

From Innovation to Impact: Embedding Sustainable Development Goals in University Research Projects - A Risk Management Perspective

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Abstract

University research projects carry a dual responsibility: fostering innovation and addressing societal challenges. However, this innovation potential is often accompanied by high degrees of uncertainty and risk due to vague initial objectives and complex stakeholder environments. Therefore, it becomes essential to design a risk management strategy that not only ensures adherence to time and budget constraints but also integrates sustainability goals into the planning and evaluation process. This paper investigates how Sustainable Development Goals can be systematically embedded into the strategic planning of university research projects to enhance research relevance and societal benefit. The study applies a qualitative approach based on expert interviews within a large-scale research project MORE at a German university. It identifies the most relevant SDGs, links them to key project risks, and develops a conceptual framework for their integration into a digital risk twin. The findings show significant alignment with internationally prioritised SDGs - especially SDG 9 (Industry, Innovation and Infrastructure), SDG 13 (Climate Action), and SDG 4 (Quality Education). This alignment confirms both the relevance of the developed methodology and its theoretical foundation. The resulting strategy supports transparent, sustainability-oriented decision-making in complex research environments and offers a transferable approach for similarly structured academic projects.

Keywords

Risk Management, Sustainable Development Goals, University Research Projects

1. Introduction

The United Nations (UN) has defined 17 sustainable development goals (SDGs), which shall be achieved by 2030. The goals belong to different challenges that society worldwide is facing. By incorporating different nations, a common vision for a better future for everyone can be established (United Nations 2015). Still, there are some conflicts of interest among nations and within countries. These conflicts can negatively affect the achievement of the SDGs. They must work together to implement the different goals in various institutions, political systems, and industries. Moreover, the Lund Declaration of 2009 made it clear that research should be oriented to the challenges society is facing (Owen et al. 2021). This includes, for example, topics from climate change to energy or security problems. Research and development projects (R&D) can be mentioned as one innovation driver. They strive to be innovative to fulfill or surpass the requirements of the customer to ensure their sales. Not just R&D projects, but also projects in the context of university research projects (URP) have a large innovation potential. It is proven that the universities are growing in size and scope (Moore et al. 2011). This, in turn, gives them a more important role in the short term to overcome challenges society is facing, but also in the long term to ensure the success of the SDGs' achievement.

1.1 Problem Statement

URP is facing different challenges during its project duration and its inherent research objectives. Some risks arise from resource constraints, unexpected research results, and delivery delays (Owen et al. 2021). This makes the research unpredictable and highly risky. Some of the projects are facing challenges according to different motivations, which can lead to conflicts of interest. Through partnerships between industry and IUP, both can pursue different goals. On the one hand, industries want to gain knowledge to be even more innovative and increase their competitiveness in the market; on the other hand, universities want to test their theoretical research practically and get additional funding (Gross et al. 2025).

Generally, these conflicts of interest can arise between IUPs and their funding organization. Funding is granted because of a specific problem, which shall be solved. Normally, these challenges arise from society. Often, the researchers are focusing on their scientific goals, but still, the management constraints shall be ensured, and the impact on the SDGs must be measured to ensure goal achievement. To drive these innovative potentials, it is important to know the risks that would endanger the success of achieving the goals, among others, to society and the army. This leads to the research question, which this paper addresses: "Which sustainability goals play a crucial role in the social and university research context, and how can these be made measurable over the entire duration of the project?"

1.2 Objectives

The objective of this thesis is to systematically explore the interrelationships between societal objectives, global sustainability goals, academic research, and the associated risks. Particular emphasis is placed on examining the extent to which societal expectations and sustainability imperatives align with the strategic orientation of university research activities, with specific consideration of military-related contexts, such as research conducted in collaboration with or for the German Armed Forces (Bundeswehr). The central research question, as introduced in Section 1.1, concerns the relevance and prioritisation of selected sustainability goals, as defined by the United Nations Sustainable Development Goals (UN SDGs; United Nations, 2015).

Building on this guiding question, the thesis pursues three further objectives that contribute to determining the answer to the central research question:

1) **Which risk management framework is most appropriate for assessing sustainability goals in a research context?**

The aim is to identify and justify the selection of a suitable approach from among established risk management methodologies. The selected framework should enable systematic identification, assessment, and prioritization of sustainability goals within the scope of academic research.

2) **What social risks emerge in the context of university research, particularly in association with the Bundeswehr?**

This objective involves the identification and analysis of social risks inherent to university research projects. Special attention is devoted to evaluating the extent to which these findings are transferable to research activities linked to the German Armed Forces. Key areas of interest include ethical, political, and communicative challenges that are especially salient in security- and defense-related research domains.

3) How can the findings be represented through a digital risk twin for research?

A conceptual framework will be developed for a digital research twin designed to visualize and interrelate goals, risks, and research outcomes. This digital risk twin is intended to enhance transparency and traceability in the management and communication of sustainability and associated risks within research processes.

By addressing these objectives, the thesis aims to develop an integrative perspective on sustainability, risk governance, and social responsibility in academic research. Through a critical review of existing risk management systems, a focused analysis of societal tensions, and the conceptual design of a digital research twin, the study seeks to formulate actionable recommendations and contribute to the methodological advancement of sustainability-oriented research strategies. The results are expected to be academically robust and simultaneously provide practical insights, particularly for research in security-sensitive domains such as those involving the Bundeswehr.

2. Theoretical Background

2.1 Risk management Methods to analyze Sustainable Development Goals

Risk management is not a new discipline. The ancient Babylonia had already expressed their results and certainty, confidence, and authority to read the signs of god (Covello 1985). Modern risk management focuses more on probabilities and mathematical models. Risk management coordinates activities to steer and control an organization regarding its risks (DIN ISO 31000:2018). Mostly, risks are seen as a threat, but they can be an opportunity for even greater results as well. Therefore, in URP, it is important to find a balance by taking risks to be innovative vs. reducing risks to adhere to the management constraints (Ernø-Kjølhede 2000).

Risks can occur in different contexts, but they still have an impact on time and/or budget. To identify and analyze risks appropriately, different methods can be used. Foremost, qualitative and quantitative risks can be distinguished. Qualitatively, they are expressed in words and often from experiences. Qualitative methods can be expert interviews, the Delphi method, a risk matrix, or a SWOT analysis. Quantitative risk management expresses its probability and severity level in concrete, measurable numbers. Therefore, sensitivity analysis or the Monte Carlo simulation based on a stochastic scenario analysis can be mentioned.

To use the benefits from both approaches for risk identification and analysis, qualitative methods and quantitative methodologies are combined. For mostly known risks, qualitative methods give the most advantages (Romeike 2018). Expert interviews, supported by a Delphi method, can be used. The Delphi method is a recognized methodology for research (Häder 2014). For creative and unknown risks, the stochastic scenario analysis can be used. This method is preferable because a three-point estimation can predict the future more accurately than a single value (Sander 2012).

2.2 Sustainable Goal Setting in the Context of University Research Projects

The German Research Foundation (DFG 2025) is regarded as a renowned European research organisation for theory- and knowledge-oriented or discipline-based work, for example, in the field of engineering. Research projects carried out within the framework of approved applications must be particularly strong in the areas of knowledge gain, innovation and problem solving, promotion of young researchers, and sustainable development. In the field of sustainable development, research projects should contribute to the implementation of the Sustainable Development Goals.

The UN Agenda 2030 defines an internationally recognised framework for promoting economic, ecological, and social sustainability with 17 SDGs. Since its implementation in 2015, member states have been pursuing the goal of translating these global fields of action into national development strategies and sectoral policies. In doing so, particular importance is attached to taking structurally disadvantaged population groups and countries into account. The central guiding principle of 'leave no one behind' emphasises the need to make development processes inclusive to ensure that the goals are achieved in their entirety by 2030. (United Nations 2015).

In the context of URP, the following five selected SDGs from Table 1, sorted by relevance to university research, are of particular importance: (SDSN 2017).

Table 1. Selected Sustainable Development Goals (SDSN 2017): Relevance and Implications for Research

SDG	Relevance	Research Context
4 – Quality Education	Universities are key institutions for fostering lifelong learning, knowledge creation, and critical reflection.	Promotion of research-based teaching, academic qualification of early-career researchers, and the development of innovative educational formats.
9 – Industry, Innovation and Infrastructure	Academic research plays a central role in driving technological progress, innovation processes, and sustainable infrastructure development.	Research on sustainable technologies, digital transformation, smart infrastructure, and resource-efficient materials.
17 – Partnerships for the Goals	Research is increasingly collaborative and transdisciplinary; global and cross-sectoral partnerships are essential.	Engagement with industry, civil society, public institutions, and international research networks.
16 – Peace, Justice and Strong Institutions	Universities contribute to societal resilience by offering evidence-based policy advice, platforms for public discourse, and ethically grounded research.	Projects on governance, rule of law, civic participation, open science, and research ethics.
13 – Climate Action	Climate change is a core concern across many research disciplines, particularly in engineering, environmental, and natural sciences.	Development of low-emission technologies, climate modeling, adaptation strategies, and life cycle assessments.

3. Methodology

The methodology is based on guideline-based expert interviews. The participants were the responsible professors of the different departments from a university research project in Germany. In addition, a stochastic risk analysis was applied to systematically assess the identified risks and provide theoretical substantiation.

3.1 Method Expert Interviews

The method used is an expert interview. It enhances efficient data collection and improves data generation (Bogner et al. 2009 and Romeike 2018). Moreover, this methodology ensures the reduction of misunderstandings and thus makes the results more reliable. The current status quo was investigated (Schnell 2019). The explored questions were standardized to enhance the comparability of the answers. The interviews were conducted in person. This was chosen because of several advantages: (1) gaining deeper insights by an open-minded conversation, (2) enabling additional questions if relevant for the topic, and (3) the interview partners are often more focused on the study.

3.2 Project of Investigation

The investigated project is called “Munich Mobility Research Campus” (MORE), which is located at the University of the Bundeswehr Munich (MORE 2025). The project was funded with a budget of € 60 Mio over 6 years. The project aims to display a sustainable, holistic, and innovative approach to the mobility of the future. The URP was chosen because it develops its research objectives for society and the Bundeswehr. Additionally, it can be described as a large and complex URP because of the objects (number of parts, number of relations) and people (interests, capabilities, notions) (Flood 1990). The inherent complexity will be described further in the next paragraph.

The project is divided into four research fields: (1) Mobility and Traffic, (2) Energy and Propulsion, (3) Autonomy and Connectivity, and (4) Opportunity and Impacts. All four research parts are further divided into different departments, which are led by a professor. Every professor has one or more researchers (research associate, students...) working on various research topics. In total, more than 45 researchers are paid for by the project, and more than 90 researchers are involved in total. This leads to interdisciplinary work and strengthens the different perspectives

on research. The involvement of these project members and their partnerships led to more than 40 laboratories and several publications. Based on the developed objectives, dependencies, partners, interests, and relations, the URP can be counted as large and complex. The key facts of the project are summarized in Figure 1.



Figure 1. Key Facts Project MORE

3.3 Data Collection

The data was collected by the different professors of the departments of the MORE project. All professors are full professors employed at the University of the Bundeswehr Munich. The professors were chosen because they are responsible for the implementation of the goals and objectives stated in the application. This ensures an overview of the research goals, which are necessary for reliable results.

The information was collected between December 2024 and March 2025. The guide was developed and discussed together to clarify any potential uncertainties. If the SDGs were not known in detail, a description was given of them to avoid misunderstandings and misinterpretations. The data collected was written down in Excel. If the participants were unsure about which SDGs belonged, the most relevant category was chosen based on their examples and descriptions.

3.4 Findings

Firstly, the participants were asked which SDG they wanted to achieve in the project. A multiple selection was possible. In total, 14 professors answered the question. Figure 2 shows the results. The x-axis displays the different SDGs, and the y-axis shows the total amount mentioned by the participants.

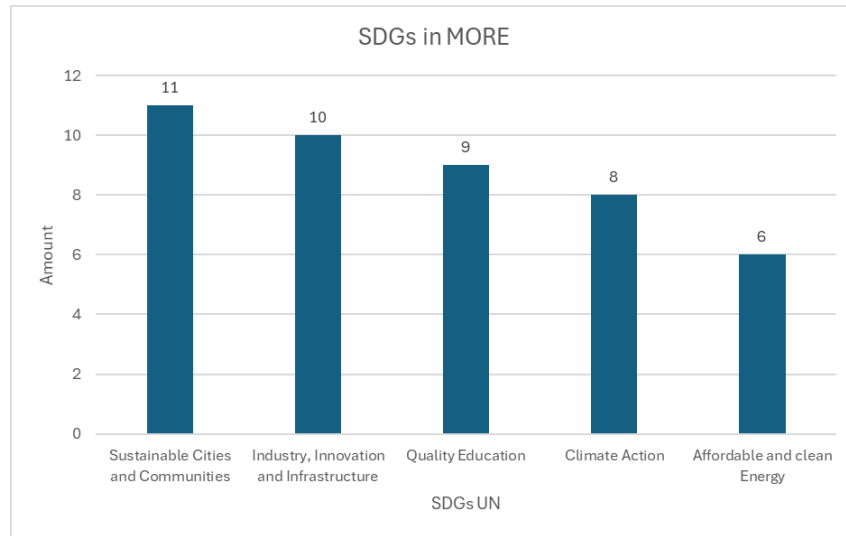


Figure 2. Top 5 mentioned SDGs

The goals 11 - Sustainable cities and communities, 9 – Industry, Innovation and Infrastructure, and 4- Quality Education were rated the highest. This is reasoned in the development of different technologies, which are developed for the mobility of the future. These can be VR technologies, innovative engine topologies, and CO2-neutral mobility strategies (cargo bikes, electric bikes). Goal 9 is important to achieve innovation, which is one of the core areas for URP. Moreover, universities want to transfer their gained knowledge to industry partners to enhance the innovation potential in practical applications. Striving for goal 4 improves the quality of education, which is important in the long term for industry growth and to raise awareness of challenges among the young generation.

The lowest rated were the 14 – Life below water, 5 – Gender Equality, 0 – Zero Hunger, and 1 – No Poverty. This is reasoned in the subject of research, which the project aims for.

In a second step, the participants were asked for a concrete example which sustainable risks to society and to the Bundeswehr that can be seen. Table 2 shows an excerpt of the top 5 risks for results for society and for the Bundeswehr.

Table 2. Excerpt of risk to SDGs

SDG	Society	Bundeswehr
Sustainable Cities and Communities	Traffic jams and uneven development	Vulnerable infrastructure in times of crisis
Industry, Innovation and Infrastructure	Less acceptance of novel technologies	Dependence on different technologies
Quality Education	No access to new developments	Not enough qualified personnel for cybersecurity
Climate Action	Sustainable solutions with alternative fuels and mobility concepts	Conflicts of Interest
Affordable and clean Energy	Lack of participation does not lead to change and acceptance	Availability of renewable energy in the field

As Table 2 displays, some major risks shall be considered in the research. According to society, it is important to enhance the acceptance and awareness of different technologies. This new knowledge can be taught to students and passed by in workshops. Moreover, ensuring economic growth and sustainability, an independent structure is crucial as a success factor. This reduces the vulnerability of infrastructure in times of crisis and ensures a distinctive quality

of life. Reducing climate change affects sustainable solutions and ensuring the belonging goals is important to the success of society.

3.5 Supplementing the Findings with Theoretical Background

In order to complement the qualitative findings from the expert interviews, a stochastic risk analysis is integrated into the methodological approach. This probabilistic perspective allows for a systematic assessment of uncertainties by estimating both the likelihood and impact of the identified risks. As a result, the analysis strengthens the robustness of the findings and provides a sound theoretical basis for connecting the empirical results with established sustainability frameworks.

Comparing the top five SDGs identified by the MORE research project with the five most relevant SDGs identified in research projects reveals an overlap in SDGs 9, 13, and 4. (SDSN 2017).

The goals of SDG 9 – Industry, Innovation and Infrastructure, SDG 11 – Climate Action, and SDG 4 – Quality Education are to be achieved.

SDG 9: Scientific research is to be strengthened, and the technological capabilities of industrial sectors worldwide, especially in developing countries, are to be expanded in a targeted manner. This includes promoting innovation, significantly increasing research and development personnel, and substantially increasing public and private investment in research and development.

In addition, the focus should be on domestic technological development, research and innovation, and on creating and promoting policy frameworks that enable and drive industrial diversification and higher value creation from raw materials.

SDG 13: Climate Action aims to consider (1) sustainable infrastructure and campus design, (2) energy, emissions, and climate protection, (3) resource management and waste prevention, (4) sustainable mobility and procurement, and (5) participation and governance in university research projects.

(1) Sustainable infrastructure and campus design include, among other things, the integration of environmentally friendly construction principles and the protection of local biodiversity and water bodies through targeted management plans. In the area of (2) energy, emissions, and climate protection, the university pursues net-zero emission targets and invests in renewable energy sources directly on campus. (3) Resource management and waste prevention focus on reducing hazardous waste and expanding water reuse. In addition, the university is committed to (4) sustainable mobility and procurement, for example, by promoting environmentally friendly modes of transport and integrating ethical criteria into procurement guidelines. Finally, the area of (5) participation and governance strengthen the active involvement of employees and students as well as transparent reporting on sustainability performance up to the management level.

SDG4: Goal 4 aims to ensure inclusive, equitable, and high-quality education and promote lifelong learning for all. In the context of higher education, this means, in particular, strengthening research and teaching, promoting critical thinking, interdisciplinary competence development, and the qualified training of young scientists. In the context of university research projects, SDG 4 stands for the combination of research-based teaching, the development of innovative educational formats, and the transfer of knowledge to society and practice. Universities should also contribute to equal opportunities in the education system.

The consistency between MORE and the theoretical framework clearly shows that key sustainability goals such as SDG 9, SDG 13, and SDG 4 are highly relevant both practically and conceptually. This confirms that the priorities set in the project are well aligned with internationally recognised sustainability priorities. At the same time, it is clear that the theoretical foundations provide useful guidance for implementation in research practice. The results thus underscore the coherent link between theory and application.

4. Development of a Strategy to identify and analyze Sustainable Development Goals

Building on the qualitative findings and the stochastic risk assessment presented in Chapter 3, this chapter advances the methodological approach by embedding the selected SDGs into the quantitative risk analysis based on the MORE research project in a digital risk twin. In accordance with DIN ISO 31000 (DIN ISO 31000:2018), the integration of SDGs into the risk management process allows for a systematic evaluation of both uncertainties and sustainability-related objectives. By linking risk identification and analysis with the SDGs, the approach not only addresses potential threats and opportunities but also explicitly incorporates societal and environmental dimensions into the assessment. This enhances the relevance of the analysis and strengthens the alignment of university research with internationally recognized sustainability priorities.

Risks are defined as the effects of uncertainties on objectives. The effect represents a deviation from the expected outcome, which can be negative, positive, or both (DIN ISO 31000:2018). If a risk is negative, it is also referred to as a hazard according to (Sander et al. 2021). A positive risk is considered an opportunity. Risk management involves an analysis of risks based on various factors. These include the cause of the risk, potential events, their effects, and the probability of their occurrence. This process is referred to as risk management. The coordination and control of risks is carried out in a process-supporting manner. (Wolf 2022) This paper focuses on the risk management process up to risk assessment, including risk identification (chapter 4.1) and risk analysis (chapter 4.2). The integration of the SDGs is classified in Figure 3 in the existing risk management process according to DIN ISO 31000 (DIN ISO 31000:2018).

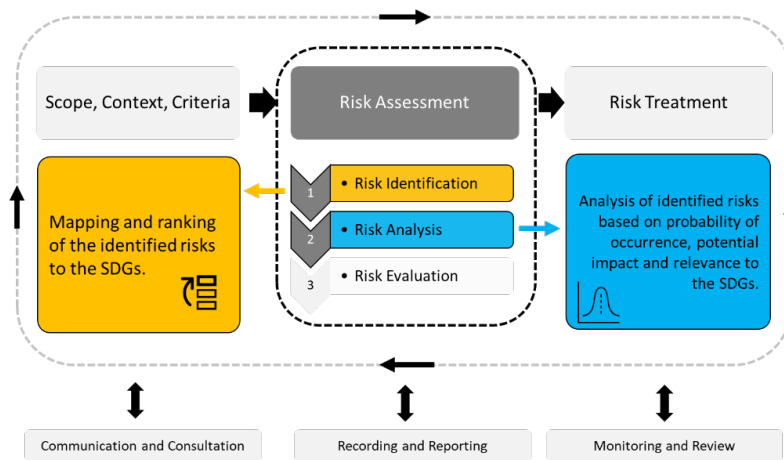


Figure 3. Risk Management Process in reference to (DIN ISO 31000:2018) with integration of the SDGs (United Nations 2015)

Based on Figure 3, a detailed process for URP is established. The developed process is divided into 5 steps. The next sections display the different steps.

4.1 Identify Risks

A qualitative approach in the form of guided expert interviews with project managers and specialists was used to identify risks. This approach makes it possible to systematically record both internal project risks and socially relevant risks addressed by the research. The identified risks were assigned to the SDGs under consideration. In particular, risks that could jeopardise the achievement of the SDGs were considered, for example, through conflicting goals, competition for resources, or ethical tensions (Figure 3).

The identified risks are then categorised and prioritised to enable targeted analysis and integration into the digital risk model

4.2 Analysing and quantifying Risks

Once the relevant risks have been identified, they are systematically analysed in terms of their probability of occurrence, potential impact, and influence on the achievement of the SDGs (Figure 4). A semi-quantitative assessment approach is used, which takes into account both subjective expert assessments and project-related

empirical values. The risks are assessed in terms of their relevance to time, costs, quality, and social impact and presented in a risk matrix. The focus is on risks that can create conflicts of interest between scientific freedom, management requirements, and sustainability goals. The analysis forms the basis for later integration into the digital risk twin and supports prioritised control of sustainability-related influencing factors during the course of the project.

4.3 Integration of sustainable Goals into a digital Risk Twin

In a third step, the identified risks, among others, are integrated into a Software Tool. Various risk categories are established. This enables a transparent depiction of the impact both individually and together. To focus on societal expectations, sustainable requirements, and military contexts, different risk categories are established.

Risk impacts are displayed in a Poisson distribution or a probability of occurrence. The impacts on time and/or budget are integrated with a three-point estimation (worst case, most likely, best case). Every identified risk can be seen in the risk register. Potential impacts of unknown risks can be included as well. The work breakdown structure (WBS) is structured after the research objective. The WBS included base costs, which will always occur, risks, and escalation from inflation costs. Every relevant risk can be connected to the WBS afterwards. The project plan with tasks and milestones is established. Dependence and uncertainties are incorporated. Per drag and drop, the risks can be connected to single tasks to show transparently the impact on the project duration. This also enables to integration of time-bound costs. The Software, based on a Monte Carlo simulation, compares the target date to the competition date and generates the results. Different dashboards allow an aggregated presentation of the total impact on time and budget, which makes the results more reliable.

During the project's progress, the milestones can be checked. This can be evaluated by the acceptance or rejection criteria for every work package. This enables a flexible adaptation of goals and enhances the taking of action. If critical risks impact time and/or schedule the most, measurements can be implemented through a dynamic risk register. The communication of risks in every step is very important to inform all relevant parties. The summary of the further developed procedure, based on Gross et al. 2025, can be seen in Figure 4.

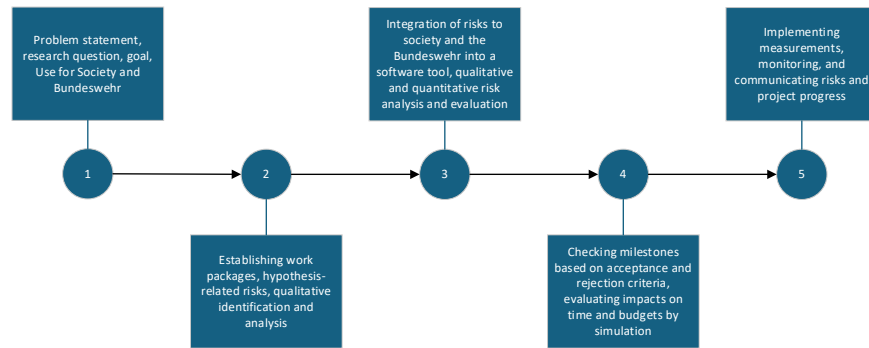


Figure 4. Procedure for the Risk Management Process in reference to Gross et al. 2025

5. Results and Discussion

5.1 Measurements for the Digital Risk Twin

By implementing the data into a digital risk twin, the simulation allows for to display of various scenarios. This enhances the accuracy of the forecast and improves data connection. Moreover, different risk categories show the impact on single and aggregated risks on the project plan. By implementing research questions, acceptance and rejection criteria for the work packages, the goal achievement based on the content can be easily measured during the project.

In the long term, through the digital risk twin approach, the risk management strategy can be constantly improved. This allows the adaptation of processes and identifies weak spots early. Heat maps, distributions, and bandwidth planning allow informed decisions.

5.2 Applicability in the Context of University Research Projects

The methodology developed as part of the MORE research project demonstrates how sustainability goals can be strategically integrated into university research projects. By combining expert interviews, systematic risk analysis and structured mapping to the SDGs, a sound assessment model was created that is based on DIN ISO 31000 (DIN ISO 31000:2018). The methodology made it possible to make both project-specific and socially relevant risks transparent and to present them in order of priority (Figure 4).

The evaluation shows that SDG 9, SDG 13, and SDG 4 are considered particularly relevant both in the MORE project and in the international university context. This consistency in content strengthens the significance of the strategy developed. (SDSN 2017).

This structured analysis clearly demonstrates the applicability of the methodology developed: risks are not considered in isolation, but are classified, evaluated, and visualised in terms of their impact on sustainability goals. The approach thus contributes to the operational implementation of Agenda 2030 in large-scale university projects with relevance for projects with a social or security focus, such as in the context of the Bundeswehr.

5.3 Proposed Improvements

The methodological approaches developed as part of the MORE research project for integrating sustainability goals into the risk management of university research projects have shown that systematically linking risks and SDGs is relevant in practice and highly compatible. The following areas for improvement can be identified for future research projects:

- Linking risk management and SDG allocation
- Digital twin for sustainability assessment (step three in Figure 4)
- Early integration of SDGs
- Development of an SDG risk catalogue

The linking of risk management and SDG allocation should be established as a structured component of project management in university research contexts. The allocation of identified risks to relevant SDGs promotes a holistic assessment and opens new perspectives for the social impact of research.

This basis then provides a further starting point for the digital twin for sustainability assessment. Visualisation and simulation options map the dynamic interaction between risks and sustainability goals, thus providing a sound basis for decision-making for project managers.

Research projects can benefit most if the focus on SDGs is considered at an early stage of the project, for example in the project conception or application phase.

The development of an SDG-specific risk catalogue based on the identified risks can also be helpful for future projects. This catalogue should contain typical risks for each SDG, thus facilitating systematic assessment and weighting, especially in security- or technology-oriented research contexts.

5.4 Validation

The strategic approach developed for integrating SDGs into the risk management of university research projects was validated in the MORE project. The methodological approach was applied in interviews with a total of 15 professors from different research areas of the project and tested for its practical suitability.

Feedback from the experts shows that the link between risk identification and SDG allocation was considered both comprehensible and meaningful in terms of content. In particular, the visualisation of risks in the context of relevant sustainability goals was described as helpful for strategic project management. The qualitative validation was

supported by a structured survey in which the assessment of the relevance of SDGs was linked to the assessment of project risks.

Initial evidence of the applicability of the approach is provided by the high degree of congruence between the SDGs prioritised in the project (especially SDG 9, SDG 13, and SDG 4) with the theoretically identified sustainability goals in the international higher education context. This congruence in content serves as an indication of the validity of the developed model and underlines its compatibility with existing frameworks (SDSN 2017).

Quantitative validation in the sense of statistical hypothesis testing has not yet been possible within the scope of this research design, but is recommended for further investigation – for example, by applying the model with accompanying evaluation of the risk and SDG impact over the course of the project.

5.5 Limitations

Despite the positive outcomes and the methodological approaches developed, this study is subject to several limitations that must be considered when interpreting its findings.

This study is based on an individual analysis of the large-scale university project MORE as an exemplary case study. Although this is a complex and interdisciplinary research project, the transferability of the results to other university contexts is limited. Case studies are suitable for gaining in-depth insights in research, but their generalisability is limited (Bogner et al. 2009 and Schnell 2019). Further applications in other research institutions would be necessary to confirm the generalisability of the developed approach.

In addition, the data was collected through qualitative expert interviews. Although this method provides deep insights, it is associated with subjective assessments and limited comparability. A quantitative supplement, e.g., through standardised evaluation grids or surveys with a larger number of cases, would be useful for validating and objectifying the results. (Schnell 2019)

The consideration of SDGs in the context of university research projects represents a new approach. There is currently a lack of standardised procedures on which the developed methodology could be based.

Despite these limitations, the work makes a well-founded contribution to the conceptual and methodological discussion of the integration of sustainability goals into university research structures.

6. Conclusion

6.1 Summary of Findings – stochastic, quantifizierung – contribution – was bietet die quantitative Analyse für einen Mehrwert

This study shows that integrating sustainability goals (SDGs) into the risk management process of university research projects can make a significant contribution to strategic project management. Using the example of the large-scale MORE project, it was demonstrated how a structured methodology consisting of risk identification, analysis and linking to relevant SDGs enables a systematic assessment of the social impact of university research.

The qualitative analysis based on expert interviews revealed that SDG 9 (industry, innovation and infrastructure), SDG 13 (climate action), and SDG 4 (quality education) were considered particularly relevant in the project under investigation. These assessments are consistent with the theoretically prioritised SDGs in the international higher education context and thus strengthen the content validity of the developed model. (SDSN 2017).

In addition, the study advances the methodological approach by introducing a stochastic and semi-quantitative risk assessment. This procedure allows a probabilistic approach, which enhances the relevance to the specific SDGs. By moving beyond qualitative insights, the quantitative analysis provides added value through increased robustness, comparability, and reproducibility of results. It thereby contributes not only to a more precise evaluation of sustainability-related risks but also to the foundation of a Digital Risk Twin, which can be further developed and validated in subsequent research phases.

6.2 Recommendations for the Project Manager

To avoid conflicts of interest, the project team members shall be integrated into the overall goal-setting. This ensures goal alignment and improves motivation in the team. This means not just incorporating them into the work packages but also into the risk management strategy. Implementing a digital risk twin approach allows informed decision-making, continuous improvements, adaptive procedures, and early feedback.

This ensures that in the short term, the sustainable goals are achieved within the budget and within time constraints. In the long term, it enhances the satisfaction and motivation of the project members and allows knowledge transfer. This transfer can enhance the capability to use the results for society and the Bundeswehr's development.

6.3 Future Work

In the future, the project MORE will perform tests on the developed procedure. The impacts and the accuracy will be measured. Based on this, a risk catalog for the most critical sustainable risks will be established. This shall enhance adherence to the SDGs, which is important to shape the future worldwide. The catalog will be developed according to defined criteria such as relevance to project goals, potential impact, and likelihood of occurrence. It aims to support future research projects in systematically identifying and evaluating SDG-related risks across different academic disciplines. These steps are mapped in Figure 4 from steps three to five.

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Univ.-Prof. Dipl.-Ing. Dr. techn. Philip Sander is a recognized expert in risk management and Integrated Project Delivery. He has over 15 years consulting experience for infrastructure projects in Europe and North and South America. Philip studied civil engineering at the Technical University of Dresden (MSc) and gained his PhD at the University of Innsbruck (Probabilistic Risk Analysis for Construction Projects). He started his professional career at Grinaker LTA in South Africa. After gaining experience in Essen and Stuttgart, Germany, he moved to Tyrol in 2006 to join the team of SSP BauConsult and RiskConsult. He is Managing Director of RiskConsult since 2009. Since 2019, he is head of the Institute for Construction Management at the University of the Bundeswehr Munich. From 2022 to 2024, he served as the President of the International Construction Project Management Association (ICPMA).

Prof. Dr.-Ing. Christian Trapp is a professor and head of the department of vehicle powertrains at the University of the Bundeswehr Munich. From 2023 he is the leader of the research center MORE – Mobility and Renewable Energies. He served as a technical leader of the combustion Systems Team for Gasoline Engines at Robert Bosch GmbH and later became the chief engineer for gasoline engines at Ricardo Deutschland GmbH. He also held the position of Global Head of Performance, Emissions, and Engine Controls at GE Jenbacher & Waukesha Gas Engines. Mr. Trapp completed his doctorate at the Research Institute for Automotive Engineering and Vehicle Engines in Stuttgart.