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Industry-Academic Collaboration Projects on Semantics-Based Content Provisioning and Linking in Technical Communication

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Abstract. This paper investigates the implementation of Semantic Information Management (SIM) through Semantic Correlation Rules (SCR) to enhance content management for companies across various industries. Effective collaboration between companies and project teams is emphasized, containing recommendations for project management strategies. Furthermore, prerequisites and requirements for the project are explained. The findings demonstrate the feasibility and benefits of SCRs, providing insights for future implementations and promoting knowledge transfer across organizational boundaries as well as the challenges that were encountered.

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INTRODUCTION

Overview of the Project and its Relevance

Content Management plays a crucial role in Technical Communication since it helps in the organization, retrieval and provisioning of content. The project focuses on implementing Content Management strategies, such as linking of meta data by building a central knowledge graph for the use in industrial environments.
The companies cooperating in the research project cover different industrial areas, namely the software sector, particularly automation and digitalization [1], as well as mechanical engineering [2], [3]. Correspondingly, there were differences in project flow and project management arising from the backgrounds of the project partners. Current and future project partners are not limited to the aforementioned industries; companies from all sectors can benefit from content management and are therefore eligible to participate in this project.
The implementation of Semantic Correlation Rules (SCR) [4] aims to enhance information delivery and subsequently information management processes. In addition to linking relevant data, a central knowledge graph [5] was developed, enabling the maintenance of a system-wide metadata framework. The participation and involvement of stakeholders are essential because the project outcomes are directly influenced by their requirements, goals, and expectations. Effective Information Management also requires appropriate systems for creating, collecting, and maintaining information. Organizing information through a metadata framework is crucial since Semantic Correlation Rules establish connections between metadata, which are derived from use cases developed based on stakeholders' experiences.
Technical Communication aims to make complex technical content understandable and accessible. With SIM, the focus is particularly on content accessibility, as well as the effective dissemination and management of information. This accessibility is particularly important for the companies, making them a central target group while simultaneously serving as providers of foundational elements necessary for the successful implementation of the project

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Objectives of the Paper

The purpose of this paper is to investigate the involvement of participating companies in semantic data integration. It will examine the prerequisites a participating company should meet and how a project team can effectively involve the company. The challenges encountered in this process will be highlighted, and recommendations will be provided on how project teams can address these challenges. On the one hand, the focus is on the project content, namely building up the semantic model (SIM) and corresponding interfaces. Additionally, project management methods that have proven helpful for this project will be presented. In this sense, the following statements can be seen as a summary of previous projects published in the respective chapters of the ACM International Conference on Educational Technology, Language and Technical Communication [6] and especially from three projects [1], [2], [3].

PREREQUISITES AND REQUIREMENTS

Requirements for the Implementation

In case the stakeholders have no expertise in the field of semantic information modeling, basic knowledge should be conveyed before the project starts so delays because of misunderstandings or lack of understanding can be avoided.

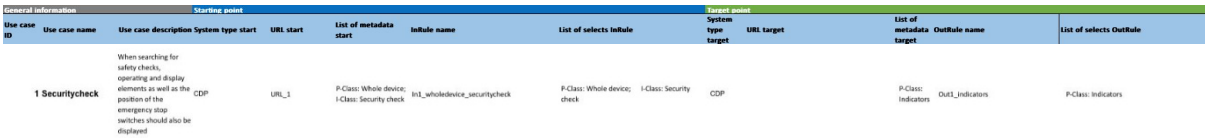
Working with charts has helped foster understanding. For example, a chart showing the project phases and basic actions during these phases has been used. Furthermore, the use of technical terms isn't recommended, or technical terms should at least be explained. This includes terms such as "Ontology", "Semantic Correlation Rules", "Microdocuments" and more.

The topic on why and how an ontology is useful as well as the benefits of SCRs had been discussed with stakeholders from time to time during all project phases. Therefore, we recommend explaining the benefits in the beginning using real world examples instead of abstract and theoretical descriptions.

When project participants have a common understanding of the topic, the goals for the project should be clarified as well as the actions to achieve these goals. Therefore, goals can be divided into a superordinated long-term goal and sub-goals. Additionally, general conditions such as the time frame and capacity should be clarified. It's important to transparently communicate expectations on both sides, stakeholders and implementing team. Therefore, in the first kick-off meeting, expectations should be aligned by considering both sides, bringing together individual goals, requirements, needs and discussing the next steps.

Development of Use Cases

The use cases for the content delivery should be planned and discussed before the practical implementation begins. In preparation for the project, it is required that stakeholders pre-define a concept for the use cases that are required for their content delivery processes. Stakeholders need to consider the following: individual needs of the target group, as well as the content already available and required in the future. Furthermore, the different sources of the content and the different systems the content should be delivered to and the target groups accessing the content should also be included. To make this complex and abstract part of the process easier to understand, it can be helpful to create a use case diagram to visually show the required use cases in their context. A template for the use cases had been developed.



General information			Starting point					Target point				
Use case ID	Use case name	Use case description	System type start	URL start	List of metadata start	InRule name	List of selects InRule	System type target	URL target	List of metadata target	OutRule name	List of selects OutRule
	1 Securitycheck	When searching for safety checks, operating and display elements as well as the position of the emergency stop switches should also be displayed	CDP	URL_1	P-Class: Whole device; I-Class: Security check	In1_wholedevice_securitycheck	P-Class: Whole device; I-Class: Security check	CDP		P-Class: Indicators	Out1_indicators	P-Class: Indicators

FIGURE. 1 Use case template with an exemplary use case

Project Management Strategies

For the implementation it is useful to set up regularly meetings to discuss and present the progress of the project. It's important to find a suitable rhythm that increases transparency and provides the opportunity to address problems, open questions and missing information but still doesn't take much capacity of the practical implementation. From project experience, it is recommended to set up a regular meeting at the beginning of each week, to have the opportunity to react to upcoming problems throughout the week. The benefit of those meetings is that feedback can

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be addressed and considered constantly and flexible.

It is important to consider the varying time requirements for such projects. In our case, the project lasted approximately four months. However, it should be noted that students did not work full-time on the project. Therefore, the available time was relatively limited, which must be considered when defining the project scope and setting objectives.

KEY FINDINGS

Advantages for Participating Companies

A crucial aspect of technical communication is the provision and dissemination of information. Through SCRs, users are made aware of relevant information linked to their primary queries and outputs. This facilitates knowledge transfer across different departments within a company. Additionally, SIM allows data to be maintained via a central graph, enabling the development of a standardized metadata framework [1].

Since content linking is based on use cases developed and collected within individual companies, SCRs are specifically tailored to each company and its users. This ensures that the links are genuinely useful. Furthermore, depending on user behavior, additional SCRs can be developed, and existing ones can be adapted. The process is efficient as it does not rely on linking individual pieces of content directly; instead, connections are established through metadata. For example, a manufacturer can provide a comprehensive user manual for its products in a holistic manner [3].

Stakeholders can understand, trace, present to superiors, manage, and potentially implement and maintain the learned concepts themselves.

The goal of the project which the research was part of was to demonstrate, despite the unique circumstances each stakeholder brought, that SCRs are feasible and effective while highlighting the benefits of SIM. The results from the individual research project provided stakeholders in industry with crucial arguments to justify realization and implementation. Since stakeholders are at different stages in the SIM implementation process, their needs vary. Some are on the verge of implementation and used the project to explore the best possible approach. For others, implementation is further in the future, making the project results primarily an argument for adopting SCRs.

In all cases, the project serves as proof of the functionality of SCRs and as a blueprint for their implementation.

Benefits for Students/Researchers

The main benefit of such projects is the opportunity to work with a real stakeholder or company. Beyond gaining practical experience, students are more motivated as their work is actively implemented and utilized. This fosters a greater sense of responsibility. Additionally, essential soft skills such as stakeholder communication and handling expert feedback are developed.

Technical communication also becomes highly relevant, as students typically do not have prior expertise in the specific industries or services of the companies they collaborate with. They must learn to explain technical knowledge in an accessible manner and ensure they can effectively work with the company. Conversely, students must also communicate their own work to professionals from different fields. Furthermore, they contribute to solving real-world challenges in technical communication, such as ensuring comprehensive access to relevant data.

Project Execution Insights

As already mentioned before, regular meetings played a crucial role in project management. These meetings allowed teams to discuss progress from the past week, address arising issues, and determine potential solutions. Additionally, they provided an opportunity to outline upcoming tasks, which were often dependent on feedback from the companies. If new questions arose, the next steps were contingent on the responses received.

A standardized metadata concept ensures that data from different systems is interpreted consistently. This includes interoperability, which enables data exchange and correct processing across various systems. Furthermore, a unified classification system enhances data discoverability, prevents redundancy, and improves overall data management efficiency.

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CHALLENGES

Organizational Challengers (Stakeholder Challenges)

A couple of challenges came up throughout the projects. These affected both the students and the stakeholders, so they had to be overcome. They had to be tackled actively and consistently to fix them. One organizational challenge was time management. While the project was a central task for the students in their studies, it was just another project in the everyday working schedule for the stakeholders. Everyone involved had to be aware of the fact that students have a different sense of time and a different way of organizing their time. This led to different priorities in the decision-making process. On the one hand, the students needed the documents as quickly as possible to be able to continue their work. On the other hand, stakeholders often had longer decision paths, such as internal approvals. These challenges can lead to problems within time management. To avoid this, it is highly important to agree on deadlines. A joint project schedule with fixed milestones avoids this problem and helps both parties of the project. This allows everyone to formulate their expectations of the project and avoids any misconceptions about the project scope

Technical Challenges

The project also presented some challenges. For example, it must be considered that different explanations or approaches should be used depending on working with a company from the IT sector or, for example, a production company. While one stakeholder may understand the programming of a server, another stakeholder may know more about the classification of metadata.

There were also technical challenges as stakeholders edited, changed or updated their data during the project. This led to inconsistencies when students did not have the latest datasets. At this point it must be emphasized again that communication is very important in a project with different stakeholders. However, it is also important not to neglect the fact that companies need to be primed and trained in metadata quality. Above all, this includes terminology management as well as the consistent assignment and use of IDs and, in the best case, classification according to the PI classification [7], [8]. If these topics are fundamentally understood, major complications when adapting or adding metadata, for example, can be avoided later and therefore a lot of time (or in the case of a company money) can be saved.

Furthermore, we encountered challenges with the service providers. An API was developed through which the various systems can retrieve and process metadata, allowing it to be displayed later in the content delivery system [9]. To be able to call the API, prior approval from the service providers is required so the API can be implemented for the respective service. Once approved, the API implementation on the side of the service provider can take some time, making it essential to initiate this process as early as possible.

If issues arise with systems involving external service providers, the troubleshooting process is more prolonged due to the need for communication across multiple parties. Therefore, such issues should be identified and reported as early as possible to ensure timely resolution. For instance, problems occurred with deep links that could not be accessed, which required the temporary use of a workaround.

Discovery of Improvement Areas

Furthermore, the project helps to identify potential issues that stakeholders can address before they occur or cause significant delays during final implementation. These issues include weaknesses in data quality, processes, and systems. For instance, inconsistencies in terminology and misleading metadata classifications were observed. To ensure correct data processing despite differing metadata concepts and potentially ambiguous PI classes when calling the interface, an additional PI classification, called the SIM-Core, was implemented [10].

SUMMARY & OUTLOOK

We recommend regular coordination meetings, as all three groups reported positive experiences with them and consistently had a need for discussions with stakeholders. Furthermore, the development of a project plan is advised to ensure deadlines and work distribution. It is important to note that unexpected challenges may arise, making a certain degree of flexibility essential. However, in combination with weekly meetings, this plan can be continuously adjusted and communicated with stakeholders.

For companies preparing for such projects, we recommend placing significant emphasis on a uniform and

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consistent metadata framework, which includes maintaining terminological continuity. Additionally, the development of use cases is crucial. The more data that is collected, the more comprehensive the SCRs can be, leading to a more precise understanding and support of user behavior. Artificial intelligence (AI) can be used to support the development of use cases. Given the speed at which AI is currently developing, this is a good reason why it is worthwhile for companies to deal with such topics at an early stage and to understand them in greater depth. By tracking user behavior when using information, AI can suggest potential use cases based on user interactions, which can then be used for further SCR development.

Collaborative projects between students and real-world companies offer advantages for both parties and are therefore highly recommended!

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