (ii) to propose a tailored framework for developing a new management model for the *Egalitarian* portfolio, and (iii) to evaluate the framework's initial implementation.

The final paper is organized as follows. First, a theoretical background is presented, to give context and relevant information about the current best practices. After this, the research

methodology is explained, followed by the results achieved from past research and a discussion based on the authors' experience with the *Global Students SDG Challenge* portfolio and the initial implementation of the new proposed framework for *Egalitarian*. At last, the conclusion is presented.

2 THEORETICAL BACKGROUND

This section introduces theoretical concepts that underpin the research.

2.1 Portfolio, Program, and Project Management

A portfolio consists of a collection of projects, programs, subsidiary portfolios, and related operations managed in an integrated way to achieve an organization's strategic objectives. A program includes related projects, subsidiary programs, and program activities managed in a coordinated manner to obtain benefits not available from managing them individually. Programs and individual projects with strategic importance are part of a portfolio – even if they are not directly related or interdependent – if they are linked to the organization's strategic plan through the portfolio. (PMI, 2017a)

Portfolio management focuses on ensuring the portfolio is performing consistently with the organization's objectives and evaluating portfolio components to optimize resource allocation, and program management applies knowledge, skills, and principles to a program to achieve the program objectives and obtain benefits and control not available by managing related program components individually (PMI, 2023). Project management is the application of knowledge, skills, tools, and techniques to project activities to meet project requirements and deliver the intended outcomes (PMI, 2021).

Portfolio, program, and project management are based on principles and performance domains, such as: Obtain and maintain the sponsorship and engagement of senior management and key stakeholders; Navigate complexity to enable successful outcomes; Create a collaborative project team environment; Tailor based on context. (PMI, 2017a; 2021)

A major reason for project failure is the lack of benefits management (Walenta, 2016). Benefits management is not a knowledge area covered by project management, but by program management (PMI, 2017b). Large organizations and organizations that want to achieve higher levels of project management maturity need to separate program and project management, since project management standards focus on the traditional triangle of scope/quality, time, and cost, while the triangle for program management could be defined as strategy/benefits, governance, and stakeholders (Walenta, 2016).

Project management is also important in education contexts. Fernandes, Dinis-Carvalho and Ferreira-Oliveira (2021) studied the application of Scrum to complex Project-Based Learning environments and found that task assignment, performance monitoring, visual management, and regular feedback were considered the main advantages of using Scrum in PjBL teams, which had a positive impact on student performance.

2.2   Portfolio, Program, and Project Management Offices (PMOs)

An important role in portfolio, program, and project management is the PMO. At the portfolio level, a PMO is an organizational entity that provides various capabilities and processes supporting portfolio management (PMI, 2017a). A program management office standardizes the program-related governance processes and facilitates the sharing of resources, methodologies, tools, and techniques. It may be specific to an individual program, or support multiple organization's programs (PMI, 2017b). A project management office has a similar function to the program management office but at the project level. The projects supported or administered by the project management office may not be related other than by being managed together (PMI, 2023). Table 1 shows the main activities and responsibilities for each type of PMO.

Table 1. Portfolio, Program, and Project Management Offices Main Activities and Responsibilities.

	Portfolio Management Office[1]	Program Management Office[2]	Project Management Office[3]
Activities and Responsibilities	- Identifying, analyzing, coordinating, negotiating, monitoring, and controlling portfolio components; supporting component proposals and evaluations; facilitating prioritization; authorization; termination of components; and facilitating the allocation of resources in alignment with organizational strategy and objectives; - Developing and maintaining portfolio, program, and project frameworks and methodologies; - Managing knowledge regarding the project management discipline, including good practices and lessons learned; - Providing program and project progress information and metric reporting utilizing key performance indicators (KPIs) (e.g., expenditure, defects, resources) to the portfolio governance process; - Managing, including monitoring and controlling, such as regulatory/governance compliance and benefit	- Defining standard program management processes and procedures that will be followed; - Providing training to ensure that standards and practices are well understood; - Supporting program communications; - Supporting program-level change management activities; - Conducting program performance analyses; - Supporting the management of the program schedule and budget; - Defining general quality standards for the program and its components; - Supporting effective resource management; - Providing support for reporting to leadership and program steering committees; - Supporting document and knowledge transfer; - Providing centralized support for managing changes and tracking risks, issues, and decisions.	- Managing shared resources across all projects administered by the PMO; - Identifying and developing project management methodology, best practices, and standards; - Coaching, mentoring, training, and oversight; - Monitoring compliance with project management standards, policies, procedures, and templates utilizing project audits; - Developing and managing project policies, procedures, templates, and other shared documentation (organizational process assets); - Coordinating communication across projects.

	Portfolio Management Office[1]	Program Management Office[2]	Project Management Office[3]
	realization across the entire portfolio; - Assisting with risk strategy development and risk identification, and communicating risks and issues related to portfolio components; - Coordinating communication across portfolio components; - Developing and conducting training and mentoring of human resources in portfolio management skills, tools, and techniques.		

([1]Project Management Institute, 2017a; [2]Project Management Institute, 2017b; [3]Project Management Institute, 2023)

In addition, the portfolio management office may provide services to a program or project management office, such as (Project Management Institute, 2017a):

- Defining and developing the portfolio management strategy;

- Providing portfolio oversight and managing the overall portfolio value and portfolio component benefits;

- Defining portfolio vision and mission statements; management structure; and methodology, best practices, and standards for use as guidelines while formulating the methodology and standards for project and program management;

- Aggregating and providing performance results of the portfolio components based on predefined metrics;

- Identifying risks, analyzing risks, and planning risk responses at the portfolio level;

- Forecasting supply and demand for the portfolio and optimizing the portfolio resource allocation. Thus, supply and demand are analyzed and broken down for each portfolio component.

The specific form, function, and structure of a PMO are dependent upon the needs of the organization that it supports. There are three main types of PMOs in organizations, varying the degree of control and influence it has on projects within the organization (PMI, 2023):

- **Supportive:** Supportive PMOs provide a consultative role to projects by supplying templates, best practices, training, access to information, and lessons learned from other projects. This type of PMO serves as a project repository. The degree of control provided by the PMO is low.

- **Controlling:** Controlling PMOs provide support and require compliance through various means. The degree of control provided by the PMO is moderate. Compliance may involve:
  - Adoption of project management frameworks or methodologies;
  - Use of specific templates, forms, and tools; and
  - Conformance to governance frameworks.
- **Directive:** Directive PMOs take control of the projects by directly managing the projects. Project managers are assigned by and report to the PMO. The degree of control provided by the PMO is high.

In the academic research environment, a PMO may also be useful. Widforss and Rosqvist (2015) analyze the PMO of a Swedish university, which provides professional project management services to researchers and research projects. The survey conducted shows that structure, tools, and templates are less useful for complex projects than governance, management support, experience, and skill. Fernandes, Souza, Tereso and O'Sullivan (2021) present three PMO structures for University Research Centres (URCs) with a total of twenty-six functions. These are divided into the three PMO typologies, with an evolution logic: 'basic' PMO, 'intermediate' PMO, and 'advanced' PMO. Functions go from general guidelines and definitions to strategic influence and direct management of the R&D projects.

2.3 Complex Systems and Systems Thinking

The inherent complexity of portfolio management often results in a context characterized by overlapping and potentially conflicting stakeholder interests. This complex landscape presents portfolio managers with the challenge of effectively navigating a high flow of unfiltered information while simultaneously experiencing not enough relevant communication (PMI, 2017a). Other components that influence portfolio and project complexity include but are not limited to: number of unpredictable stakeholders who need individual care; dimension of change imposed on the environment; complicatedness or unpredictability of project results; timeline and number of parallel activities; organizational structure; geographic distribution (*Svenskt projektforum*, 2011, as cited in Widforss & Rosqvist, 2015).

A systems thinking approach tends to help analyze the portfolio system as a whole (PMI, 2017a), and understand how the portfolio system and subsystems fit into the larger context of the organization and day-to-day life (International Council on Systems Engineering, 2006).

The portfolio may be analyzed and managed as a System-of-Systems, i.e., as "an interoperating collection of component systems that produce results unachievable by the individual systems alone" (International Council on Systems Engineering, 2006), which helps

portfolio managers to analyze the whole portfolio and focus on the effects of the interactions between the portfolio components. Employing a systems perspective facilitates a more comprehensive understanding of both the objectives driving change initiatives and the mechanisms employed to achieve them. This approach also provides valuable insights into the individual components of the portfolio and their interactions within the broader organizational system (PMI, 2017a).

2.4   Tailoring

Project Management Institute (2021) defines tailoring as "the deliberate adaptation of the project management approach, governance, and processes to make them more suitable for the given environment and the work at hand". Project aspects that can be tailored include life cycle and development approach selection, processes, engagement, tools, and methods and artifacts. The process of tailoring for the organization and for a specific project is composed of four steps (PMI, 2021):

- **Select Initial Development Approach:** Choose a development approach best suited for the endeavor;
- **Tailor for Organization:** Modify based on organizational modifications;
- **Tailor for Project:** Adjust based on size, criticality, and other factors;
- **Implement Ongoing Improvement:** Inspect and adapt.

According to Project Management Institute (2023), "tailoring is necessary because each project is unique". The standards for portfolio, program, and project management identify several processes, tools, techniques, inputs, and outputs, but not everything is required for every project or group of projects. The importance of each constraint and performance domain is different for each project, program, or portfolio, and the management of these elements should be tailored based on the environment, organizational culture, stakeholder needs, and other variables (PMI, 2023).

Additional guidelines for tailoring, based on the Agile Practice Guide (PMI, 2017c), include: Restructure large projects as multiple smaller projects; Break large teams into multiple smaller teams and use program management to synchronize and coordinate; Use agile and lean program management to organize the larger effort; Use tools like instant messaging, video conferencing, and electronic team boards to help bridge communication gaps; Consider building centers of competencies to help provide guidance and build domain knowledge, especially when team members are inexperienced.

3   METHODOLOGY

This research has an applied nature and utilizes an action research strategy with a qualitative approach. A highly interactive method, action research is often used in educational settings, and it aims to simultaneously investigate and solve an issue (George, 2023). One of the characteristics of this method is the active role of the researcher as a true agent of intervention and change in organizations (Westbrook, 1995, as cited in Ganga, 2011).

This research has three steps, as shown in Figure 1.

Main Objective		
Provide a guide for the development and implementation of a management model for a complex portfolio.		
Specific Objectives	**Research Steps**	**Technical Procedures**
Analyse the model used for managing the *Global Students SDG Challenge* portfolio	Present the *Global Students SDG Challenge* model and its limitations	Bibliographic analysis Observation
Propose a tailored framework for developing a new management model for the *Egalitarian* portfolio	Suggest a framework for the *Egalitarian* model	Bibliographic analysis Previous step analysis Framework design
Evaluate the framework's initial implementation	Analyse feedbacks and lessons learned from the initial implementation	Form application Data analysis

Figure 1. Research Structure.

A literature review provided theoretical background for all steps. Step 1 focuses on presenting the portfolio, program, and project management model used by the production engineering undergraduate program at the University of Brasília. It complements the works made by Barreto (2022) and Brito (2023), and it uses both bibliographic analysis and observation techniques. Step 2 aims to suggest a framework for developing a new model for the portfolio, program, and project management of the international Erasmus+ program called *Egalitarian*. The framework consists of a tailoring of the portfolio, program and project management approach, governance, and processes. Step 3 analyses received feedbacks and lessons learned from the initial framework implementation.

The form used in Step 3 (Appendix I) was responded by members of the *Egalitarian* Portfolio Board. Table 2 shows the respondents' roles and universities.

Table 2. Number of Form Respondents by Category (Sample/Population).

Respondent's University	Respondent's Role		
	Professor	Supervisor/ Tutor	Student (PMO Coordinator)
UNB	0/3	0/0	3/4
AAU	0/1	1/1	0/0
UMINHO	2/3	1/1	0/0
SAXION	2/3	0/0	0/0

4 RESULTS AND DISCUSSIONS

4.1 *Global Students SDG Challenge* Model

The production engineering course at the University of Brasília (UnB) has a set of subjects with the proposal to apply the active learning methodology through projects that have scopes related to other technical subjects in the student's curriculum (Barreto, 2022). Some of these project-based subjects, such as Production Systems Project 2 (PSP2) and Production Systems Project 5 (PSP5), are integrated and were part of a portfolio of projects arising from the *Global Students SDG Challenge*, a student-centered initiative that connects students from different universities and countries to develop solutions that help achieve the 2030 Agenda's goals (Global Students SDG Challenge, 2023). This section describes the model used to manage the *Global Students SDG Challenge* portfolio at UnB and analyses its limitations.

4.1.1. Model Description

The portfolio involved courses and subjects from the University of Brasília, Brazil, and Aalborg University, Denmark. The PSP2 and PSP5 subjects were fixed subjects in the portfolio, and other subjects were involved depending on the projects being developed in a specific semester. For each academic semester, the following schedule was executed (Figure 2):
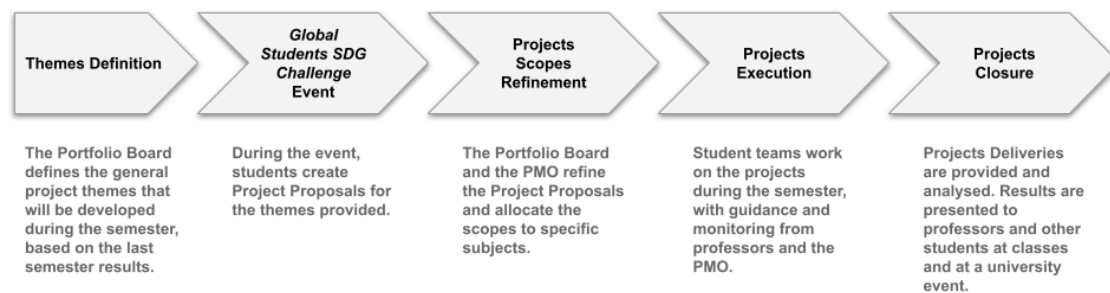

Figure 2. General Schedule for each Semester.

The Portfolio Board was made up of key professors and students from UnB that coordinated the PMO. Their main responsibility was to define the portfolio components, according to the *Global Students SDG Challenge* strategy and objectives. The PMO served many functions, such as (Brito, 2023):

- Strategic management and transformation, team and human resources management, and portfolio management, performed by professors in the Management role;
- Strategic management and guidance regarding the PMO, team and human resources management, and learning and knowledge management, performed by students in the Coordination role;
- Projects and programs monitoring, performed by students in the Control role; and
- Management of information tools and systems, management of data intelligence and communication, and management of processes and improvements, performed by students in the Support role.

Teams were integrated in a matrix way: students of the same subject interact and share lessons learned, and students of the same theme cooperate and work together to deliver their scopes. Same-subject interaction is encouraged by the subject professors, and same-theme synergy is influenced by the Control team of the PMO. Figure 3 indicates how the portfolio was organized and distributed through subjects and extension projects.
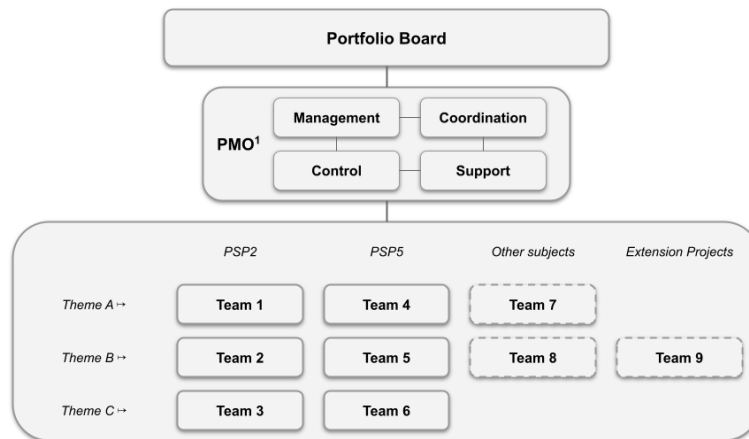

Figure 3. *Global Students SDG Challenge* Portfolio. ([1]Brito, 2023)

Projects inside the *Global Students SDG Challenge* portfolio used a hybrid project management approach that combined iteration-based agile approaches with predictive life cycle elements (PMI, 2017c). The project execution was divided into sprints, and the project deliverables were organized in backlogs with epics, user stories, and tasks. All tasks had a Definition of Done (i.e., an acceptance criteria).

The PMO provided for each team the project context, general scope, and main deliveries from last semesters. At the beginning of the project executions, all teams provided a filled Project Model Canvas (Finocchio Júnior, 2013) and an initial product backlog, based on the directions received. For each sprint, the team detailed a sprint backlog and sent a status report for the PMO. These artifacts and information fed a dashboard from the PMO, used for monitoring the portfolio.

4.1.2. Model Limitations

This model, that was used to manage the *Global Students SDG Challenge* portfolio, was updated each semester, based on lessons learned, results achieved, the portfolio's strategic objectives, and portfolio, program, and project management best practices. It created the UnB PMO and defined roles and responsibilities for local management. However, it focused on the PSP2 and PSP5 subjects from the production engineering course at UnB, thus it didn't manage the whole portfolio. Additionally, this model didn't define processes and artifacts, as stated by Souza (2023).

For the next three years, the *Global Students SDG Challenge* was replaced by *Egalitarian*, an Erasmus+ program that will involve not only the University of Brasília (Brazil) and Aalborg University (Denmark) but also the University of Minho (Portugal) and Saxion University (Netherlands). Therefore, the portfolio became more complex – with more stakeholders, professors, teams, and projects –, which requires a more robust management and control system, e. g., with key performance indicators being monitored (at a project and a portfolio levels).

Both portfolios share characteristics because of its academic context, such as high student turnover in projects, interdisciplinarity, academic cycles with specific deadlines, and low dedication hours (Souza, 2023). All these particular elements and the portfolios' high complexity makes a generic model inefficient; tailoring the portfolio, program and project management approach, governance, and processes is fundamental. The framework proposed on the next topic aims to guide the development of a new model for the portfolio, program, and project management of the *Egalitarian* portfolio.

4.2   Proposed Framework

Based on (i) the portfolio, program and project management principles, performance domains, processes, tools, methods, and artifacts, (ii) the model used for managing the *Global Students SDG Challenge* portfolio, and (iii) the processes and guidelines for tailoring, this section details the proposed framework for managing the new *Egalitarian* portfolio.

4.2.1. Concept Map

The Concept Map illustrated in Figure 4 helps to contextualize the *Egalitarian* portfolio structure and the proposed framework main elements, which will be detailed in the next topics.
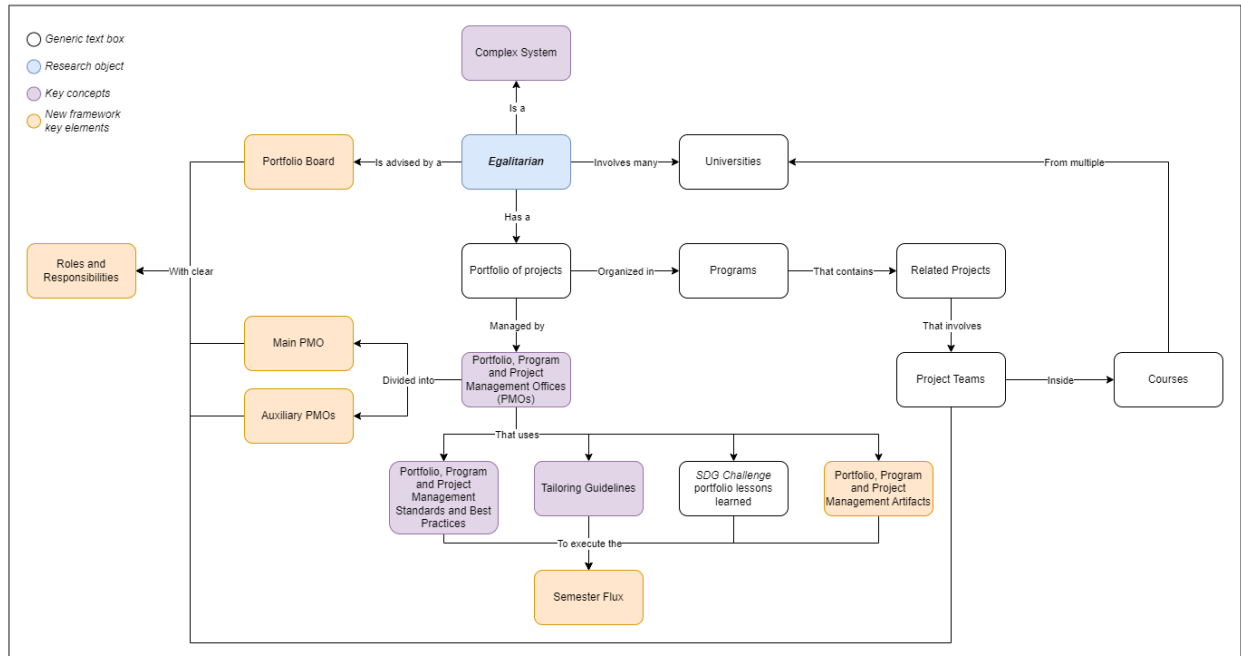

Figure 4. Concept Map.

The blue box shows the research object, i.e., *Egalitarian*. Purple boxes indicate the key concepts presented in the Theoretical Background, and orange boxes present the new *Egalitarian* framework key elements. White boxes show additional concepts, and arrows show the relationship between each element of the Concept Map.

4.2.2. Structure

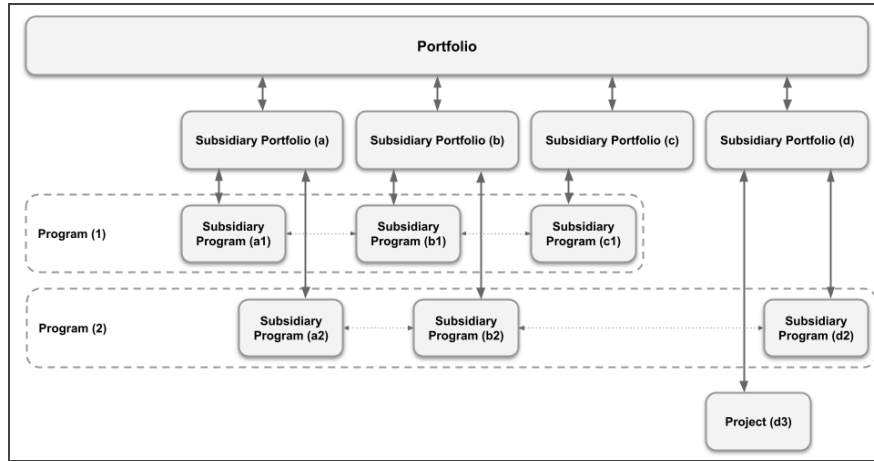Figure 5 shows the new portfolio structure.

Figure 5. New Portfolio Structure. (adapted from PMI, 2017a)

The subsidiary portfolios, one for each country/university, are composed of programs and projects that may be integrated into other programs and projects inside the other subsidiary portfolios. Teams from different universities should work together to deliver their projects in an integrated way, and the PMOs are responsible for facilitating that cooperation. The number and scope of programs and projects can vary for each semester.

Figure 6 shows the new portfolio management structure. It updates the structure presented on Figure 3, considering the four involved universities.
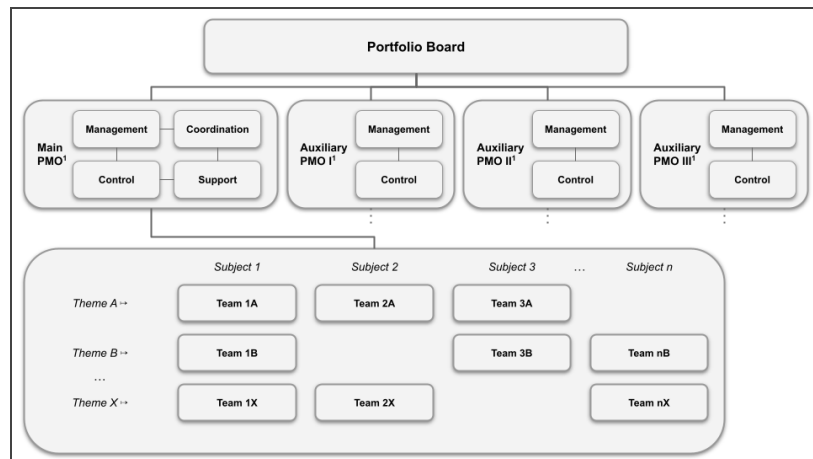

Figure 6. New Portfolio Management Structure. ([1]adapted from Brito, 2023)

The Portfolio Board members are the professors in the Management role inside the PMOs and the students in the Coordination role of the Main PMO. Other students and professors may be involved in the Portfolio Board if needed. Each PMO – here considered a Portfolio, Program, and Project Management Office – is responsible for managing a subsidiary portfolio. The PMO from University of Brasília is the Main PMO and manages both its subsidiary portfolio and the Auxiliary PMOs. Each Team is responsible for executing a project, and it may have one of the

two following structures: a Product Owner (PO), a Scrum Master (SM), and an Executing Team; or a Project Manager (PM) and an Executing Team. The structure adopted will depend on the Team's subject and university.

4.2.3. Roles and Responsibilities

The Portfolio Board functions and responsibilities are: Define the portfolio strategy, objectives, and guidelines; Define the portfolio components and general project themes for each semester; Establish partnership guidelines; Develop the portfolio charter; Develop the portfolio roadmap; Manage the portfolio value. (adapted from Barreto, 2022 and PMI, 2017a)

Table 3 describes the Main PMO functions and responsibilities.

Table 3. Main PMO Functions and Responsibilities.

Role	Functions and Responsibilities
Management	**Strategic management and transformation:** Manage resource allocation within the PMOs and the portfolio; Assist in the implementation of frameworks and methodologies for managing the portfolio, PMOs, subsidiary portfolios, and programs; Implement organizational changes and transformations in the PMOs. **Team and human resources management:** Define the expected profile of students for each PMO role; Select the PMO team. **Portfolio management:** Manage the portfolio; Monitor the portfolio performance.
Coordination	**Strategic management and guidance regarding the PMOs:** Guide resource allocation within the PMOs; Provide frameworks and methodologies for managing the portfolio, PMOs, subsidiary portfolios, and programs; Guide the need to implement organizational changes and transformations in the PMOs; Coordinate communication across portfolio components. **Team and human resources management:** Guide the expected profile of students for each PMO role; Execute the integration process for new PMO members; Develop and conduct training and mentoring of human resources in portfolio and program management skills, tools, and techniques; Monitor and advise Support and Control teams and Auxiliary PMOs. **Learning and knowledge management:** Manage the PMOs lessons learned meetings; Manage PMOs knowledge base; Train PMOs members.
Control	**Portfolio and program monitoring:** Monitor the subsidiary portfolio performance; Monitor the programs and subsidiary programs performance; Conduct project audit; Manage interfaces with project customers and project sponsors; Monitor projects and programs risks; Ensure the production of project reports by the Teams.
Support	**Management of information tools and systems:** Provide tools and information systems for project management, PMOs knowledge management, and portfolio metrics and KPIs management; Manage project documentation database; Provide training and support on the use of tools for PMOs members. **Management of data intelligence and communication:** Prepare periodic reports containing relevant insights into data acquired through tools and information systems used for project management. **Management of processes and improvements:** Carry out fault diagnosis in internal processes and identify improvement needs within the PMOs.

(adapted from Barreto, 2022, Brito, 2023 and PMI, 2017a)

Table 4 details the Auxiliary PMOs functions and responsibilities.

Table 4. Auxiliary PMOs Functions and Responsibilities.

Role	Functions and Responsibilities
Management	**Strategic management and transformation:** Manage resource allocation within the Auxiliary PMO and the subsidiary portfolio; Assist in the implementation of frameworks and methodologies for managing the Auxiliary PMO, subsidiary portfolios, and subsidiary programs; Implement organizational changes and transformations in the Auxiliary PMO. **Team and human resources management:** Select the Auxiliary PMO team. **Subsidiary portfolio management:** Manage the subsidiary portfolio; Monitor the subsidiary portfolio performance.
Control	**Subsidiary portfolio and subsidiary program monitoring:** Monitor the subsidiary portfolio performance; Monitor the subsidiary programs performance; Conduct project audit; Manage interfaces with project customers and project sponsors; Monitor projects and subsidiary programs risks; Ensure the production of project reports by the Teams.

(adapted from Barreto, 2022, Brito, 2023 and PMI, 2017a)

Teams functions and responsibilities may have two structures. In the first one, a Project Manager (PM) is responsible for managing project stakeholders, improving problem definition and project scope, providing project reports to the PMO, and managing project risks, while the Execution Team proactively study and seek possible solutions for the project, organize the deliveries for each milestone of the project timeline, and execute the project. In the second model, a Scrum Master (SM) lead, train, and guide the Team in adopting Scrum, help project members and stakeholders understand and apply an empirical approach to complex work, and remove barriers between stakeholders and the Team; a Product Owner (PO) develop and explicitly communicate the Product Goal, create and communicate Product Backlog items, prioritize Product Backlog items, and ensure the Product Backlog is transparent, visible, and understandable; and the Execution Team create a plan for the sprint – the Sprint Backlog –, gradually introduce quality by adhering to a Definition of Done, adapt the plan each day toward the Sprint Goal, and provide a status report for each sprint. (adapted from Barreto, 2022 and Schwaber & Sutherland, 2020)

The Main PMO serves as a Center of Excellence for the Auxiliary PMOs and the whole portfolio (PMI, 2017a). The number of professors and students in each role will depend on the capacity and capability analysis of each university, but ideally, a student in the Control role should be responsible for managing no more than 2 programs or subsidiary programs. On a project management level, the PMOs (specifically, the Control role) provide integration between teams, project scope, project management methodology, insights and mentoring, and project evaluation and feedback; the Teams provide status report, executive summary, difficulties and blockings, project deliveries, and ideas and feedbacks.

4.2.4. Semester Flux

The Semester Flux (Figure 7) shows the milestones and main artifacts needed before, during and after each semester. It also highlights which elements are new or updated from the previous model (presented in section 4.1). The improvements made are based on both the author's and PMO members' experiences with the *Global Students SDG Challenge* and aim to improve the general semester execution.
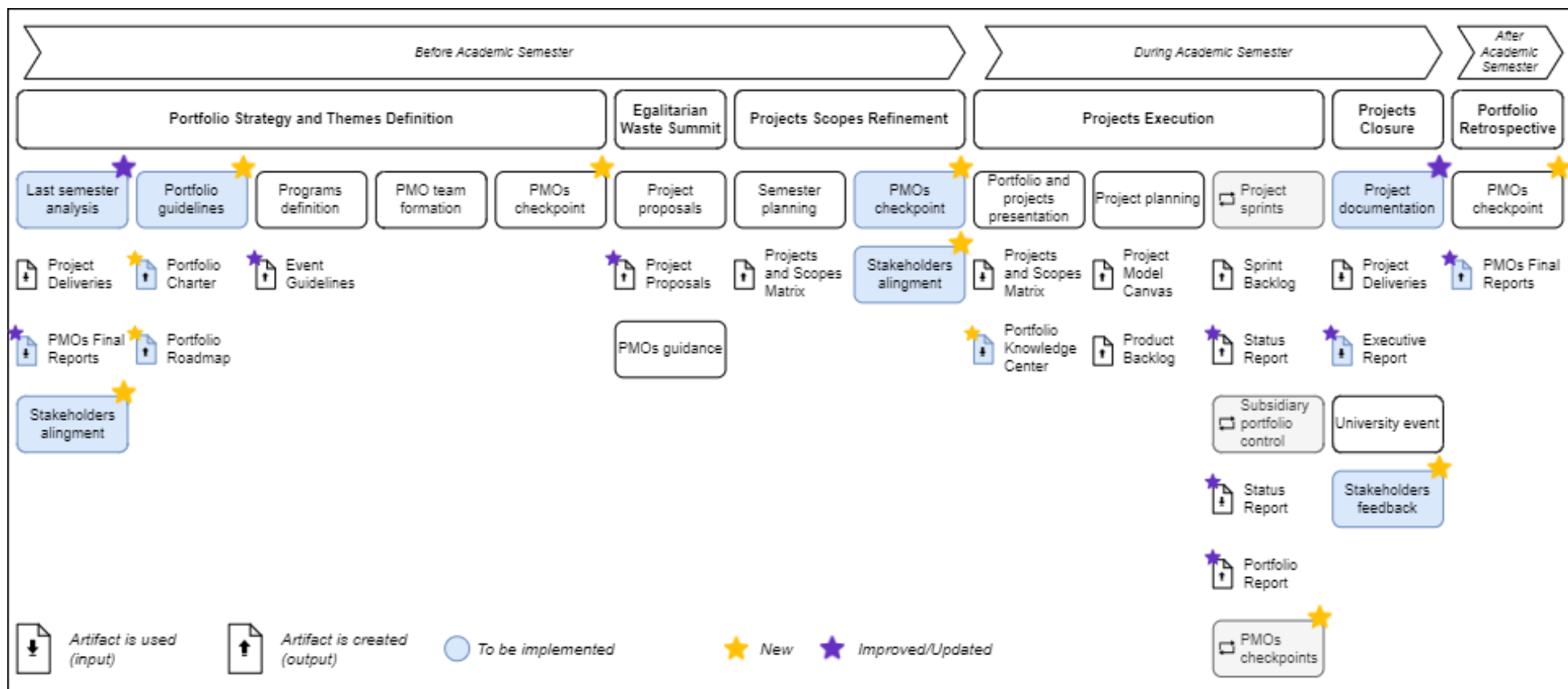
Figure 7. Semester Flux.

Some artifacts are used as input for knowledge sharing and/or decision-making, while others are created during certain moments/activities. During the Projects Execution phase, there are cyclical activities; the number of cycles vary depending on the course and semester. Activities and artifacts highlighted in blue aren't implemented yet and will be implemented during the next semesters. The following topics explain each moment and each artifact shown in the Semester Flux.

4.2.4.1. *Portfolio Strategy and Themes Definition*

The first phase of the Semester Flux, before the academic semester starts, focus on setting the portfolio strategy and defining the themes guidelines that will orient the *Egalitarian Waste Summit*. It has 5 steps:

1. The Portfolio Board analyses the last semester deliveries and the PMOs Final Reports and captures the stakeholders' expectations for the new projects cycle.
2. Based on this analysis, it stipulates the portfolio guidelines, creating or updating the Portfolio Charter and the Portfolio Roadmap.
3. Once the portfolio guidelines are clear, the Portfolio Board decides which programs will have allocated teams for the semester and elaborates an initial draft of all project scopes. These information are documented in the Event Guidelines.
4. Based on the number of programs and project teams allocated, each PMO Management team selects staff to be part of their PMO.
5. With all PMO teams formed, a general meeting is held to onboard everyone and share the portfolio strategy and defined themes/programs guidelines.

4.2.4.2. *Egalitarian Waste Summit*

The Waste Summit is an international in-person event that takes place every semester. During a whole week, nearly 70 students, professors, and supervisors work together to define the semester projects. Each group is responsible for creating project proposals for one of the portfolio programs, and the PMOs guide the groups using the Event Guidelines.

4.2.4.3. *Projects Scopes Refinement*

The Portfolio Board validates and adjusts the project proposals created during the Waste Summit, and then elaborates the Projects and Scopes Matrix. A general meeting with all PMO teams is then held, to align project scopes and project teams allocation. Stakeholders are also

informed about the expected deliveries from each project.

4.2.4.4. *Projects Execution*

The academic semester starts in this phase. Students from all involved courses receive a presentation from the PMO about the *Egalitarian* portfolio and the projects that will be executed. The PMO makes available the Projects and Scopes Matrix and gives access to the Portfolio Knowledge Center.

Each Team then creates a Project Model Canvas and a Product Backlog to better detail the project scope and manage stakeholders' expectations.

For each project sprint (1-2 weeks duration), Teams create a Sprint Backlog and execute all the tasks planned in that backlog. At the end of the sprint, Teams fill out a Status Report form to provide the PMO Control team with relevant information about the project evolution. The PMO Control team fill out a Portfolio Report to align the PMO and the Portfolio Board of main deliverables, obstacles, and risks. PMOs Checkpoints are held to discuss execution and management problems and share lessons learned.

4.2.4.5. *Projects Closure*

For the projects closure phase, Teams need to document all Project Deliveries and make an Executive Report – artifacts that will be stored in the Portfolio Knowledge Center. A University Event may happen to showcase the best projects, and deliverables should be evaluated by the stakeholders, that provide feedbacks to the Portfolio Board.

4.2.4.6. *Portfolio Retrospective*

A final PMOs Checkpoint is then held by the Portfolio Board, to evaluate the whole semester and discuss the PMOs Final Reports. During the retrospective, PMOs share their lessons learned and the *Egalitarian* portfolio management structure is reviewed and updated.

4.2.5. Artifacts

The proposed framework includes 14 artifacts (Figure 8), distributed during the Semester Flux. For each artifact, an example is provided.
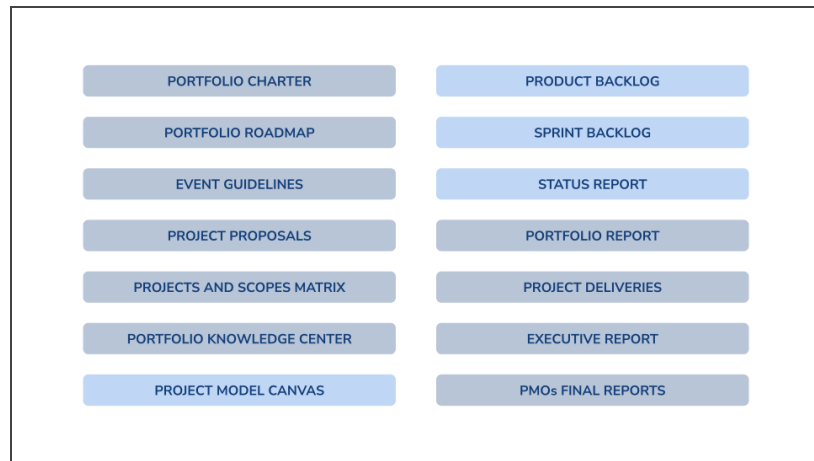
Figure 8. Artifacts.

The Project Model Canvas, Product Backlog, Sprint Backlog, and Status Report are optional but recommended artifacts.

4.2.5.1. *Portfolio Charter*

The Portfolio Charter provides general guidelines based on the portfolio strategy and assets. It may include (PMI, 2017a):

- Portfolio objectives;
- Portfolio management roles and responsibilities;
- Key and major stakeholders;
- Stakeholder expectations and requirements;
- High-level scope;
- Assumptions, constraints, dependencies and risks.

Figure 9 shows a Portfolio Charter model tailored to the *Egalitarian* portfolio.

Figure 9. Portfolio Charter Model.

4.2.5.2.   Portfolio Roadmap

The Portfolio Roadmap aims to represent the milestones of each program, giving an overview of the portfolio main deliveries during the semesters. As the time horizon extends, deliveries are less defined and more uncertain, but can provide a useful forecast. The Portfolio Roadmap may be unraveled in a more detailed roadmap for each program or main solution (Figure 10).
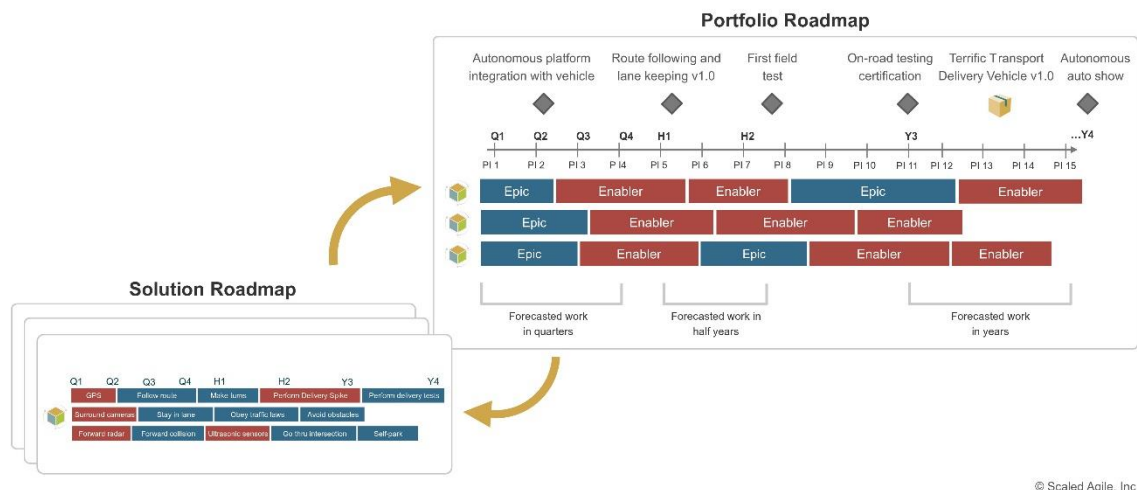

Figure 10. Portfolio Roadmap Model. (Scaled Agile, Inc, 2024)

Figure 11 shows a real example of a program roadmap for one semester: each project has its own objectives and milestones, providing a general semester plan.
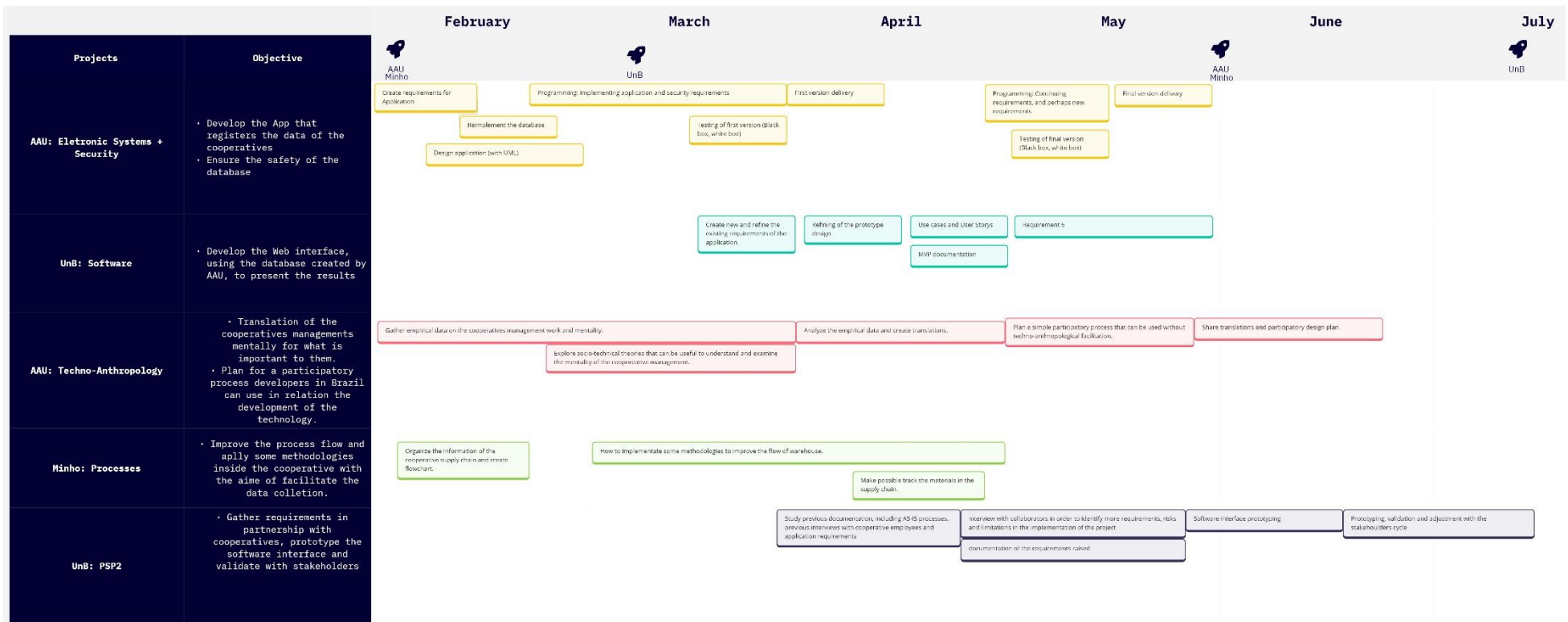
Figure 11. Program Roadmap Example – Integrated Supply Chain Management System.

4.2.5.3.   Event Guidelines

The Event Guidelines is a document that describes (i) how the teamwork will be organized during the event, (ii) last project deliveries, (iii) project scopes, and (iv) how project proposals should be delivered. Figure 12 shows an example of the teamwork guidelines, and Figure 13 exemplifies a project scope provided.
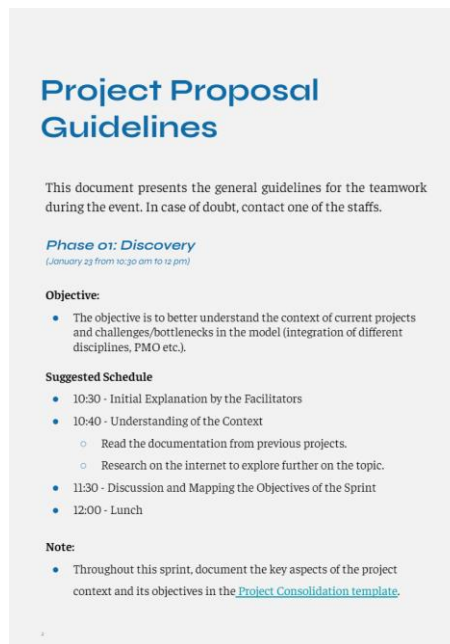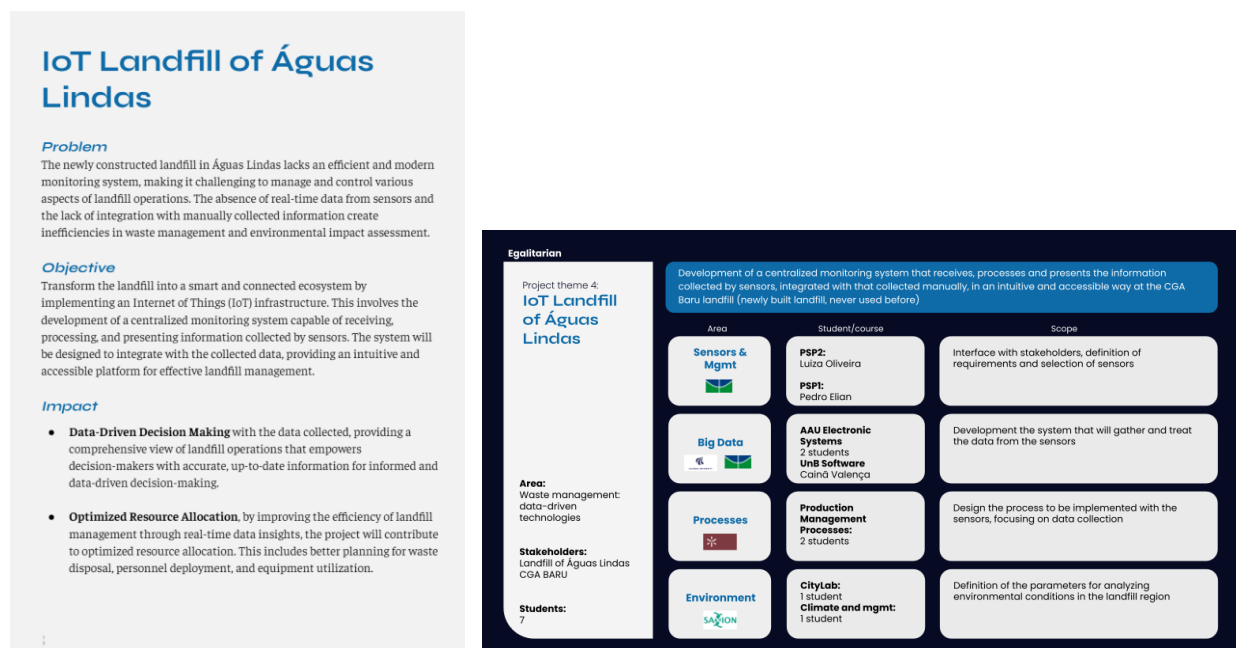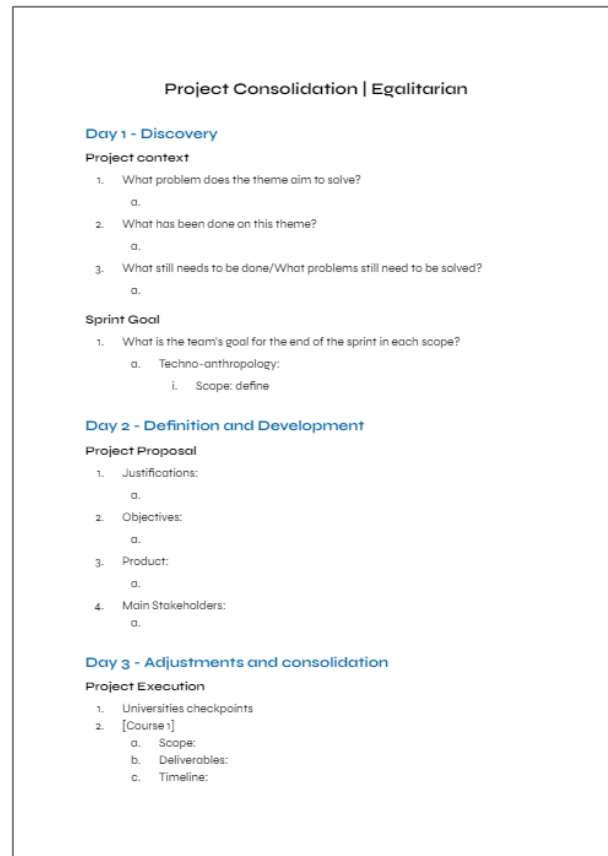

Figure 12. Teamwork Guidelines Example.

(a) synthetic description   (b) detailed description

Figure 13. Project Scope Example.

4.2.5.4.   Project Proposals

Based on the Event Guidelines, each group builds and delivers a Project Proposal, a structured document with ideas for the project execution during the semester. Figure 14 presents the Project Proposal template.

Figure 14. Project Proposal Template.

The Project Proposal includes a project context, goals for each project sprint, a detailed description of the proposed project and a general schedule for the semester execution.

4.2.5.5.   Projects and Scopes Matrix

The Projects and Scopes Matrix is shown in Figure 15.

Program	Description	Project Scopes							Client	Touchpoint	Communication Channel (TEAMS)	Support Materials
		PSP1	PSP2	PSP5	Aalborg	Minho	Saxion	Extra Courses/Teams				
Mobile Education App	Create personalized content for collectors, using a web system and an app called Educado, with the aim of promoting better living conditions or better employment opportunities.		TEAM 1 - Definition of content for personalized courses for the Educado web system and app. Compilation of courses offered to collectors free of charge. TEAM 2 - Structuring courses for implementation within the web system.	TEAM 1 - Identification of update needs and adaptations of the web system and app based on functionality and usability tests. TEAM 2 - Survey of development needs for 2024.2 (AAU) and prioritization of new developments and improvements according to functionality and usability testing.					Collectors AAU	Iara Andrade	Egalitarian 2024.1 - Educado (Education Platform for waste pickers) | Geral | Microsoft Teams	1) Mobile Education App
Integrated Supply Chain Management System	Structure a web system for viewing general production that can serve as decision-making and an application for employees to individually control their production.	Identification of the entire supply chain from disposal to recycling to propose two project proposals to improve the chain.	Refinement of Web screens and creation of screens for the App according to stakeholders' needs.	Validation of Web requirements and gathering new ones for the App.	Creation of a strategy to reduce resistance when using the software.	Improvements to the cooperative's screening and data collection process.			Cooperative (Recicle Mais Brasil)	Gabriel Brum	Egalitarian 2024.1 - Integrated Supply Chain Management System | Geral | Microsoft Teams	3) Sistema de SCM para as Cooperativas
PUMA Indicators	Propose 5 indicators for each SDG (1 to 17), which can support a method for classifying projects and companies, with sustainability criteria.			Development of indicators to measure how sustainable companies are			Development of indicators to measure how sustainable sustainability projects are.	SOFTWARE ENGINEERING - UNB Survey of functional and non-functional requirements and MVP	Professors and Students	Ricardo Accorsi	Egalitarian 2024.1 - Impact Indicators for PUMA Plataform | Geral | Microsoft Teams	7) PUMA
IoT Landfill of Águas Lindas	Structure a system with sensors to collect solid waste data (weight, location of waste, etc.) and data from the landfill (amount of gas, humidity, pH, etc.) In addition, we intend to structure a database that supports decision-making regarding landfill processes.		Definition of sensor requirements to better adapt data collection at the Landfill.	Definition of system requirements for data collection and integration with sensors.	Database modeling from existing data.	Process modeling and Proposal for improving landfill processes with a view to receipt.	Proposal for improvements to the environmental impacts of the Landfill.	SOFTWARE ENGINEERING - UNB Structuring a database that generates analysis of data extracted from sensors.	Paulo Celso	Luiza Oliveira	Egalitarian 2024.1 - IOT technology application on the Águas Lindas landfill | Geral | Microsoft Teams	IoT Landfill of Águas Lindas
Sustainable Hub App	Structure an application that centralizes information and projects linked to sustainability.		Knowledge management of project information and documents for the next semesters	Validation of functional requirements with interested parties. Improving user journeys.			Definition of branding, layout and gamification elements of the application. Definition of non-functional requirements. Creation of mockup models illustrating the user interface.	ENERGY ENGINEERING - UNB Construction of educational indicators on the relationship between energy generation and consumption and reuse and recycling of materials in the application modules.	Professors and Students	Lucas Iwano	Egalitarian 2024.1 - Sustainable Hub App | Geral | Microsoft Teams	Sustainable Hub App
Semi-Automated Sorting of Urban Solid Waste	Structure a process to automate the sorting of solid waste before it reaches the conveyor belt at the recyclable materials cooperative.	Design of the new process chain involving all actors.	Feasibility study of return on investment (ROI).			Study of reception of materials for screening and research flows on occupational health and safety in the cooperative.		ELECTRICAL ENGINEERING - UNB Study on the electricity network to meet the new system with definition of electrical load. MECHANICAL ENGINEERING - UNB Technical study on the design of the pre-sorting machinery.	CENTCOOP Paulo Celso	Brenda Cordeiro	Egalitarian 2024.1 - Semi-Automated Sorting of Urban Solid Waste | Geral | Microsoft Teams	Automated Sorting of Urban Solid Waste

Figure 15. Projects and Scopes Matrix Example.

The Matrix gives an overview of all project teams and its scopes, making it easier to visualize all initiatives from a specific program and the portfolio as a whole. Detailed scopes and additional information can be found in the revised versions of the Project Proposals.

4.2.5.6. *Portfolio Knowledge Center*

The Portfolio Knowledge Center is a tailored version of a Portfolio Management Information System (PMIS) that aims to integrate all the needed information for portfolio, program and project management. It may be developed inside Microsoft Teams, Microsoft SharePoint, Google Drive, the *Egalitarian* website or other platform considered appropriate by the Portfolio Board.

This PMIS needs to be "a comprehensive, documented, dynamic set of policies, processes, tools, plans, and controls for portfolio management" (PMI, 2017a). It allows for validated and consolidated communication of information and knowledge to be shared with the entire portfolio and its stakeholders. The Portfolio Knowledge Center may include tools and processes such as (adapted from PMI, 2017a):

- Portfolio categorization with components, dependencies, stakeholders, etc.;
- Centralized online document repository and version control;
- Change or configuration management;
- Workflow management and documentation of escalation communication;
- Historical and current information on portfolio risks, issues, assumptions, and dependencies;
- Updated versions of the Portfolio Charter and the Portfolio Roadmap;
- Historical and current information on events related to the portfolio;
- Historical and current Projects Artifacts, e.g., Project Model Canvas, Product Backlog and Sprint Backlog, deliverables, Executive Report;
- Historical and current Portfolio Artifacts, e.g., Project Proposals, Projects and Scopes Matrix, Portfolio Report, PMOs Final Reports.

4.2.5.7. *Project Model Canvas*

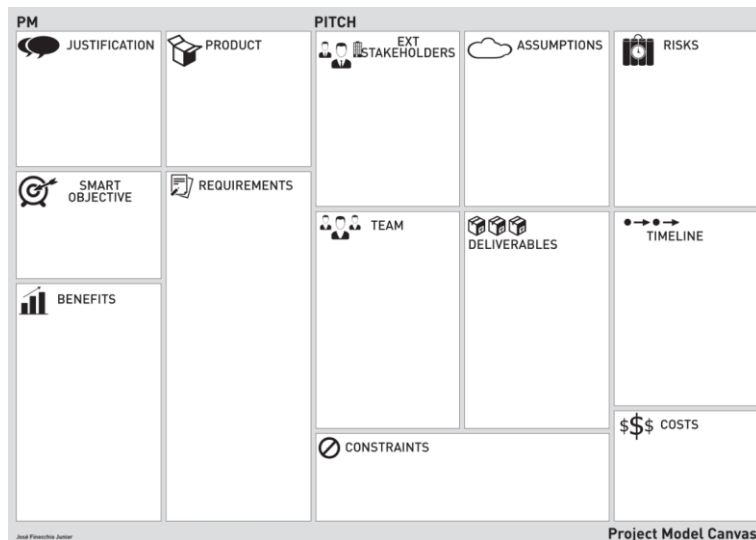Figure 16 shows the PM Canvas template.

Figure 16. Project Model Canvas Template. (Finocchio Júnior, 2013)

The Project Model Canvas (PM Canvas) is an Artifact developed by each Team during the project planning. It helps teams to organize their academic semester and validate their plan with professors and the PMO.

4.2.5.8. *Product Backlog*

Figure 17 presents a Product Backlog example.

Product Backlog						
ID	Epics	Stories	Definition of Done	Importance	Predicted Sprint	Comments
1	Analysis and assessment of the quality of AS-IS process modeling delivered by PSP2 and identification of points for improvement	Definition of the AS-IS process evaluation criteria	The story will be accepted if the criteria are clear, cover all key assessment points and are easily assessed	Essential (Must Have)	Sprint 1	Use the BPMN standard
2	Analysis and assessment of the quality of AS-IS process modeling delivered by PSP2 and identification of points for improvement	Analysis and evaluation of the AS-IS process delivered by PSP2	The story will be accepted if the evaluation follows the established criteria and is documented	Essential (Must Have)	Sprint 1	
3	Analysis and assessment of the quality of AS-IS process modeling delivered by PSP2 and identification of points for improvement	Critical analysis of the process seeking improvements	The story will be accepted if optimization points in the AS-IS process are highlighted and documented based on Production Engineering knowledge	Essential (Must Have)	Sprint 1	
4	Proposal for an optimized process based on good practices identified in research and preparation of the TO-BE	Identification of good waste management practices in condominiums for TO-BE construction	The story will be accepted if rules, norms, tips and recommendations from experts and competent bodies are listed and recorded	Essential (Must Have)	Sprint 2	Professor Paulo Celso, SLU website
5	Proposal for an optimized process based on good practices identified in research and preparation of the TO-BE	TO-BE process modeled and validated with stakeholders	The story will be accepted if the process follows all BPMN standards and identified good waste management practices	Essential (Must Have)	Sprint 2	
6	Epic 3	Story 3.1	The story will be accepted if... [requirements]	Expected (Should Have)	Sprint 3	
7	Epic 3	Story 3.2	The story will be accepted if... [requirements]	Expected (Should Have)	Sprint 4	
8	Epic 3	Story 3.3	The story will be accepted if... [requirements]	Extra (Nice to Have)	Sprint 4	
9	Epic 3	Story 3.4	The story will be accepted if... [requirements]	Extra (Nice to Have)	Sprint 5	

Figure 17. Product Backlog Example.

Based on the PM Canvas, each Team develops a Product Backlog. Items at the Product section in the canvas are translated into Epics, and items at the Deliverables section turn into Stories. Each story is then further detailed, with correlated Definition of Done, Importance, Predicted Sprint and additional Comments.

4.2.5.9.   Sprint Backlog

Figure 18 shows a Sprint Backlog example.

		Sprint 1 Backlog			
ID	**Epics**	**Stories**	**Definition of Done**	**Tasks**	**Comments**
S1.1	Analysis and assessment of the quality of AS-IS process modeling delivered by PSP2 and identification of points for improvement	Definition of the AS-IS process evaluation criteria	The story will be accepted if the criteria are clear, cover all key assessment points and are easily assessed	Study the BPMN standard	
S1.2	Analysis and assessment of the quality of AS-IS process modeling delivered by PSP2 and identification of points for improvement	Definition of the AS-IS process evaluation criteria	The story will be accepted if the criteria are clear, cover all key assessment points and are easily assessed	Define the evaluation criteria	
S1.3	Analysis and assessment of the quality of AS-IS process modeling delivered by PSP2 and identification of points for improvement	Definition of the AS-IS process evaluation criteria	The story will be accepted if the criteria are clear, cover all key assessment points and are easily assessed	Organize the criteria into a checklist	Use Google Sheets
S1.4	Analysis and assessment of the quality of AS-IS process modeling delivered by PSP2 and identification of points for improvement	Analysis and evaluation of the AS-IS process delivered by PSP2	The story will be accepted if the evaluation follows the established criteria and is documented	Apply the checklist in the AS-IS process	
S1.5	Analysis and assessment of the quality of AS-IS process modeling delivered by PSP2 and identification of points for improvement	Analysis and evaluation of the AS-IS process delivered by PSP2	The story will be accepted if the evaluation follows the established criteria and is documented	Metrify the evaluation and generate a final score	
S1.6	Analysis and assessment of the quality of AS-IS process modeling delivered by PSP2 and identification of points for improvement	Analysis and evaluation of the AS-IS process delivered by PSP2	The story will be accepted if the evaluation follows the established criteria and is documented	Document all correction points	
S1.7	Analysis and assessment of the quality of AS-IS process modeling delivered by PSP2 and identification of points for improvement	Analysis and evaluation of the AS-IS process delivered by PSP2	The story will be accepted if the evaluation follows the established criteria and is documented	Send feedback to the PSP2 team	Send with copy to professors
S1.8	Analysis and assessment of the quality of AS-IS process modeling delivered by PSP2 and identification of points for improvement	Critical analysis of the process seeking improvements	The story will be accepted if optimization points in the AS-IS process are highlighted and documented based on Production Engineering knowledge	Analyze the AS-IS process looking for optimization points	
S1.9	Analysis and assessment of the quality of AS-IS process modeling delivered by PSP2 and identification of points for improvement	Critical analysis of the process seeking improvements	The story will be accepted if optimization points in the AS-IS process are highlighted and documented based on Production Engineering knowledge	Document identified points of improvement	

Figure 18. Sprint Backlog Example.

At the beginning of each project sprint, teams unravel the Stories into tasks, providing clearer steps to the sprint execution.

4.2.5.10.   Status Report

All project teams should fill out the Status Report form at the end of each sprint, providing relevant information to the PMOs Control teams. It includes:

- **Tasks status:** which planned tasks for the sprint were completed, which are still in progress, and which are pending;
- **Blockings status:** blockings and/or impediments that made it difficult to execute sprint tasks (e.g., communication with stakeholders, absence of team members, partner team did not deliver a task that would be input for the work);
- **Risks status:** risks in resolution, risks mitigated, and comments about project risks;
- **Sprint assessment:** how was the Team performance during the sprint and if it made the Team come closer to the project objectives;
- **Project health and performance:** level of conformity to project management methodology, number of scope changes, number of changes in the sprint backlog, how good was the tasks distribution amongst team members, and team satisfaction levels in

relation to project theme, project development, received feedbacks, and project deliveries.

4.2.5.11.   Portfolio Report

The PMOs Control teams fill out a Portfolio Report to align the PMOs and the Portfolio Board of main deliverables, obstacles, and risks. Each program has its own menu (Figure 19), schedule (Figure 20), and report (Figures 21 and 22). A dashboard (Figure 23) provides an overview of the portfolio. The Portfolio Report is the main tool for managing the *Egalitarian* portfolio.

Figure 19. Portfolio Report – Program Menu Example.

The program menu summarizes the program scope and each project scope and provides relevant links and dates.

General Schedule

Figure 20. Portfolio Report – Program Schedule Example.

The program schedule shows detailed deadlines for each project sprint.

Figure 21. Portfolio Report – Project Center and Sprint 0 Report Example.

The Project Center documents each project's scope, possible problems and impacts on the execution, team members and roles, important dates and links, and stakeholders. The Sprint 0 Report focuses on evaluating the PM Canvas and Product Backlog. Both professors and the PMO's Control team give the project team a score for each sprint deliveries.

Figure 22. Portfolio Report – Sprint Report Example.

Sprint Reports analyses the Status Report answers and documents the professors and PMO's feedbacks and sprint score.

Figure 23. Portfolio Report – Dashboard Example.

The portfolio dashboard allows for a quick analysis of all project's situation, based on 4 indicators: MTL represents the percentage of the project execution time (in days) that has already passed; IDP shows the percentage of deliveries made on time; IDE indicates the average of all sprint scores; and IDR represents the risk score of the project (a higher percentage shows a lower

number of risks mitigated or solved). The project final score is the average of IDP, IDE and 1-IDR scores.

4.2.5.12.   Project Deliveries

Project Deliveries are all artifacts produced by a Team during the project execution. It may include documents, spreadsheets, presentations, illustrations, diagrams, prototypes, lessons learned, and the Executive Report. All Project Deliveries should be submitted to the PMO for feedback and to be uploaded to the Portfolio Knowledge Center.

4.2.5.13.   Executive Report

The Executive Report is a standard document developed by project teams at the Projects Closure phase. It contains:
- Project title, course, semester, team members and supervisors;
- Project summary;
- Project context, problems and objectives;
- PM Canvas and Product Backlog;
- Project methodology;
- Description of all project deliveries;
- Results achieved;
- Conclusions.

4.2.5.14.   PMOs Final Reports

The PMOs Final Reports aim to document the semester execution and management experiences and to provide lessons learned and recommendations to the next semester. It should answer questions such as (adapted from PMI, 2017a):
- Which portfolio components will best support the *Egalitarian*'s strategies and goals?
- Does each portfolio component have appropriate resources, including staff with the right skill sets?
- Does the Portfolio Report reflect the real overall status of the portfolio and is it the ultimate source for decision making?
- Is the portfolio structure adequate?
- What main challenges should the portfolio overcome to the next semester?

4.3 Feedbacks and Lessons Learned

The proposed framework, presented in section 4.2, has been partially implemented during the first semester of 2024. Each Portfolio Board member was asked to fill out a form to provide feedback about the framework based on the information provided and their experience with the *Egalitarian* portfolio management. Appendix I contains the complete form; section 4.3.1 presents the form responses and analysis, and section 4.3.2 contains the author's lessons learned.

4.3.1. Form Responses and Analysis

Table 5 shows the questions on the form.

Table 5. Feedback Form Questions.

Question ID	Question Statement
LS-1	What's your general evaluation of the proposed framework? (from 1 – very bad to 5 – very good)
LS-2	How clear is the Concept Map? (from 1 – very unclear to 5 – very clear)
LS-3	How clear is the Portfolio Structure? (from 1 – very unclear to 5 – very clear)
LS-4	How applicable is the Portfolio Structure? (from 1 – very inapplicable to 5 – very applicable)
LS-5	How clear are the Roles and Responsibilities? (from 1 – very unclear to 5 – very clear)
LS-6	How applicable are the Roles and Responsibilities? (from 1 – very inapplicable to 5 – very applicable)
LS-7	How clear is the Semester Flux? (from 1 – very unclear to 5 – very clear)
LS-8	How applicable is the Semester Flux? (from 1 – very inapplicable to 5 – very applicable)
OE-1	Additional feedbacks and suggestions

The form is composed of 8 linear scale questions and 1 open-ended question. It had 9 responses from Portfolio Board members: 3 from University of Brasília (UNB), 1 from Aalborg University (AAU), 3 from University of Minho (UMINHO), and 2 from Saxion University (SAXION).

Table 6 presents the answers provided for the 8 linear scale questions, segmented by the respondent's university.

Table 6. Form Answers – Linear Scale Questions.

Selected Answer		1	2	3	4	5	Average Score (per university)	Average Score (general)
Question ID	Respondent's University	Frequency						
LS-1	UNB	0	0	0	0	3	5	3,89
	AAU	0	0	0	0	1	5	
	UMINHO	0	0	3	0	0	3	
	SAXION	0	1	0	1	0	3	
LS-2	UNB	0	0	0	0	3	5	3,56
	AAU	0	0	0	1	0	4	
	UMINHO	0	0	2	1	0	3,3	
	SAXION	1	1	0	0	0	1,5	
LS-3	UNB	0	0	0	1	2	4,7	3,44
	AAU	0	0	0	1	0	4	
	UMINHO	0	0	2	1	0	3,3	
	SAXION	1	1	0	0	0	1,5	
LS-4	UNB	0	0	1	2	0	3,7	3,11
	AAU	0	0	0	0	1	5	
	UMINHO	0	2	1	0	0	2,3	
	SAXION	0	1	1	0	0	2,5	
LS-5	UNB	0	0	0	1	2	4,7	3,89
	AAU	0	0	0	0	1	5	
	UMINHO	0	0	2	1	0	3,3	
	SAXION	0	1	0	1	0	3	
LS-6	UNB	0	0	1	2	0	3,7	3,11
	AAU	0	0	0	1	0	4	
	UMINHO	0	1	2	0	0	2,7	
	SAXION	1	0	0	1	0	2,5	
LS-7	UNB	0	0	0	1	2	4,7	3,44
	AAU	0	0	0	0	1	5	
	UMINHO	0	0	3	0	0	3	
	SAXION	1	1	0	0	0	1,5	

Selected Answer		1	2	3	4	5	Average Score (per university)	Average Score (general)
Question ID	**Respondent's University**	Frequency						
LS-8	UNB	0	0	0	1	2	**4,7**	**3,44**
	AAU	0	0	0	0	1	**5**	
	UMINHO	0	2	1	0	0	**2,3**	
	SAXION	0	1	1	0	0	**2,5**	

Table 7 provides the overall averages, i.e., averages considering all scores (not divided by question).

Table 7. Form Answers – Overall Averages.

Respondent's University	Number of Respondents	Overall Average Score (per university)	Overall Average Score (general)
UNB	3	4,5	3,49
AAU	1	4,6	
UMINHO	3	2,9	
SAXION	2	2,3	

Tables 6 and 7 give insightful information on the Portfolio Board members vision about the proposed framework. The general evaluation of the framework is positive (average score of 3,89 on question LS-1), but its clarity (average score of 3,58 considering questions LS-2, LS-3, LS-5, and LS-7) and applicability (average score of 3,22 considering questions LS-4, LS-6, and LS-8) can be improved. It's important to notice that University of Minho and Saxion University respondents gave lower scores than those from University of Brasília and Aalborg University. This may be explained by the fact that UNB and AAU have previous experience with the *Global Students SDG Challenge* portfolio, while UMINHO and SAXION are new in this kind of international cooperation.

The IRaMuTeQ software was used to analyze answers from the open-ended question. 8 responses had valid answers for question OE-1 (Table 8) and were qualitatively analyzed.

Table 8. Form Answers – OE-1.

Answer ID	Respondent's University	Answers for Question OE-1
ANS-1	SAXION	"I think it would be very good for the project if there is one central dashboard with a clear overview of which documents are where, what they are for and to keep it simple but effective. Right now I am getting lost in all the documents."
ANS-2	UMINHO	"The project and portfolio management models need to be less hierarchically and heavily structured for the context of PBL course

Answer ID	Respondent's University	Answers for Question OE-1
		delivery. The courses, teachers and students need more flat and agile structures. We also need a teacher coordinator for each project/team, to act as a focal time for the project. In my perspective, the model should be evolved more cooperatively involving at least one representative of each university. Moreover, this model should be evaluated in interviews, not by a questionnaire."
ANS-3	UMINHO	"In my opinion, the framework can work for specific contexts, such as UnB's, but it does not consider the reality of other universities. The fact is that most of the artifacts were not used during the semester, and the responsibilities for each function were not clearly defined. Finally, it does not seem that we operated as a portfolio, given that the interaction was low and only started in mid-April, when practically half of the semester at UMinho had already passed. An example of this lack of international project management is reflected in the feedback from our students, as all of them mentioned that they had very little interaction with other universities and that the projects were carried out in isolation."
ANS-4	UMINHO	"Sorry, it seems to me that it is a heavy structure, and I really do not see the benefits of it. Portuguese students are having problems contacting their teammates and achieving the work they were supposed to do. Also, the way the teams were formed seems quite disbalanced in relation to the nationalities in each team. Probably, it is only my perspective!"
ANS-5	SAXION	"For me this is not clear at all and there is a lot of specific project management language that (to me) seems unconnected to what the students do in practice. Also, the collaboration between the four partner institutions and and the relationship with the 'cooperativas', the dump sites and the waste pickers does not become clear from these pictures. It is probably my lack of knowledge in this areas, but it does not help me at the moment in the organisation and execution of Egalitarian as a whole nor with the separate student projects. It would be great if the ideas of the concept map could be translated into practice and give more insight in the actual tasks that need to be done. It also seems to become a very large management structure in terms of time spent on project management on all different levels, not balanced with the work that is done by the students. The first question I had to choose between good and bad. It is not a bad framework, but I have doubts about the usability in the current form, so I could not say good (sorry for that)."
ANS-6	UNB	"I think that to apply the portfolio structure, in addition to understanding the role and responsibilities of each PMO, it is necessary to sign a term of commitment defining who will be in charge of each role. This ensures that the main PMO does not become overloaded. Another important formalization is a term of acceptance of the implementation of the projects by the stakeholders. This would help ensure that the project adds value and the needs of stakeholders are actually met."
ANS-7	UNB	"How applicable is the Portfolio Structure? To be applicable, PMOs from partner universities need to be trained, as they have different backgrounds and skills, lacking key project skills. How applicable are the Roles and Responsibilities? I think it is hardly applicable for coordination to take on team integration and training responsibilities. Suggestion: be a support front.

Answer ID	Respondent's University	Answers for Question OE-1
		Semester Flux: Program definition: it was not clear to me how we create the themes and whether this is at this stage or not. As this discovery task requires a lot of effort and usually blocks a lot of things, as it requires the approval of those involved (teachers and clients), I think it needs greater emphasis."
ANS-8	AAU	"The proposed portfolio management framework adds value to Egalitarian, because not only it formalizes existing fluxes and structures, but also makes proposals to have them further developed. Particularly, having a clear struture as proposed in the model is critical to the optimal management, as roles and responsibilities become clearer and clearer. So the framework and this work are super appreciated by egalitarian and bring improvement in portfolio management! As other feedbacks and possible future works, (i) it would be valuable to further develop such portfolio management framework in an increasingly closer collaboration with Egalitarian supervisors. They are, together with the students, the main customers of a porfolio management framework dedicated to the context of the ERASMUS+ collaboration among universities. Especially in this context, it was clear that some professors/supervisors/stakeholders were not as onboard in the adoption of the framework due to the feeling that it came a bit top-down without many co-creation opportunities. (ii) Besides, for future execution, an even more active lead in implementing the framework - and communicating its implementation - to the team of supervisors and students might be a good aspiration. (iii) the framework now tends to give a prominent importance to the PMO (justly), but I truly think that this over time should be re-balance/shifted towards the POs. Thx."

Figure 24 illustrates the Similarity Analysis conducted to identify co-occurrences between words.
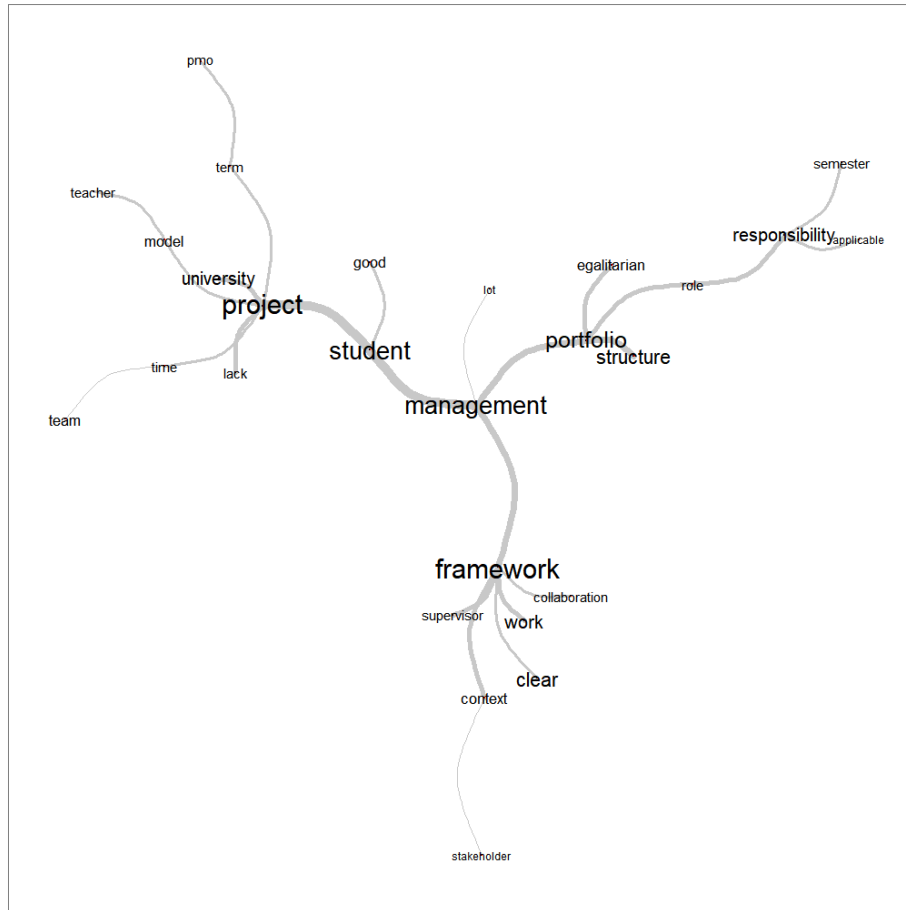
Figure 24. Similarity Analysis.

The structure shows the word "management" at the central core, which relates to the words "project", "student", "portfolio" and "framework". This analysis makes clear the main pillars of the feedbacks and suggestions provided.

The Correspondence Factor Analysis – CFA (Figure 25) detects associations and oppositions existing between subjects and objects, measuring their contribution to the total inertia for each factor (Teil, 1975).

Figure 25. Correspondence Factor Analysis.

The CFA by the respondent's university shows a high similarity in responses from University of Minho and Saxion University in terms of words and ideas presented, while responses from University of Brasília and Aalborg University had different focuses. This is reinforced by the word cloud diagrams for each of these 3 group responses (Figures 26-28):

Figure 26. Word Cloud Diagram – UMINHO and SAXION responses.

Figure 27. Word Cloud Diagram – UNB responses.
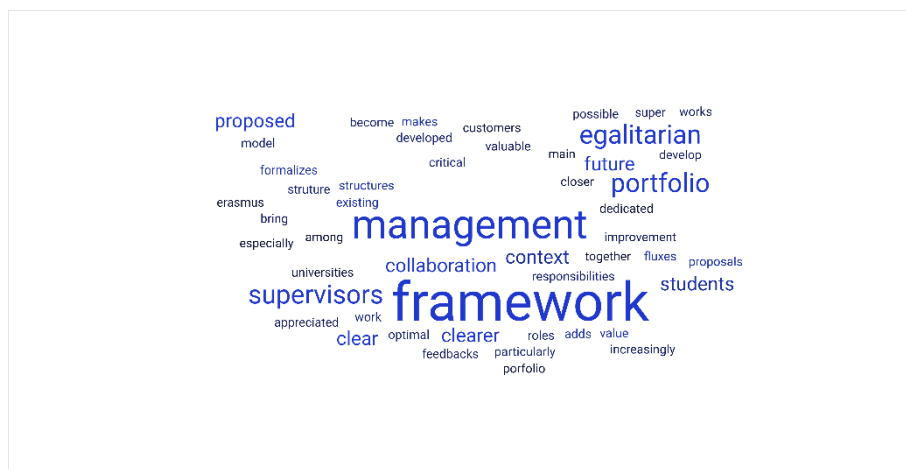
Figure 28. Word Cloud Diagram – AAU responses.

Feedbacks from University of Minho and Saxion University highlights concerns about a heavy structure, with high complexity, hierarchical levels, and many documents and touchpoints. For the framework to be more applicable at the project management level, in the respondents' opinions, it should emphasize a more agile structure, with higher interactions amongst students from correlate teams. The framework should also use a more clear and didactic language.

Respondents from University of Brasília focused on adjustments needed in the framework to make it more applicable. Suggestions include to formalize each member's role and responsibilities by a term of commitment, provide training to all PMOs members, and emphasize more the themes and programs definition processes. Also, responses indicated concerns about the PMO Coordination role being overloaded and recommended that some responsibilities were redistributed.

Aalborg University responses had a positive reaction to the proposed framework and also suggested some improvements: to involve more the *Egalitarian* supervisors in the next steps of the framework creation and implementation, to better manage the implementation by having a

leader responsible for communicating all changes and guidelines, and to gradually shift importance and decision-making power from the PMOs to the Product Owners.

4.3.2. Author's Lessons Learned

In addition to the Portfolio Board members' feedback, it's important to notice some lessons learned during the framework development and initial implementation.

Regarding the portfolio structure, due to its size and complexity, a robust model is needed. But to reduce the capacity and capability required to manage the portfolio, it's recommended to lower the number of active programs and execution teams. Once the *Egalitarian* supervisors' management maturity increases, then the portfolio may be expanded.

The portfolio does not have exclusive dedication from its members, so it's important to reduce synchronous meetings. The management workload should also be reduced when possible.

The portfolio uses a hybrid project management approach, but the proposed framework may be further tailored to transition more to an agile perspective. Processes and artifacts should help the portfolio, program and project management levels, and not make it difficult.

Stakeholders and portfolio members have low maturity regarding portfolio, program and project management standards and best practices. Change Management strategies should be better used in next steps for an easier adoption of the proposed framework. Additionally, training sessions should be provided for all members.

The proposed framework is at a more advanced stage of implementation at University of Brasília and needs more effort to be fully implemented in other universities. Because of that, some roles and responsibilities from the Portfolio Board are being executed solely by the Main PMO, i.e., by the UnB PMO.

5   CONCLUSION

In conclusion, a framework is "a loose but incomplete structure which leaves room for other practices and tools to be included but provides much of the process required" (Think Insights, 2020). Therefore, the framework proposed in this final paper should serve as a guideline for the development of a new model for the portfolio, program, and project management of the *Egalitarian* portfolio. This initial proposal is already a great start, but additional tailoring may be necessary during the new model creation/implementation. Also, members from all four universities should be included in the next steps, to make sure that the final model fits all necessities and realities.

This work contributes to the portfolio, program, and project management of an international Erasmus+ initiative that connects students and promotes interdisciplinary student projects, which impacts the students' personal and professional development. It provides a guide for the development and implementation of a management model for a complex portfolio by analyzing the current standards and best practices and the model used for managing the *Global Students SDG Challenge* portfolio. The tailored framework proposed provides a new portfolio structure with defined roles and responsibilities, macroprocesses and artifacts. Therefore, the research objectives were completely achieved.

However, this research also has limitations. It didn't analyze modern agile approaches for programs and portfolios, such as Disciplined Agile and SAFe®. The framework implementation is far from complete. And the contribution from the European universities was scant.

Future research may explore similar frameworks for different systems and organizations or focus on the creation and implementation of the complete *Egalitarian* portfolio management model based on the proposed framework. A further analysis of the framework's impact on teaching and learning, from both the professors' and the students' perspectives, is also welcomed.

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Feedbacks | *Egalitarian* Portfolio Management Framework

Hi!

Thank you for taking the time to fill out this form :)

We need a quick feedback about the proposed framework to manage the *Egalitarian* Portfolio.
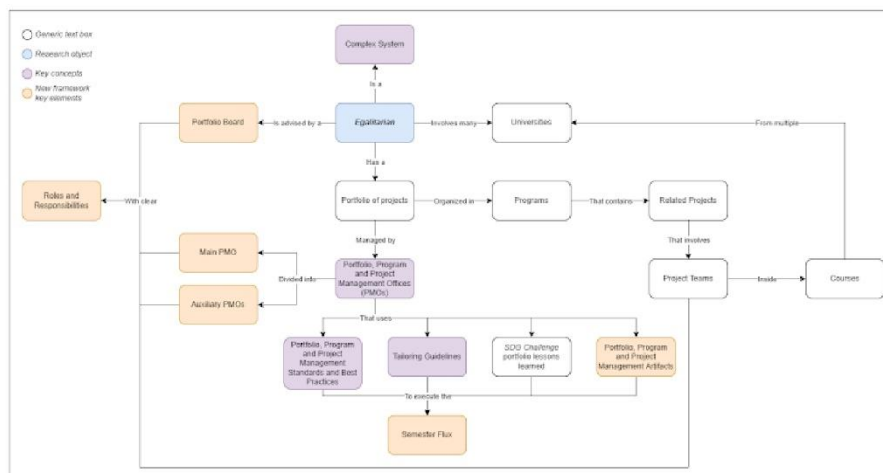
* Indica uma pergunta obrigatória

1. **E-mail** *

_____

2. **Name** *

_____

Remembering the Framework

A quick review of the new framework key elements

Concept Map

Concept Map: [access the high resolution image here]

Illustrates how the key elements are connected to *Egalitarian*.

Structure

The subsidiary portfolios, one for each country/university, are composed of programs and projects that may be integrated into other programs and projects inside the other subsidiary portfolios. Teams from different universities should work together to deliver their projects in an integrated way, and the PMOs are responsible for facilitating that cooperation. The number and scope of programs and projects can vary for each semester.

The Portfolio Board members are the professors in the Management role inside the PMOs and the students in the Coordination role of the Main PMO. Other students and professors may be involved in the Portfolio Board if needed. Each PMO – here considered a Portfolio, Program, and Project Management Office – is responsible for managing a subsidiary portfolio. The Main PMO manages both its subsidiary portfolio and the Auxiliary PMOs. Each Team is responsible for executing a project, and it may have one of the two following structures: a Product Owner (PO), a Scrum Master (SM), and an Executing Team; or a Project Manager (PM) and an Executing Team. The structure adopted will depend on the Team's subject and university.

Roles and Responsibilities

Portfolio Board Functions and Responsibilities

Role	Functions and Responsibilities
Portfolio Board Member	- Define the portfolio strategy, objectives, and guidelines; - Define the portfolio components and general project themes for each semester; - Establish partnership guidelines; - Develop the portfolio charter; - Develop the portfolio roadmap; - Manage the portfolio value.

Main PMO Functions and Responsibilities

Role	Functions and Responsibilities
Management	**Strategic management and transformation:** - Manage resource allocation within the PMOs and the portfolio; - Assist in the implementation of frameworks and methodologies for managing the portfolio, PMOs, subsidiary portfolios, and programs; - Implement organizational changes and transformations in the PMOs. **Team and human resources management:** - Define the expected profile of students for each PMO role; - Select the PMO team. **Portfolio management:** - Manage the portfolio; - Monitor the portfolio performance.
Coordination	**Strategic management and guidance regarding the PMOs:** - Guide resource allocation within the PMOs; - Provide frameworks and methodologies for managing the portfolio, PMOs, subsidiary portfolios, and programs; - Guide the need to implement organizational changes and transformations in the PMOs; - Coordinate communication across portfolio components. **Team and human resources management:** - Guide the expected profile of students for each PMO role; - Execute the integration process for new PMO members; - Develop and conduct training and mentoring of human resources in portfolio and program management skills, tools, and techniques; - Monitor and advise Support and Control teams and Auxiliary PMOs. **Learning and knowledge management:** - Manage the PMOs lessons learned meetings; - Manage PMOs knowledge base; - Train PMOs members.

Control	**Portfolio and program monitoring:** - Monitor the subsidiary portfolio performance; - Monitor the programs and subsidiary programs performance; - Conduct project audit; - Manage interfaces with project customers and project sponsors; - Monitor projects and programs risks; - Ensure the production of project reports by the Teams.
Support	**Management of information tools and systems:** - Provide tools and information systems for project management, PMOs knowledge management, and portfolio metrics and KPIs management; - Manage project documentation database; - Provide training and support on the use of tools for PMOs members. **Management of data intelligence and communication:** - Prepare periodic reports containing relevant insights into data acquired through tools and information systems used for project management.

	Management of processes and improvements: - Carry out fault diagnosis in internal processes and identify improvement needs within the PMOs.

Auxiliary PMOs Functions and Responsibilities

Role	Functions and Responsibilities
Management	**Strategic management and transformation:** - Manage resource allocation within the Auxiliary PMO and the subsidiary portfolio; - Assist in the implementation of frameworks and methodologies for managing the Auxiliary PMO, subsidiary portfolios, and subsidiary programs; - Implement organizational changes and transformations in the Auxiliary PMO. **Team and human resources management:** - Select the Auxiliary PMO team. **Subsidiary portfolio management:** - Manage the subsidiary portfolio; - Monitor the subsidiary portfolio performance.
Control	**Subsidiary portfolio and subsidiary program monitoring:** - Monitor the subsidiary portfolio performance; - Monitor the subsidiary programs performance; - Conduct project audit; - Manage interfaces with project customers and project sponsors; - Monitor projects and subsidiary programs risks; - Ensure the production of project reports by the Teams.

Teams Functions and Responsibilities

| Role	Functions and Responsibilities
Project Manager (PM)	- Manage project stakeholders; - Improve problem definition and project scope; - Provide project reports to the PMO; - Manage project risks.
Execution Team	- Proactively study and seek possible solutions for the project; - Organize the deliveries for each milestone of the project timeline; - Execute the project.

or

Role	Functions and Responsibilities
Scrum Master (SM)	- Lead, train, and guide the Team in adopting Scrum; - Help project members and stakeholders understand and apply an empirical approach to complex work; - Remove barriers between stakeholders and the Team.

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Role	Functions and Responsibilities
Product Owner (PO)	- Develop and explicitly communicate the Product Goal; - Create and communicate Product Backlog items; - Prioritize Product Backlog items; - Ensure the Product Backlog is transparent, visible, and understandable.
Execution Team	- Create a plan for the sprint, the Sprint Backlog; - Gradually introduce quality by adhering to a Definition of Done; - Adapt the plan each day toward the Sprint Goal; - Provide a status report for each sprint.

Semester Flux
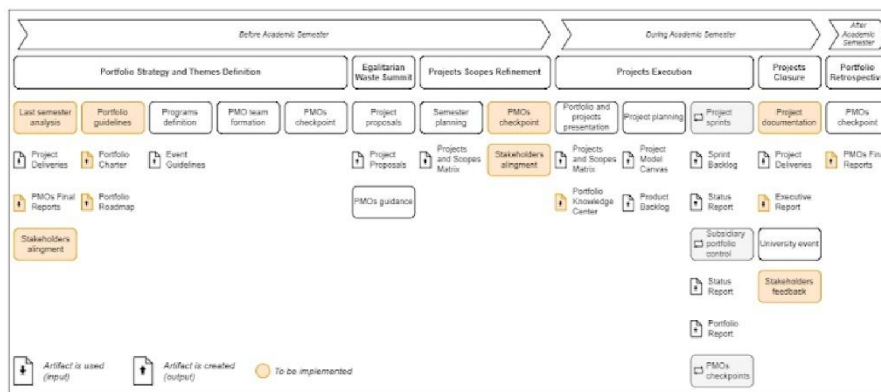
Semester Flux: [access the high resolution image here]

Shows the milestones and main artifacts needed before, during and after each semester.

Feedbacks

Based on the information provided in this form and your experience with the *Egalitarian Portfolio Management*, please answer the questions below.

3. **What's your general evaluation of the proposed framework?** *

    Marcar apenas uma oval.

	1	2	3	4	5	
Very	○	○	○	○	○	Very good

4. **How clear is the Concept Map?** *

    Marcar apenas uma oval.

	1	2	3	4	5	
Very	○	○	○	○	○	Very clear

5. **How clear is the Portfolio Structure?** *

Marcar apenas uma oval.

	1	2	3	4	5	
Ver	○	○	○	○	○	Very clear

6. **How applicable is the Portfolio Structure?** *

Marcar apenas uma oval.

	1	2	3	4	5	
Ver	○	○	○	○	○	Very applicable

7. **How clear are the Roles and Responsibilities?** *

Marcar apenas uma oval.

	1	2	3	4	5	
Ver	○	○	○	○	○	Very clear

8. **How applicable are the Roles and Responsibilities?** *

Marcar apenas uma oval.

	1	2	3	4	5	
Ver	○	○	○	○	○	Very applicable

9. **How clear is the Semester Flux?** *

Marcar apenas uma oval.

	1	2	3	4	5	
Ver	○	○	○	○	○	Very clear

10. How applicable is the Semester Flux? *

Marcar apenas uma oval.

	1	2	3	4	5	
Ver	○	○	○	○	○	Very applicable

11. Additional feedbacks and suggestions *

_____

_____

_____

_____

_____