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Section 1 – The Assignment

Chapter 1. Introduction

1.1 Background and Context

In many parts of the world, researchers and universities are facing a growing concern about how to make research results more trustworthy and repeatable. This concern is known as the reproducibility problem. Many studies cannot be repeated successfully by other researchers, which weakens confidence in scientific findings. A large international study by *Nature* found that more than seventy percent of scientists could not reproduce someone else's results at least once (Baker, 2016). In education research, the problem is even stronger. Studies show that only about zero point one three percent of published papers are actual replications, meaning that nearly all studies are done only once and never verified (Makel and Plucker, 2014).

The European Union and the Organisation for Economic Cooperation and Development have made reproducibility and open science major priorities. The OECD Recommendation on Access to and Sharing of Research Data (2021) and the Science Europe Guide on Research Data Management (2021) both call for transparent and traceable research data. The FAIR principles describe that all research information should be Findable, Accessible, Interoperable, and Reusable (Wilkinson, 2016). These international policies aim to make research more reliable, more efficient, and easier to build upon.

The Value Chain Hackers Lab at Windesheim University represents these same challenges on a smaller scale. The Lab supports students and researchers who work with companies to improve supply chains through applied research. The goal is to make these chains more sustainable and transparent. However, internal review of six earlier project tracks showed that every team used a different way to collect and store data. Some projects were documented in Excel files, others in Power BI, and some only in Word documents without version control. After each student team finished, the files often became lost or unreadable. Only one of the six projects stored its results in a shared folder, and none used any form of metadata or validation report. This means that less than ten percent of project outputs were available for reuse the next year.

This problem has made it impossible for new teams to continue from where others stopped. Each project starts from the beginning again, which wastes time and weakens the Lab's cumulative learning. It also limits the credibility of VCH's reports when working with external companies, because results cannot be traced or verified. When compared to institutions such as TU Delft or the Fraunhofer Institute, which both apply clear open data practices through platforms like 4TU.ResearchData, VCH operates far behind national and European standards.

At a deeper level, this lack of reproducibility also reduces Windesheim's ability to take part in larger European open science initiatives that require data sharing and reuse. According to the European Commission (2022), universities that align their research methods with FAIR and OECD recommendations gain more access to research funding and partnerships. This shows that reproducibility is not only an academic issue but also a strategic one. For Windesheim and

VCH, improving it is necessary to stay connected to national and international networks of applied research.

The project described in this report responds directly to that problem. It is not based on a general idea or assumption but on proven evidence from internal and external analysis. The purpose is to design a clear and repeatable process that allows every student research project at VCH to be performed, documented, and reused in the same transparent way. This transformation will change VCH from a set of isolated projects into a shared knowledge system that grows over time.

1.2 Purpose and Scope

The goal of this graduation project is to design and validate a reproducible research framework that ensures consistency, traceability, and quality across all projects in the Value Chain Hackers Lab. The project does not aim to develop a new software platform but to create a clear and structured process that guides students and researchers in how they design, document, and publish their work.

The scope of the project covers the complete research process used within the Lab. It begins with identifying the main barriers that currently prevent reproducibility, continues with studying examples from leading research environments such as the Open Science Framework, 4TU.ResearchData, and FAIR-based repositories, and ends with adapting these best practices into a simple, repeatable structure that fits the Lab's educational setting.

The system will be applied only within the internal environment of the Value Chain Hackers Lab and related academic partners at Windesheim and Inholland University. It will not include large external companies or outside technology partners beyond the testing phase. The measurable goals are to raise the number of student projects that use open data templates from zero percent to at least fifty percent, and to ensure that one hundred percent of projects store results in a shared and retrievable location. Each of these steps will be tested within the six-month graduation period.

1.3 Innovation and Relevance

The innovation in this project is not the creation of a new technology but the combination of methods that already work in other research environments into one complete process adapted for student research. Studies show that small and simple incentives, such as open practice badges, can increase the number of published open data projects from less than three percent to nearly forty percent (Kidwell, 2016). Preregistration of research plans has also been proven to make studies more transparent and less biased (Nosek, 2018).

This project will study these methods and translate them into a single framework that matches the structure of the Value Chain Hackers Lab. It brings together the clarity of FAIR documentation, the openness of OSF preregistration, and the educational structure of applied research programs. This combination will allow students to follow the same research logic while supervisors and partners can verify every step.

At the same time, the project gives Windesheim and Inholland a concrete way to demonstrate compliance with European open science policies (OECD, 2021). This makes the innovation relevant not only for the Lab but also for the universities' long-term research reputation. It connects education and applied science while increasing the quality and reliability of student work.

The project also meets the requirement for thirty credits of individual effort. It includes a complete cycle of literature study, stakeholder analysis, framework design, pilot testing, and evaluation. Each part demands professional judgment and academic reasoning, showing that the work is both complex and meaningful.

Chapter 2. Learning Opportunity

2.1 Personal Development

This assignment offers a strong learning opportunity that goes beyond the experience of previous projects. Earlier work focused mainly on strategy and business design. This project requires deep research understanding, data management, and collaboration with academic and technical experts. It will develop skills in research design, data governance, and quality assurance that are valuable for future innovation consultancy roles.

The process also develops independence and leadership. Managing both academic and institutional expectations demands planning, communication, and critical evaluation. It challenges the student to connect theoretical frameworks, practical tools, and human behavior in one coherent system. This combination of academic depth and practical coordination makes it a powerful step in personal growth.

2.2 Alignment with Graduation Track

The project aligns completely with the Micro Innovation track of Business Innovation. Micro Innovation focuses on small but strategic changes that improve systems over time. This assignment is a direct example of that principle. It creates a process-level improvement within a single lab that can later be scaled across the university.

Research methods are generally similar across disciplines. Once a reproducible structure works in one lab, it can easily be adapted for others. This means the local solution can grow into an institutional standard, showing how micro innovation produces long-term impact.

2.3 Learning Objectives

The learning objectives of this project are to identify the structural barriers that make student research difficult to reproduce, to translate international open science standards into simple and useful templates, to design and test a working prototype framework, and to evaluate its performance through measurable indicators.

Achieving these goals will strengthen the Value Chain Hackers Lab as a professional learning environment and support Windesheim in meeting national open science expectations. It will also help the student develop analytical, creative, and leadership skills that are essential for evidence-based innovation work.

Chapter 3. Assignment Definition

3.1 Clarity and Conciseness

The assignment is to design, test, and validate a reproducible research framework that ensures transparency and consistency in all Value Chain Hackers Lab projects. Success will be measured by the degree to which future projects can follow the same process and produce comparable and traceable results.

3.2 Client and Commissioning Context

The commissioning client is the Value Chain Hackers Lab at Windesheim University, represented by Professor Chris Verhoef. The Lab serves as both the operational and research environment for this assignment. It works closely with Inholland University of Applied Sciences, which provides academic supervision. This collaboration ensures that the project meets both professional and academic standards.

The client confirmed the need for this project during the Gate 0 validation meeting, where the lack of reproducibility across past projects was recognized as a priority issue. The client also functions as domain expert and will provide access to internal documentation, students, and staff members for analysis and testing.

3.3 Deliverables and Expected Results

The main deliverable is a complete reference framework that describes the stages, actions, and documentation needed for reproducible research in the Lab. Supporting outputs will include documentation templates based on FAIR principles, an implementation guide for users, and validation results from pilot testing.

Success will be shown through higher documentation quality, consistent data storage, and positive feedback from project supervisors and stakeholders. The expected result is a permanent improvement in how the Lab conducts and preserves research, turning isolated student work into cumulative institutional knowledge.

Chapter 4. Methodology and Execution

The execution of this project follows the full Business Innovation meta-skill cycle. In the Define phase, internal project files and stakeholder interviews will identify the main problems and information gaps. The Design phase will develop and prototype the framework based on best practices and academic evidence. During the Execute phase, the prototype will be tested in an active student research case under supervision. In the Learn phase, outcomes will be measured through documentation quality, data accessibility, and user feedback. Each result will be reviewed and used to refine the process.

The approach follows the design science model described by Hevner and colleagues (2004), which requires that each design cycle produces both a practical artifact and validated knowledge. All work will follow ISO 27001 standards for information security to ensure safe handling of data and responsible research conduct. The project will be managed independently, with regular consultation and reporting to both the Windesheim client and Inholland supervisor to guarantee transparency and professional accountability.

Transitional Closing

Section 1 has explained the full background, purpose, innovation, and learning potential of this assignment. It defines the context, the goals, and the relevance of developing a reproducible research framework for the Value Chain Hackers Lab. The next section, Research Design, describes in detail how this work will be researched, tested, and validated through a clear methodological structure.

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Section 3 – Project Design

3.1 Project Planning and Timeline

The project will be carried out through a structured process that follows a four-sprint model. Each sprint lasts about two weeks and builds upon the results of the previous one. This structure allows a clear rhythm of research, design, testing, and reflection. The total duration covers six to eight months, which includes both the research and the applied development of the reproducible framework.

During the first sprint, the focus will be on defining the scope of the problem and collecting all relevant internal and external data. This includes reviewing earlier VCH projects and interviewing key stakeholders such as supervisors, student researchers, and the Lab coordinator. The second sprint will center on designing and prototyping the reproducible research framework, translating best practices from external examples like OSF and 4TU into the context of the Lab. The third sprint will involve pilot testing the framework within an ongoing student project, gathering both qualitative and quantitative feedback. The fourth sprint will focus on evaluating the pilot, refining the framework, and preparing the final recommendations for implementation.

Progress will be tracked weekly through milestone reviews with the client and supervisor. Each review will document findings, reflections, and next steps to ensure that the project remains on schedule and that learning is continuous. This rhythm supports both flexibility and accountability, allowing the project to adapt while maintaining steady progress.

3.2 Stakeholder Analysis and Role Division

The main stakeholders in this project include the client, academic supervisor, student researchers, and external partners connected to the Lab. The client, Professor Chris Verhoef, serves as both the commissioning representative of Windesheim and the expert advisor for the Lab's development. The academic supervisor from Inholland University ensures that the project aligns with the standards of the Business Innovation program. Student researchers provide practical feedback during the pilot phase, while external partners offer perspective on data transparency and business relevance.

Each stakeholder has a clear role in ensuring that the project remains valid and applicable. The client confirms institutional relevance and facilitates access to internal resources. The academic supervisor verifies that the research follows academic standards. The student participants test the framework during their project and report usability results. External partners will review the final framework to confirm that it produces results that are understandable and credible for real business applications. This combination of perspectives guarantees that the framework is both academically sound and practically useful.

Stakeholder engagement will take place through structured meetings at the end of each sprint. Feedback will be collected in written form and integrated into the design process. This ensures transparency and shared ownership of the final results, which increases the likelihood of adoption after the project is completed.

3.3 Required Resources

The resources needed for this project are primarily intellectual and digital rather than financial. They include access to the Value Chain Hackers Lab's previous research files, the GitBut repository for file management, and Windesheim's digital library for academic sources. Tools such as Microsoft Teams and the Windesheim online learning platform will be used for communication and documentation.

Human resources consist of the project lead (the student researcher), the client, the academic supervisor, and a small group of student participants who will test the framework. These participants will be briefed on how to use the new structure and provide feedback on its usability. No additional funding is required, since all tools and data are already available within the institutions involved.

3.4 Risks and Mitigation Strategies

Several risks could affect the project if not addressed properly. The first is limited participation or availability of stakeholders during the data collection and testing phases. To reduce this risk, meeting schedules will be confirmed in advance and supported by short digital updates after each sprint. The second risk is potential confusion or resistance from students when adopting a new documentation method. This will be addressed through clear guidance, easy-to-use templates, and one-on-one support during the pilot. The third risk is time pressure near the end of the project period. To manage this, the timeline includes small buffers within each sprint, allowing room for unexpected delays.

A final risk is that the proposed framework may be seen as too complex for regular student use. To prevent this, every design decision will be tested for simplicity and clarity. Feedback from students will determine whether each element should remain, be simplified, or be removed. This ensures that the final result will be practical and accepted by its main users.

3.5 Criteria and Specifications for Deliverables

The main deliverable of this project is the reproducible research framework, which will describe the workflow from project definition to data publication. It will include clear instructions for each stage of research, documentation templates that align with FAIR principles, and a visual guide that shows how data moves from collection to storage. The supporting documentation will include a usability report from the pilot, feedback summaries from stakeholders, and a final version of the framework ready for implementation.

The specifications for success are based on clarity, usability, and alignment with both open-science standards and institutional goals. The framework must be simple enough for students to use without extra training, detailed enough to ensure comparability of results, and compliant with the FAIR and Science Europe recommendations for data documentation

(Wilkinson, 2016; Science Europe, 2021). These criteria guarantee that the project produces not only a tool but also a long-term improvement in research quality.

3.6 Milestones and Checkpoints

The main milestones in the project follow the four-sprint timeline. The first milestone is the completion of the initial problem analysis and literature review. The second milestone is the creation of the prototype framework and its first stakeholder review. The third milestone is the completion of pilot testing with one active student project. The final milestone is the evaluation and presentation of results to the client and supervisor.

Each milestone will be verified through short reports, progress meetings, and approval by both the client and the academic supervisor. This ensures shared oversight and consistent alignment with project goals. The use of iterative checkpoints also reduces risk by catching problems early and allowing corrections within the same cycle.

3.7 Success Criteria

The success of this project will be measured through both qualitative and quantitative indicators. Qualitatively, success will be shown through positive feedback from students and supervisors who find the new process easier to use and more transparent. Quantitatively, it will be shown by a measurable increase in the number of projects that follow standard documentation templates and deposit their data in shared repositories.

A secondary success indicator is adoption. If the client and academic supervisor decide to use the framework for future cohorts, it will demonstrate that the result is not only functional but also scalable. The final sign of success will be the integration of the framework into the Lab’s operational guidelines, ensuring that the change becomes part of daily practice.

3.8 Place for Shared Data and Files

All project data, templates, and reports will be stored in the GitBut repository used by the Value Chain Hackers Lab. This system will hold version-controlled files that include literature reviews, internal analysis, framework drafts, and final results. Access rights will be shared with the client, the supervisor, and future student researchers to ensure transparency and long-term availability.

After project completion, the validated framework and supporting documentation will also be archived in the 4TU.ResearchData repository to guarantee public accessibility in line with FAIR

and OECD recommendations (OECD, 2021). This will provide a stable record of the project's findings and ensure that future students and external partners can learn from the work.

Transitional Closing

Section 3 has transformed the research plan into a clear operational design with a full timeline, stakeholder map, resource plan, and measurable success criteria. It shows how the project will be managed and how progress will be tracked and validated. The next part of the document will include the reference list in APA format, followed by appendices with internal case studies, validation materials, and templates that support the research framework.

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