(08-009) - Risk-based Project Management in University Research Projects: A Guide to Implementing a Control System for Goal Achievement

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The focus of university research projects is usually stated in the objectives of the application. In most cases, however, there is no evaluation of intermediate goals in university research. This, in turn, means that objectives are not continuously reviewed. Due to the high degree of innovation in research, the approach can change quickly.

This paper shows how risk-based project management for research projects can be used to adjust procedures and work packages, including objectives, to maximize research output. The objectives should be met under the premise of budget and time, taking risks into account. First, existing models are reviewed through a literature review. Second, the characteristics of university research projects are analyzed. Third, the results are validated using a project plan with probabilistic methods, which is based on a Monte Carlo simulation. A guideline is generated as a result, providing a method for establishing intermediate goals in university research projects. This enhances the predictability of outcomes and ensures that projects remain on schedule and within budget.

Keywords: university research project; goals; project plan

Gestión de Proyectos basada en Riesgos en Proyectos de Investigación Universitaria: Guía para Implementar un Sistema de Control de Objetivos

Los proyectos de investigación universitaria a menudo se enfocan en los objetivos iniciales, pero carecen de una evaluación sistemática de los objetivos intermedios. Esta falta conduce a una revisión insuficiente de los objetivos.

Este documento expone la aplicación de la gestión de proyectos basada en riesgos para proyectos de investigación, destacando su utilidad en la adaptación de procedimientos y paquetes de trabajo, incluyendo objetivos, para optimizar la productividad en la investigación académica. Los objetivos planteados deben ser alcanzados considerando tanto las restricciones presupuestarias como temporales, tomando en cuenta los riesgos inherentes. En primer lugar, se realiza una revisión exhaustiva de los modelos existentes a través de un análisis bibliográfico. Posteriormente, se procede a examinar las características específicas de los proyectos de investigación universitaria. Finalmente, los resultados obtenidos se validan mediante la implementación de un plan de proyecto que emplea métodos probabilísticos, basados en una simulación de Monte Carlo. Como resultado de este proceso, se desarrolla una guía que ofrece una metodología para establecer objetivos intermedios en proyectos de investigación universitaria, mejorando la predictibilidad de los resultados y garantizando que los proyectos se desarrollen conforme a los plazos y presupuestos establecidos.

Palabras clave: proyecto de investigación universitaria; objetivo; plan de proyecto

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1. Introduction

A project is a “temporary endeavor undertaken to create a unique product, service, or result” (PMI, 2021, p. 4). This also applies to university research projects, which are characterized by many unknown factors as well as a high degree of innovation.

According to the Federal Ministry of Education and Research, federal spending on science, research, and development amounted to around €16.16 billion in 2021 (BMBF, 2022). Most of the university research projects have to be financed by third-party funds or, for example, by cooperations. Government agencies, companies, international organizations, universities, research institutions, private individuals, research funds, and organizations can be funding parties. The funding bodies can have specific requirements for creating the research objectives for the research project, as these requirements are not uniformly standardized. The European Union, in its function as a funding party, regularly updates its research framework program "Horizon Europe" and publishes an "HE Programme Guide" in which research projects are defined as a portfolio of measures that should be explicitly clearly formulated, targeted, measurable and time-bound (European Commission, 2023, p. 11).

Evaluating the effectiveness and progress of research activities is necessary to ensure the efficiency of the resources used. Uniform requirements within the context of goal formulation for individual projects generally promote comparability, as well as transparency and clarity among all stakeholders.

Therefore, this paper explores how risk-based project management can be used to adapt approaches, definitions for work packages, and objectives to maximize research output. Existing models for goal setting are investigated. These are then compared with the specific characteristics of research projects, and a novel approach is developed. By using a project plan with a probabilistic methodology, the achievement of interim goals is examined.

The results are presented using a guideline for the creation of verifiable interim goals and objectives in university research projects, to make them even more successful. Additionally, this approach intends to support the goal achievement and reliability of forecasts.

2. Goals

2.1 Definition of project goals and objectives

At the beginning of the project, the goals and objectives must be defined. There are existing many definitions of it. As a reference, the definition following the IPMAs approach will be used:

> Every project is started because of the needs and goals of the organisation. From these organisational goals the project goals are derived: high-level statements that provide the rationale and overall context for what the project is trying to achieve. In their turn, from these project goals, the project objectives are derived: lower level statements that describe the specific, tangible products and deliverables that the project will deliver. This goal hierarchy is influenced and determined both by contextual factors and by elements such as specific stakeholder needs and requirements. The project mission statement explains the strategic reasons for starting this project. Secondly the project objectives are defined, which are to realise the project outcomes within the constraints of acceptable risk, agreed timeframes and budget. (IPMA, 2017, p. 107)

As can be seen here, the project goal is the outcome that is intended to be achieved during the project. The objectives are smaller and more specific tasks, including intermediate results, which are achieved in shorter periods, considering risks, budget, and time constraints. Since

project goals and objectives are defined at the beginning of the project, they are an important measure of project success or failure.

2.2 Goal relations

There are existing different types of target relationships In some literature, objective relationship is defined as harmony, conflict, ambivalence, and redefinition of the principle of rationality (Gorres et al., 1991). In other investigated literature, objective relationships are highlighted as goal exclusion, goal neutrality, goal competition, and goal complementarity (Zell, 2024). The magic triangle of project management shall also be included to determine the project objectives in more detail, as these objectives typically compete with each other. To establish a balance between effort, cost, and time, goals should be weighed up.

2.3 Goal setting

The goal-setting theory was originally developed within the context of industrial and organizational psychology (Latham & Locke, 1991). It is proven that success has been achieved in various areas through effective goal formulation (Stetler & Magnusson, 2015). Goal-setting is intended to reduce uncertainties and adhere to constraints related to time and budget (Hoegl & Parboteeah, 2024).

Well-formulated goals must fulfill three basic functions that results-oriented organizations must have (Mullins, 1999): First, the goals must provide a conceptual framework to achieve the desired outcomes (Mullins, 1999). Secondly, the goal must be measurable to ensure an objective assessment of quality and progress (Bipp & Kleingeld, 2011; Mullins, 1999). This supports controlling and goal attainment. Thirdly, goals provide a certain relevance and assessability for project execution as well as the efficiency and accountability of resource use (Bipp & Kleingeld, 2011; Greenbank, 2001). In innovative projects, such as university research, which are characterized by uncertainties, it becomes even more important to strategically integrate goals to maintain focus (Rekonen & Björklund, 2016).

3. Methodology

A systematic literature review on the topic “goal-setting/goal formulation” was conducted. Firstly, general methods were investigated and analyzed in which context they were used. Secondly, the search was limited by university research projects to narrow down the number of hit ratios. Aiming to identify existing models and assess them to the applicability of university research. Scopus, Google, Scholar, and SpringerLink as research platforms were investigated. Relevant literature was identified based on the abstracts. By evaluation of the publications, relevant topics from the literature were identified and incorporated.

4. Findings

4.1 General Alignment of Goal-setting

First, the most common goal-setting methods were investigated. Most of the found methods were used in health care and behavioral analysis. Predominantly the SMART (specific, measurable, achievable, relevant, time-bound) method with different meanings, was found (Haag & Luppold, 2020; Ogbeiwi, 2018). Additionally, there were modifications of the method by KRAFT (Specific, Realistic, Attractive, Skills, Time-bound), START method (Specificity, Timing, Acquisition, Rewards and feedback, and Tools) (Pearson, 2012), and the SMARTER method (Shared, Monitored, Accessible, Relevant, Transparent, Evolving and Relationship-centred), (Hersh et al., 2012). More modifications in the context of healthcare were found by Ogbeiwi‘s SMART-C (challenging and collaborative), SMART-S (stretch, sustainable,

significant), and der SMA-A-RT method (actionable) (Ogbeiwi, 2018). Other found literature did not mention specified methods, but guidelines through goal formulations shall be fully, precise, understandable, realistic, and solution-neutral (Flitter et al., 2016, p. 10). All identified methods have in common to enhance the work performance or method focus.

4.2 Goal-setting for innovative projects

Literature focusing on goal-setting in university research projects could not be found. Since university research projects are also classified as research and development (R&D) projects, which aim to create innovations, the literature review was expanded by R&D or innovation projects. Mixed opinions were found. Locke describes innovative projects, that want to create innovation and creativity, specifically formulated goals can hinder achieving the desired outcome, which may limit creativity. This opinion supported by Prather stated that the exemplary method SMART restricts breaking-through processes and requires a different type of definition. This was justified by the argument that freedom, creativity, and risk-taking are constrained (Prather, 2005). However, Brun also found that innovation can be enhanced by a challenging approach to goal-setting (Brun & Sætre, 2009). On the other hand, Locke describes clear, specific, and challenging goal settings to achieve a higher goal performance than no goals or "do-your-best" goals (Locke et al., 1981). This supports the theory that innovative goals must be challenging and well-formulated to enhance innovations.

4.3 Interpretation of the Results for University Research Projects

During the literature review, it becomes apparent that a wide variety of goal-setting theories exist and can be used. However, all aim to increase the team performance and define the requirements. The SMART method gained the most popularity, which is defined differently in various publications. As described in section 2.3 goal-setting has a significant impact on the actual achievement of the results. However, it must be added here that not every goal can be quantified, as qualitative goals are just as important as long-term and short-term achievable goals. Additionally, goals must not only be formulated correctly but also must be understood, as demonstrated by the study of the SMART method in the USA (Bjerke & Renger, 2017). Therefore, based on the settings of university research projects, the most popular used method SMART, will be developed further to be applicable in research. The developed method will be discussed and shown in this section.

Research projects must be granted a certain degree of flexibility in goal formulation, as Art. 5 of the German Constitution states: "Art and science, research and teaching, are free." This, in turn, presupposes that a certain flexibility is necessary to create artistic freedom. The focus here is on the research personnel, as the processing of specific questions mainly arises from the scientific questions/research questions for knowledge. For this reason, research objectives must be formulated *specifically* to ensure control by incremental goal achievement. This means in this context goals should be clear and precise and should answer the 5W questions. Flexibility should be improved through short feedback loops.

The goals should be *measurable*. Each participant should define the results of the interim goals of the work packages they are working on. For example, the hypothesis and the associated goals can be supportive of academics.

Still, goals must be *achievable*, otherwise the overall and overarching goals cannot be achieved. This means they should be realistic in terms of material and immaterial requirements. These resources can relate to laboratories, equipment, funding, or know-how.

Furthermore, the implemented goals shall be *relevant* to the overarching goals of the project. The research objective should be in line with the overarching goals, but also whether the research is relevant and contributes to the development of the knowledge in the respective field.

In this context, the important target groups for the respective goals should be defined and considered.

A clear *time-bound* must be set in which certain milestones or results can be achieved. Otherwise, a review of intermediate targets and their results, for example through work packages or the project plan, is not possible.

University research projects aim to be innovative through their research drive. This in turn supports the theory that goals must be formulated in a *challenging* way to motivate the team members in their research field for the best possible result and thus maximize the research output. At the same time, the scientific claim should be guaranteed but also challenge the participants to do their best. The results can also be published results in high-ranking journals. In addition, challenging goals promote the degree of innovation and the impact of research on society.

Risk awareness can be seen as a key element in research. Since innovations and their research questions are so diverse and varied, it is all the more important to integrate risk management into research. Therefore, integrating risk awareness into the goal-setting, also alternative strategies can be considered. This promotes alternative outputs and strategies, which can support the achieving of the maximum research outcome.

To integrate risk awareness into the goal formulation, risks shall be identified and risk analyses should be carried out at the beginning of the goal-setting. Potential risks that could endanger the success of the research projects should be identified. This refers to assessable risks, which are not desirable. Arising opportunities from the consideration of risk management should not be completely ruled out. In the case of the determination that a specific research process cannot be fulfilled during the implementation phase, the question arises as to whether it is necessary to change the formulation of the goals. Perhaps no change in this goal formulation would be necessary if the failure of this research process had already been considered in the goal formulation process. If the success of a project directly depends on the formulated target state, which has been defined in the formulation of the goals without taking risks into account, and no room for adjustments is allowed, there is an immediate risk of failure of the research project. This connection is fundamental because the knowledge from research, which will be acquired in the future during project implementation, can currently only be guessed at. This approach could look like this, for example:

1. Risk Identification • What risks exist in the existing research context?
2. Prioritization of identified risks through risk assessment • Which risks endanger project success particularly?
3. Implementation of identified and prioritized risks in goal formulation
4. Determination of risk management strategies • How can potential threats be reduced through risks?
5. Implementation of risk management strategies in goal formulation
6. Integration of measurement variables, amounts, and tolerances into goal formulation

In addition, research is characterized by complex problems, which often require cooperation and interaction between different departments and disciplines. Therefore, collaboration in cross-functional teams is important to address uncertainties. This means that goal formulations should, if possible, not exclude each other to achieve a goal alignment.

Based on this analysis, the modified SMART method results in the SMART-CR (specific, measurable, achievable, relevant, time-bound, challenging, risk-aware) method. In the following, a guide is provided on how to conduct improved goal control.

5. Guideline for Goal-Achievement

First, the general goal concepts are established through a vision or values and standards that are pursued. Goals can be identified, for example, through brainstorming, target group analysis, SWOT analysis, or literature review (step 1).

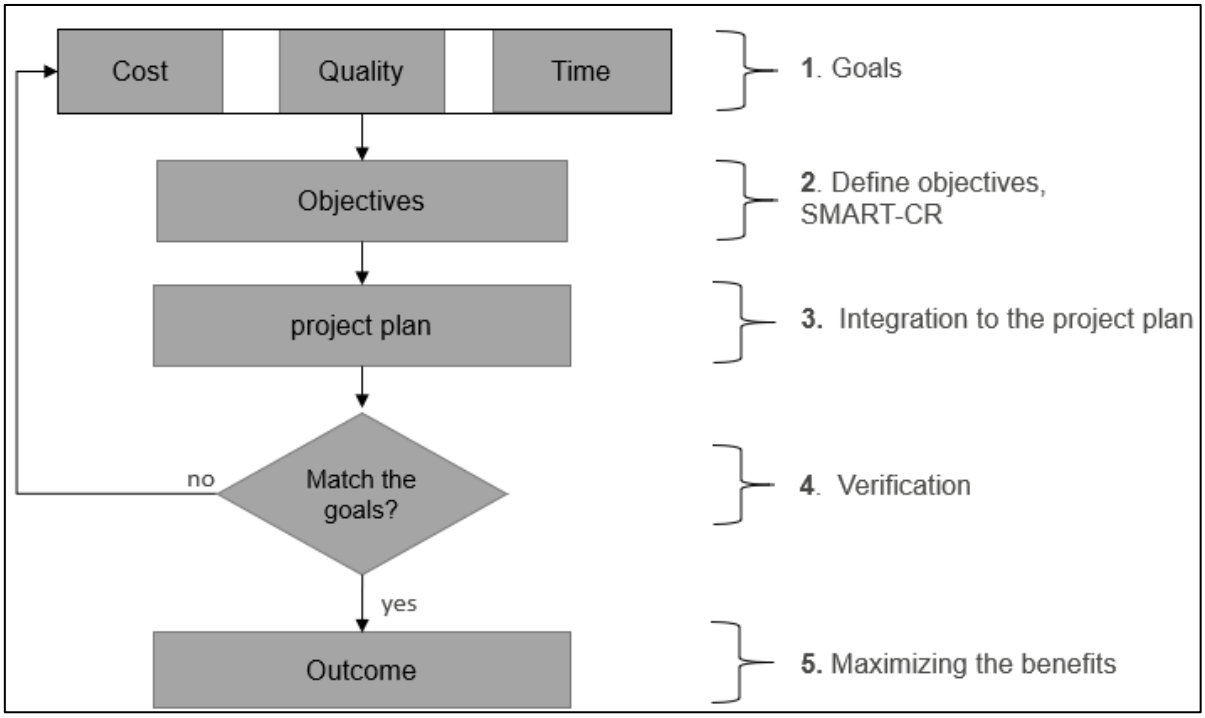
Second, the concrete project goals/objectives are set. This can include other factors such as social and sustainable goal setting. These are the core objectives that are to be achieved during the project. The core goals are broken down into interim goals in the form of work packages. This refers to the scientific goals of the academic personnel, which are mostly related to a doctoral thesis or other research work. Subsequently, the goals get linked to each other by reviewing them to avoid conflicts and goal exclusion. The objectives are then formulated in SMART-CR. Afterwards, the requirements are established (step 2).

Next, the project plan is drawn up. The tasks are formulated and linked together. The interim goals are now integrated into the project plan in the form of milestones. These milestones and the interim goals to be achieved should be reviewed at least monthly to be able to respond quickly to changes in an agile and anticipatory manner. This enables target control (step 3).

In the next step, the goals are verified. This means the work packages and the interim goals/objectives are checked, and the progress is monitored. This results in a feedback loop. It can now be determined, whether the overall goals (cost, quality, time) are at risk and may require readjustment (step 4).

If the objectives align with the requirements and goals, the results can be evaluated. For this purpose, the outcome can be measured in terms of the overarching goals to maximize the benefits (step 5). The discussed procedure is shown in Figure 1.

Figure 1: Guideline for Goal Achievement



6. Verification of goal attainment

The verification will be demonstrated on an example project, “Development of an innovative hydrogen engine”. The software solution RIAAT is used because this program was developed for highly uncertain processes, which is primely used in large infrastructure projects. The program shows a digital model of a project that represents uncertainties and dependencies. It combines cost management, scheduling, and risk analysis in a fully transparent project (RiskConsultGmbH, 2024). The program "RIAAT" is based on stochastic scenario analysis and is therefore used because it has proven to be highly suitable for different types of risks (Romeike, 2018). Additionally, bandwidth planning makes uncertain processes more predictable (Gleißner & Klein, 2017).

The used approach aims to illustrate the future as exactly as possible. Still, every forecast has inherent uncertainties (P. Sander et al., 2010). Through the probabilistic method at every project phase cost, time delays, and risks can be estimated with the actual state of knowledge (Becker et al., 2024, pp. 22–27). This displays reality much better than a single deterministic value (P. Sander et al., 2010). The individual distribution functions will be summarized using simulation methods. One example is the Monte Carlo simulation, which is based on several thousand random combinations to provide bandwidth planning of relevant risk impacts. Sander states that ”Inputting the risks requires a value for the likelihood of occurrence and, in a three-point estimate, three values for the minimum, most likely, and maximum impact” (Philip Sander, 2012, p. 88). The more iteration steps are carried out, the more accurate the evaluation becomes.

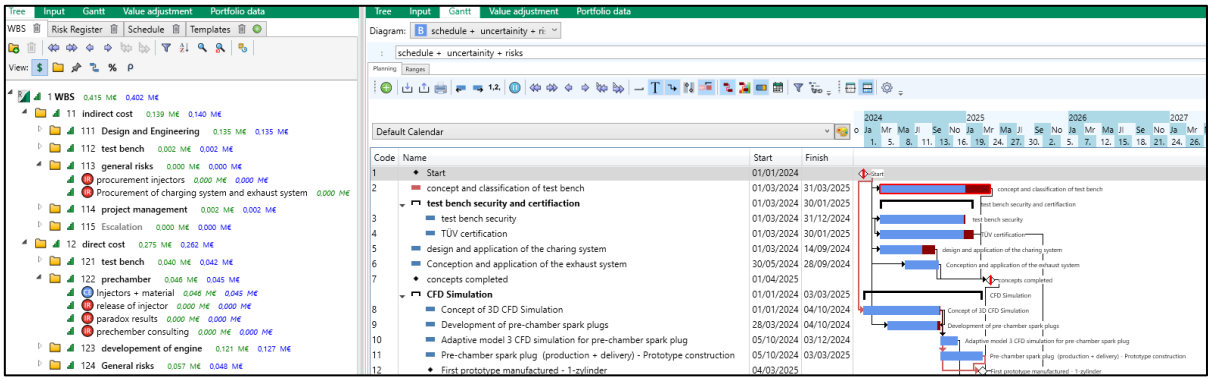
In the first step, the basic structure of the project is established. The goals form the foundation for the work breakdown structure (WBS). In our example, the project structure plan is object- and phase-oriented according to the scientific research questions. The lowest elements are the work packages of the involved individuals. Each of these work packages is connected to an intermediate goal. General risks are also presented under a separate heading. These include general risks, as well as unknown risk potential, and time-related delay costs, which may result in additional costs for personnel due to project extensions. Additionally, the budget plan for the respective development items is integrated as input for the program.

In the next step, risks are identified and compiled into a risk register. It is important to consider uncertainty and distribution functions. The impact in days and/or costs is provided with the associated probability of occurrence. Currently, relevant risks are linked to the WBS. Risks that relate directly to work packages and their interim goals are provided with superordinate points and associations to the project plan. These goals are described in detail in a separate Excel file.

The project plan is then provided with processes and their associated uncertainty, which cannot be estimated in the probability of occurrence. Milestones are created hierarchically for the respective interim goal achievement. The target date is integrated. The time-related risks can now be linked to the project plan. This allows an aggregated presentation of individual risks, which makes it possible to simulate dependencies and potentially threatening developments to be identified early (Gleißner, 2016).

The impact of risks on the project duration is displayed in red, added to the normal tasks, which are shown in blue. It is also possible to illustrate the critical path (outlined in red in Figure 2). An excerpt from the program is shown in Figure 2.

Figure 2: WBS and project plan



Considering an interim goal marked with a milestone, it is possible to anticipate changes, as scenario comparisons can be performed within seconds using a Monte Carlo simulation. Thus, progress monitoring is easily achievable, indicating whether an adjustment of goal formulation for the future is necessary. Through the SMART-CR method, part of the risk analysis is intended to be integrated into the goal formulation. An example of applying this method would be integrating risks and challenging goals into the SMART goal formulation for the mentioned research project. A possible goal, formulated by SMART for this project, could be:

The hydrogen engine with innovative pre-chamber spark plugs should be tested from the 1st October of 2025 to the 1st of January 2026. The goal is to use the generated hydrogen from renewable resources located on the Campus of the university to power the hydrogen engine on the test bench. Achieving a minimum efficiency rating of 40 % for the hydrogen engine.

In the second step, the goal should be taking risks and challenging settings into account. A possible risk could be fluctuation in the availability of renewable energy due to unpredictable weather conditions. Furthermore, the minimum efficiency is rated at 43 %, which is ambitious, but not unrealistic for hydrogen engines. The adjusted goal formulation could read as follows:

The hydrogen engine with innovative pre-chamber spark plugs should be tested from the 1st October of 2025 to the 1st of January 2026. The goal is to use the generated hydrogen from renewable resources located on the Campus of the university to power the hydrogen engine on the test bench, considering unpredictable weather conditions. Achieving a minimum efficiency rating of 43 % for the hydrogen engine.

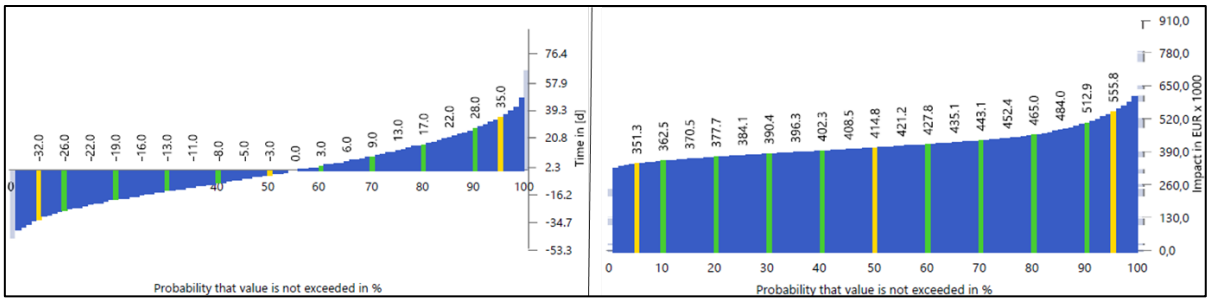
Not only can the risk itself be integrated into the goal formulation, but also the risk mitigation strategy. Such a goal formulation could be:

Implementation of an intelligent energy management system based on real-time data, anticipating fluctuations in the availability of renewable energy. Development of backup measures to compensate for temporary energy shortages and ensure the stability of energy supply.

Flexibility in goal formulation can be increased by setting metrics. An example could be the achievement of an energy supply rate of at least 90 % from renewable sources, with the possibility of further increase considering weather conditions and advancements in energy technology.
The program can generate different outputs, which allows the illustration of impacts on time and budget due to goal-setting (milestones). Also, necessary changes in goal formulation can be made apparent. Histograms can display the results. The evaluation of time delays is based

on defined milestones, which are compared to the actual completion date with probabilistic methods. The costs are evaluated based on the actual costs. Cost- and times are both considering risks and uncertainties. The confidence interval is stated from 5-95% to avoid giving too much weight to extreme values. In Figure 3 on the left side, the evaluation of an interim milestone illustrates the effects on time. The right side shows the impacts of uncertainties and risks on the total project costs.

Figure 3: Impacts on time (left) and on budget (right)



The evaluated milestone (first prototype manufactured 1-zylinder) on the left side compared the target date (15.03.2025) to the probability of actual completion date. The evaluation revealed that, at the current stage of development, the milestone and the related goal can be achieved within the specified timeframe with a probability of 55 %. On the right side, the probability of not exceeding a certain budget can be observed. Therefore, the actual costs and the planned budget can be calculated and compared. These impacts can be made visible in the probable total project costs or at each stage of the project, which increases the transparency of the project.

By including these risks and uncertainties, forecasts for goal achievement can be made. Through implementing the SMART-CR method, risks can be considered in an early stage, and alternative strategies can mitigate risks and eventually contribute to the goal's robustness. Furthermore, at every milestone, the evaluation can be conducted, which makes the achievement transparent and foreseeing.

7. Conclusion

This publication demonstrates how a risk-based approach to goal formulation, based on a systematic literature review, can contribute to increasing the resilience of research projects. The analysis of goal formulation in different contexts revealed that conventional methods such as SMART need to be modified to meet the specific challenges of university research projects. Incorporating project-specific risks, and challenges in the goal formulation process, as depicted, offers a preventive approach to dealing with uncertainties and contributes to making the failure of research projects less likely through the adapted SMART-CR method.

The application of the developed guideline for goal achievement supports research teams in systematically defining and monitoring their objectives and goals. Through regular review and adjustment of goals, projects can flexibly respond to changes and maximize their chances of success.

The example of the presented approach using RIAAT software demonstrates that comprehensive project planning considering risks and uncertainties is possible. Simulating various scenarios allows for a realistic assessment of project performance and helps proactively manage potential risks. This in turn helps to maximize the benefits and make research projects even more successful.

8. References

Becker, S. C., Friedinger, C. P., & Sander, P [Philip]. (2024). *Risk Management and Contract Models in Tunnel Construction – Part 1: Basics of Risk Management*. https://www.tunnel-online.info/de/ausgaben/2024-01-4075811.html

Bipp, T., & Kleingeld, A. (2011). Goal-setting in practice. *Personnel Review*, *40*(3), 306–323. https://doi.org/10.1108/00483481111118630

Bjerke, M. B., & Renger, R. (2017). Being smart about writing SMART objectives. *Evaluation and Program Planning*, *61*, 125–127. https://doi.org/10.1016/j.evalprog-plan.2016.12.009

BMBF. (2022). *Höhe der Ausgaben des Bundes für Wissenschaft, Forschung und Entwicklung nach Ressorts von 2018 bis 2021 (in Millionen Euro)*. https://de.statista.com/statistik/daten/studie/157107/umfrage/ausgaben-des-bundes-fuer-wissenschaft-forschung-und-entwicklung-nach-ressorts/

Brun, E., & Sætre, A. S. (2009). Managing Ambiguity in New Product Development Projects. *Creativity and Innovation Management*, *18*(1), 24–34. https://doi.org/10.1111/j.1467-8691.2009.00509.x

European Commission. (2023). *HE Programme Guide*. programme-guide_horizon_en.pdf (europa.eu)

Flitter, H., Niederhuber, M., & Bart, P. (2016). *Systematisches Vorgehen beim problemlösen - Methoden und Techniken.* GITTA. http://www.gitta.info/SystProbSolv/de/text/SystProbSolv.pdf

Gleißner, W. (2016). *Bandbreitenplanung, Planungssicherheit und Monte-Carlo-Simulation mehrerer Planjahre*.

Gleißner, W., & Klein, A. (Eds.). (2017). *Risikomanagement und Controlling: Chancen und Risiken erfassen, bewerten und in die Entscheidungsfindung integrieren* (2. Auflage). Haufe Gruppe. https://www.haufe.de/

Gorres, A., Hogrebe, P., Krüger, M., Nett, F., & Schumann, U. (1991). *Das magische Dreieck: Harmonie- und Konfliktpotential sozialökologischer Technikentwicklung am Beispiel der Mikroelektronik*. *Sozialverträgliche Technikgestaltung Materialien und Berichte: Vol. 22*. Westdt. Verl.

Greenbank, P. (2001). Objective setting in the micro-business. *International Journal of Entrepreneurial Behavior & Research*, *7*(3), 108–127. https://doi.org/10.1108/EUM0000000005531

Haag, P., & Luppold, S. (2020). *Zielgruppenorientierte Veranstaltungskonzeption: Messen, Kongresse und Events auf Zielgruppen ausrichten*. *Essentials*. Springer Gabler. https://doi.org/10.1007/978-3-658-31888-8

Hersh, D., Worrall, L., Howe, T., Sherratt, S., & Davidson, B. (2012). SMARTER goal setting in aphasia rehabilitation. *Aphasiology*, *26*(2), 220–233. https://doi.org/10.1080/02687038.2011.640392

Hoegl, M., & Parboteeah, P. (2024, March 14). *Goal Setting And Team Performance In Innovative Projects*. https://journals.sagepub.com/doi/epdf/10.1177/1046496402239575

IPMA. (2017). *Individual Competence Baseline* (Version 4.0). *IPMA Global Standard*. IPMA.

Latham, G. P., & Locke, E. A. (1991). *Self-regulation through goal setting. Organizational Behavior and Human Decision Processes*.

Locke, E. A., Shaw, K. N., Saari, L. M., & Latham, G. P. (1981). Goal setting and task performance: 1969–1980. *Psychological Bulletin*, *90*(1), 125–152. https://doi.org/10.1037/0033-2909.90.1.125

Mullins, L. J. (1999). *Management and organisational behaviour* (5. ed., reprint). Financial Times Prentice Hall.

Ogbeiwi, O. (2018). General concepts of goals and goal-setting in healthcare: A narrative review. *Journal of Management & Organization*, *27*(2), 324–341. https://doi.org/10.1017/jmo.2018.11

Pearson, E. S. (2012). Goal setting as a health behavior change strategy in overweight and obese adults: A systematic literature review examining intervention components. *Patient Education and Counseling*, *87*(1), 32–42. https://doi.org/10.1016/j.pec.2011.07.018

PMI. (2021). *A Guide to the Project Management Body of Knowledge: (PMBOK Guide)* (7th edition). Project Management Institute. https://learning.oreilly.com/library/view/-/9781628256642/?ar

Prather, C. W. (2005). The Dumb Thing About Smart Goals for Innovation. *Research-Technology Management*, *48*(5), 14–15. https://doi.org/10.1080/08956308.2005.11657331

Rekonen, S., & Björklund, T. A. (2016). Adapting to the changing needs of managing innovative projects. *European Journal of Innovation Management*, *19*(1), 111–132. https://doi.org/10.1108/EJIM-10-2014-0103

RiskConsultGmbH. (2024). *Project Risk Twin*. https://en.riskcon.at/services/digital-project-twin

Romeike, F. (2018). *Risikomanagement*. Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-13952-0

Sander, P, Spiegel, M., & Schneider E. (2010). *Die exakte Zahl Gedanken zum Umgang mit Unschärfen*. https://drive.google.com/file/d/0B7HVib4JGv2YUXVsR2NZbElnVWc/view?resourcekey=0-zfze_7Bgdvt7HF5xcsX_tQ

Sander, P. (2012). *Probabilistische Risiko-Analyse für Bauprojekte: Entwicklung eines branchenorientierten softwaregestützten Risiko-Analyse-Systems*. Zugl.: Insbruck, Univ., Diss., 2012 (1. Aufl.). *Thesis series*. innsbruck univ. press.

Stetler, K. L., & Magnusson, M. (2015). Exploring the Tension between Clarity and Ambiguity in Goal Setting for Innovation. *Creativity and Innovation Management*, *24*(2), 231–246. https://doi.org/10.1111/caim.12102

Zell, H. (2024). *Projektziele*. http://www.ibim.de/projekt/1-4.htm

Communication aligned with the Sustainable Development Goals