Aligning Enterprise Knowledge and Data: A Domain-Specific Modeling Method for Social Media Strategies

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Abstract. For supporting decision makers in their day-to-day operations, enterprise knowledge needs to be combined with data acquired from various IT systems. For this purpose, specifically designed IT-based modeling methods enable this linkage on a conceptual as well as a technical level. In the paper at hand, we describe a domain-specific modeling method that supports the alignment of enterprise knowledge in the form of social media strategies with data acquired from social media platforms. For testing the feasibility of the approach, we implemented the modeling method on the ADOxx meta modeling platform, which was extended with a Java application for linking it to Twitter. Subsequently, we describe a use case for representing and analyzing a social media strategy in a University setting and evaluate the benefits and drawbacks of the approach.

Keywords: *social media strategies, social media strategy modeling method, domain-specific modeling method.*

1 Introduction

The number of social media interactions per second grows steadily. According to InternetLiveStats.com, 797 Instagram photos are uploaded, 7,716 tweets are sent, and 70,355 YouTube videos are viewed per second[1]. The decision makers in businesses that use social media for their purposes, e.g. in marketing or customer interaction, are thus often overwhelmed by these amounts of data. They require structured procedures for the continuous setting of goals concerning social media, for measuring according achievements, and for the adaptation of respective measures. This will be denoted in the following as a *social media strategy*. Such a strategy represents enterprise knowledge made explicit by the decision makers that subsequently needs to be aligned with according data sources [7]. In this way it can be navigated through the different options for addressing social media, setting goals and subsequently measuring the achievement of these goals. In the following we will investigate how this need can be satisfied by reverting to conceptual modeling methods. As a solution, we will present a

[1] See http://www.internetlivestats.com/ (Data from 2017-09-18)

Multikonferenz Wirtschaftsinformatik 2018,
March 06-09, 2018, Lüneburg, Germany

domain-specific, i.e. specifically designed, conceptual modeling method for representing social media strategies that is able to directly connect to social media platforms. The remainder of the paper is structured as follows. In Section 2, we outline the characteristics of social media, existing social media strategy approaches and according model-based approaches. In Section 3 the domain-specific modeling method is presented. Section 4 reports about the technical realization of the modeling method and its application to a use case. The approach is discussed in Section 5. The paper is concluded with an outlook in Section 6.

2 Foundations

In this chapter, we discuss required foundations for the design of our approach. These concern social media characteristics, social media strategy approaches and existing strategy modeling approaches.

2.1 Social Media Characteristics

At their core, social media can be described as internet-based applications that are created with Web 2.0 technologies for enabling creative consumers to define value-added content [2, 10].

Web 2.0 is thereby understood as a group of technologies to support consumers rather than organizations in collaboration, communication, content creation, and interoperability [10]. “Creative consumers” are characterized by their intention to create content that is published on social media or websites, and the intention of content creation should be based on personal and not professional reasons. Through the usage of Web 2.0 technologies, a shift from one-to-many to many-to-many is achieved in terms of communication. Several types of content are realized through social media depending on the chosen social media channel, e.g. text, pictures, videos, and networks [2].

From the viewpoint of organizations, it is important to keep track of shared information on social media, especially for the fast reaction on negative comments [13]. Therefore, organizations need to monitor social media channels constantly. In addition, they use social media to engage in a positive manner with consumers [10, 14]. This is today typically realized by using social media management tools that are helpful for natural language processing, data mining, and the identification of public reactions [1]. Popular examples for such tools include swat.io, tweetdeck, or hootsuite[2].

2.2 Social Media Strategy Approaches

Effing & Spill [4] identified a lack of comprehensive, dedicated frameworks for social media strategies and elaborated therefore the “social strategy cone framework”. The research was based on a literature review and included nine case studies. The literature

[2] See the websites: https://swat.io/, https://tweetdeck.twitter.com/, https://hootsuite.com/ (retrieved 2017-09-18)

review revealed seven key elements to consider for social media strategies: target audience, social media channel, goals, resources, policies, monitoring, and content activities. For a successful social media strategy, the authors consider it important to identify the appropriate target audience and consequently the right social media channel. A successful social media presence requires a consistent overall appearance. Therefore, an alignment of business goals, e.g. in terms of customer satisfaction, with social media is essential as well as a clear purpose. The assignment of competent resources is necessary for authentic and valuable communication. To ensure that resources communicate in the name of the organization in a proper manner, policies are required. Furthermore, for managing posts over time, a content activity plan is required. The content activity plan should be used to plan and schedule content that will be posted. Monitoring is inalienable for social media strategies to keep track of the ongoing environment [4].

In another approach, the honeycomb framework by Kietzmann et al. [12] aims to support managers to draw the attention to social media ecology, required engagements, and the audience. The framework defines the seven building blocks: identity, conversation, sharing, presence, relationships, reputation, and groups. It analyzes the functionalities based on the seven building blocks and the linked implications. Therefore, identity is the extent to which users disclose themselves. That implies data privacy controls and additional tools for supporting user self-promotion. Relationships are about the relation from user to user, that requires management of structural and flow properties in a relationship network. The social standing of others and content subsumed under "reputation" comes with monitoring strength, passion, sentiment, and reach of users or organizations. Groups are users coming together as communities and need membership rules and protocols. Conversations cover the extent of user communication and imply the conversations' velocity as well as the risks of starting and joining conversations. The ability to share content requires a content management system and a social graph. Moreover, presence is an important factor on social media platforms. To that end, it is necessary to create and manage the reality, intimacy and immediacy of the context [12].

2.3 Existing Strategy Modeling Approaches

The use of conceptual modeling techniques for the domain of strategic management has been explored in the past from several perspectives. One essential aspect in defining and evaluating strategies is the formulation of goals and the analysis of how goals interact with each other. Recently, a formal approach based on the i* modeling language has been proposed by Horkoff and Yu that permits in-depth analyses of goals including the detection of contradictions or the evaluation of the reachability of goals [8].

In addition to goals, several other aspects of strategic management approaches may be represented using conceptual models. Bock et al. compiled several concepts originating from approaches such as SWOT analyses, the Five Forces framework or balanced scorecards into one meta model and linked it to the MEMO enterprise modeling method [3]. However, the meta model has not yet been implemented as a modeling tool.

With the approach of ADOscore a comprehensive, industrial-scale modeling approach has been proposed. ADOscore is based on Balanced Scorecards developed by Kaplan and Norton and is used to measure the performance of an organization's strategy. The

focus is on the correlation of the financial, internal business process, learning and growth, and customer perspective [11]. ADOscore enables the creation of a flexible controlling system through customizable key performance indicators. The modeling method consists of several modeling types. These are: the Strategy Model, the BSC Map, the Success Factors Model, the Organization Model, the Initiatives Model, the Cause and Effect Model, and the Key Performance Indicator Model. Strategy, vision, guiding principle, slogan and strategic direction are defined in the Strategy Model. Objectives, targets, measures, and initiatives are defined in the Cause and Effect Model. The model type Key Performance Indicator contains the definition of key performance indicators that are used to measure the achievement of strategic goals [15].

3 A Domain-Specific Modeling Method for Social Media Strategies

Although one can partially apply the existing approaches for modeling strategies to the domain of social media strategies, none of them permitted to establish a linkage between the definition of a social media strategy and the data and specific indicators delivered by social media platforms on a technical level. This seems however favorable in order to immediately evaluate the success of the strategy using actual data sources. Based on the foundations in Section 2, we thus decided to create a domain-specific modeling method that would permit such a linkage. In the following, we will describe the procedure used in the modeling method, the underlying meta model and the visual notation for the modeling language. Furthermore, we add algorithms for linking the models with social media platforms.

3.1 Procedure

The procedure of the modeling method for social media strategies builds on the seven key elements identified by Effing & Spil [4] introduced in Section 2.2. The main purpose of the modeling method is to create and analyze social media strategies using actual data. Considering the importance of aligning the social media strategy to an organization's overall business strategy, the definition of the vision and strategy of an organization constitutes the fundament of the modeling method. After vision and strategy are defined, policies and resources are added, followed by the strategy plan definition.

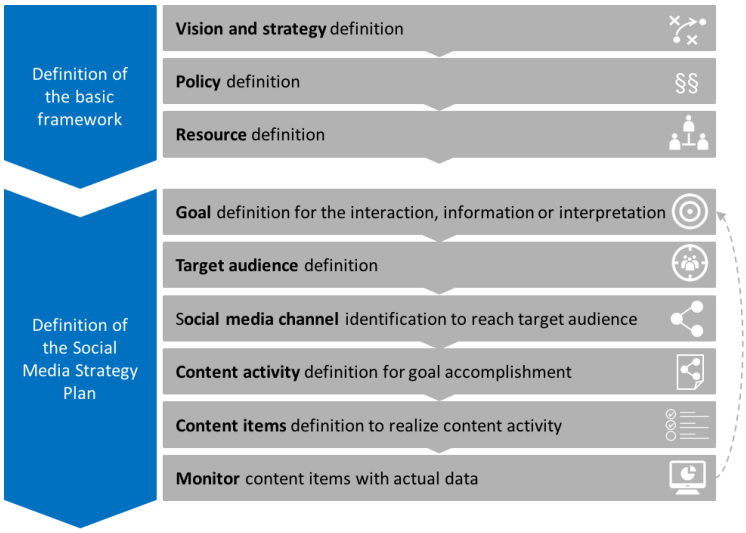


Figure 1. Procedure of the Modeling Method

In the strategy plan, at first the goals for the interaction, information or interpretation are set. This is followed by the definition of the target audience and the social media channel to reach this audience. For goal accomplishment, content activities are elaborated with the according content items that contain the data to be published on a social media platform. For example, this can be posts on a social media platform for a particular topic. Finally, it is important to monitor content items, i.e. the achievement of goals, by retrieving social data. In the case of Twitter for example this would be information on "likes" and "retweets". According to the results of monitoring the strategy plan, actions are identified, e.g. new goals or new content items.

3.2 Meta Model and Visual Notation

For supporting the modeling procedure with a meta model of a domain-specific modeling method, four model types were derived: Vision and Strategy, Policy, Resource, and Strategy Plan (see Figure 2). Each model type consists of at least one class. Every class inherits from the abstract class _StrategyModelElement_ with the attribute description.

In addition to the relations within the model types, e.g. for representing that goals refer to target audience elements and these in turn to content activities, also cross-model references are possible. These are depicted in Figure 2 using the INTERREF connectors. Furthermore, some of the attributes of the elements in the meta model are not to be modified by users but are automatically filled by algorithms (e.g. the Like Count attribute of the Content Item element) as will be described in the next section.

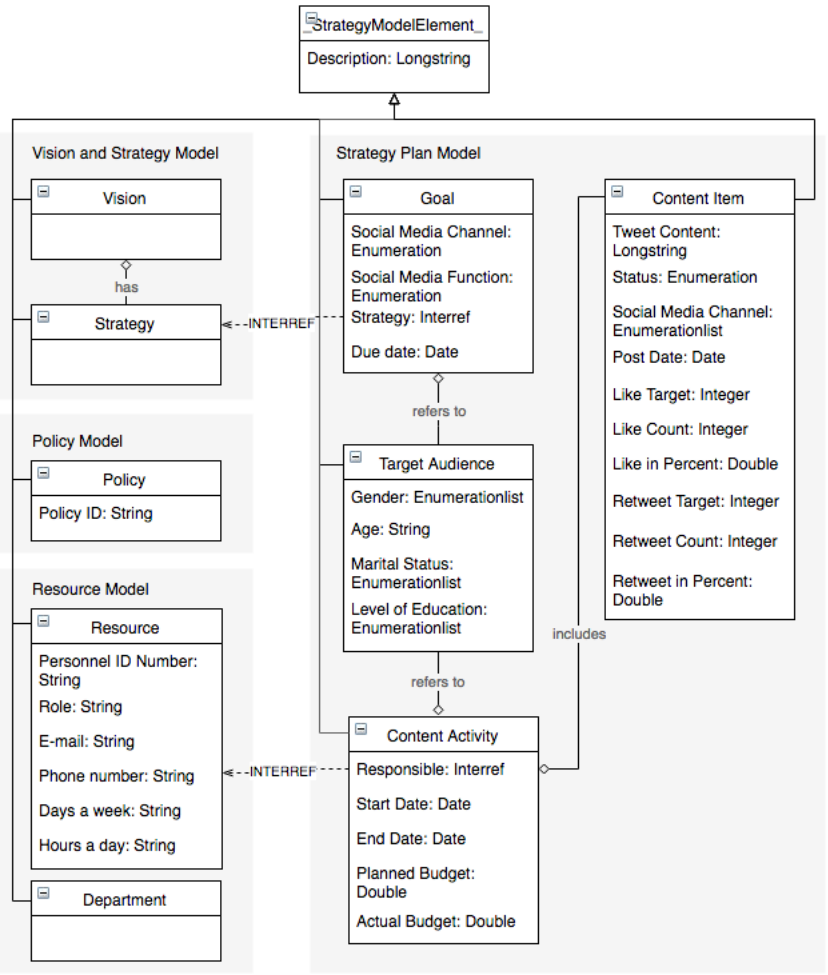
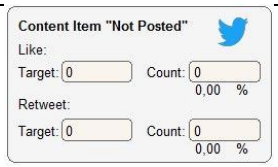
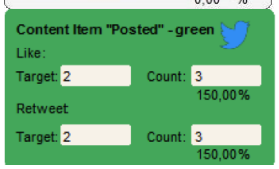
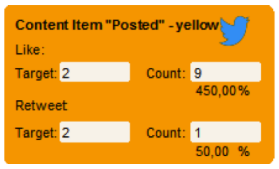
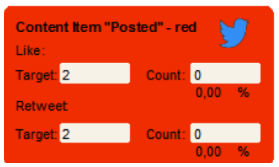


Figure 2. Meta Model for a Domain-Specific Modeling Language for Social Media Strategy Management [16]

The visual notation of the classes and relations in the meta model is shown in Table 1 below. Thereby, a specific color coding is applied to instances of the Content Item class that represents items that are about or were posted on social media. Based on a target value specified by the user for likes and retweets, the color is automatically switched between green, yellow, and red. This indicates – similar to traffic lights – whether the target has been reached, which is assumed if the value in regard to the target is above 88% and the color code is set to green, whether it has not yet been sufficiently reached, which applies if the value in regard to the target is below 33% or, whether it is in a middle stage, i.e. between 33% and 88% - then it is visualized in yellow. It has to be noted that these values are assumptions and may need to be adapted for different scenarios and user preferences.

Table 1. Visual Notation of the Classes and Relations

Class / Relation	*Visual Notation*	*Description*
has		Creates a relation from the Vision element to the Strategy element within the Vision and Strategy Model.
includes		Creates a relation from Content Activity to Content Item within Strategy Plan Model.
refers to		”refers to” is used in the Strategy Plan Model to create a relation between Goal and Target Audience as well as between Target Audience and Content Activity.
Vision		The Vision class is part of the Vision and Strategy model and is used to define the vision of the organization.
Strategy		The Strategy class is part of the Vision and Strategy model and is used to define the strategy to achieve the vision.
Resource		The Resource class is part of the Resource model and is used to define Resources of an organization with information about the role, contact details and availability.
Department		For the assignment of resources to a department the Department class is used within the Resource model.
Policy		The Policy model consists out of the Policy class and is required for the definition of policy elements.
Goal		Within the Strategy Plan model, the goal definition is embedded through the Goal class. It enables to specify the name, description, social media channel, social media function, the INTERREF connector to the Strategy element of the Vision and Strategy Model, and Due date.
Target Audience		The Target Audience is defined in the Strategy Plan model and enables to specify the target group in terms of gender, age, marital status, and level of education.
Content Activity		The Content Activity is used for categorization and content item planning. Next to the definition of a responsible resource with an INTERREF connector to the resource model, the start date, end date, planned budget, and the actual budget could be set.

Class / Relation	*Visual Notation*	*Description*
Content Item (Status: Not Posted)		The Content Item is assigned to the Content Activity and is part of the Strategy Plan model. It holds the actual post content and the social media channel (for now restricted to Twitter). The update of likes and retweets from Twitter is saved in the attributes Like Count and Retweet Count, that are write-protected for users so that they can only be changed by according algorithms. The notation of the Content Item changes based on following attributes: Status, Like in Percent, and Retweet in Percent. The color code depends on the latter two attributes. This notation is displayed with the status "Not Posted".
Content Item (Status: To be Posted)		The Status "To be Posted" is represented with this Content Item notation.
Content Item (Status: Posted; with green color code)		The Status "Posted" is represented with this Content Item notation. If the attributes "Like in Percent" and "Retweet in Percent" are above 88% of the target, the item is represented in green color.
Content Item (Status: Posted; with yellow color code)		The Status "Posted" is represented with this Content Item notation. If the attribute "Like in Percent" is between 33% and 88% of the target or "Retweet in Percent" is between 33% and 88%% of the target, the item is represented in yellow color.
Content Item (Status: Posted; with red color code)		The Status "Posted" is represented with this Content Item notation. If either the attribute "Like in Percent" or "Retweet in Percent" is below 33% of the target, the item is represented in red color.

3.3 Algorithms

The modeling method includes two algorithms for linking the created models with social media platforms. The first algorithm "Update Content Items" refers to Content Item elements that are contained in a strategy plan. If the items have not yet been posted on the respective social media channel, the algorithm automatically posts them using the credentials of a user. Subsequently, for all posted items, the information about likes and retweets (in the case of Twitter) is collected and assigned to the model elements. The

second algorithm “Create Content Items” is used for the analysis of content items that already exist on the social media platform but that have not yet been represented in the model. Based on criteria to be specified by the user, e.g. using time intervals, the algorithm automatically collects content items from a social media platform and adds them to a model. For the next versions of the algorithms it is planned to include further semantic information such as hash tags or particular user names to permit groupings of the elements.

4 Technical Realization and Application to a Use Case

To evaluate the feasibility of the approach, the modeling method has been technically implemented using the ADOxx meta modeling platform [6] and then applied to a use case. In the first iteration, the implementation has been restricted to the use with Twitter as a social media platform. Connectors to other social media platforms such as Facebook, LinkedIn or Instagram are possible and considered for future work. The meta model together with the visual notation was realized in ADOxx. The algorithms were partly realized using the ADOscript language of ADOxx and partly in Java. The latter was used for providing a user interface for entering account data for Twitter and for establishing the connection to the Twitter API using the OAuth protocol. For exchanging data between ADOxx and Twitter it was reverted to the ADOxx XML import and export interfaces. The details of the data exchanges are shown in Figure 3 below.

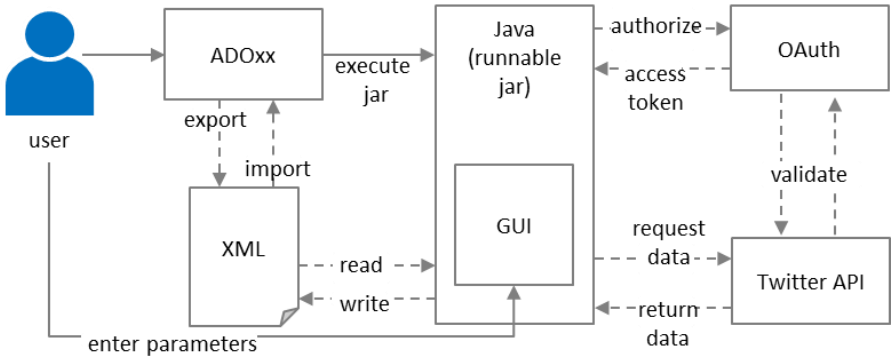


Figure 3. Technical Architecture of the Implementation [16]

A use case of the Research Group Knowledge Engineering at the University of Vienna was considered for the proof of concept to illustrate how the approach could be applied. Therefore it has been focused on Twitter posts in the context of the Next Generation Enterprise Modelling (NEMO) Summer School 2015. The use case application follows a bottom up approach by retrieving first the content items that had already been posted, analyzing them and then developing an according social media strategy. This is beneficial in cases where social media have already been in use but no according strategy had been defined so far.

Figure 4 represents an extract of a possible Strategy Plan model with imported tweets from Twitter about the NEMO Summer School 2015. After we imported all tweets from 23.07.2015 – 31.07.2015 we analyzed the Content Items and identified suitable Content Activities. Target values for likes and retweets were manually identified for each Content Item to assess the success of the items posted so far in regard to the user base (i.e. the followers on Twitter).

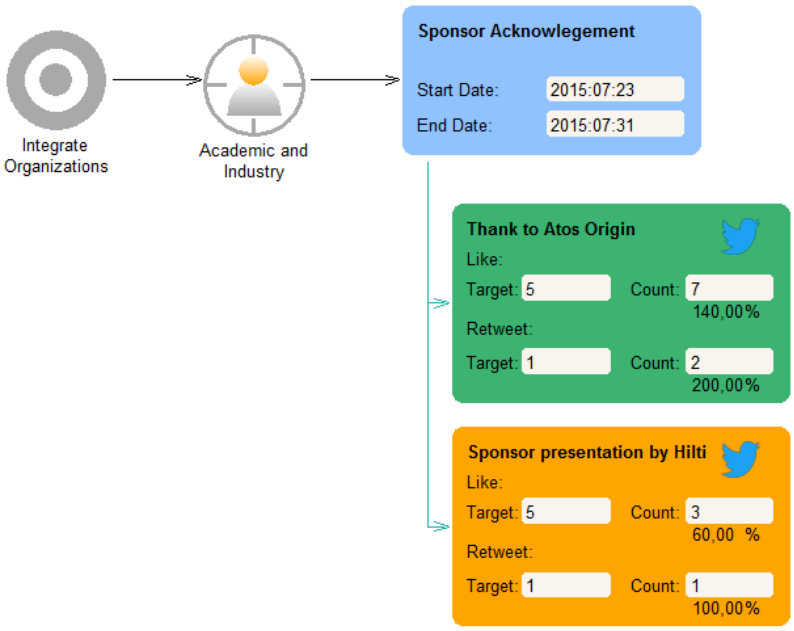


Figure 4. Possible Strategy Plan Model of the Use Case for the NEMO Summer School

The assignment of Content Items to Content Activities enabled in addition to a categorization, an overview of the success of one category and the Content Items. To complete the Strategy Plan model, Goal and Target Audience elements were created. For the assignment of responsible persons to Content Activities and strategies to goals, a Resource model and Vision and Strategy model were created (see Figure 5). A Policy model was also created for usability reasons.

5 Discussion

The domain-specific modeling method enables a structured approach of social media strategy definition with a direct link to social media platforms. In addition, existing social media information can be imported into the Strategy Plan model based on the username and timeframe. Furthermore, post content is visualized through Content Items and categorized by the association of Content Items to Content Activity elements. This is an enhancement in regard to the traditional direct interaction with social media platforms such as Twitter where posts on a common topic are spread over the time line with

no reference, which makes their analysis difficult. Hence, an analysis of success or failure of Content Items and therefore Content Activities is easy to identify based on the provided color code of Content Items. The color code refers to the achieved target likes and target retweets, that are automatically updated with the function Update Content Item.

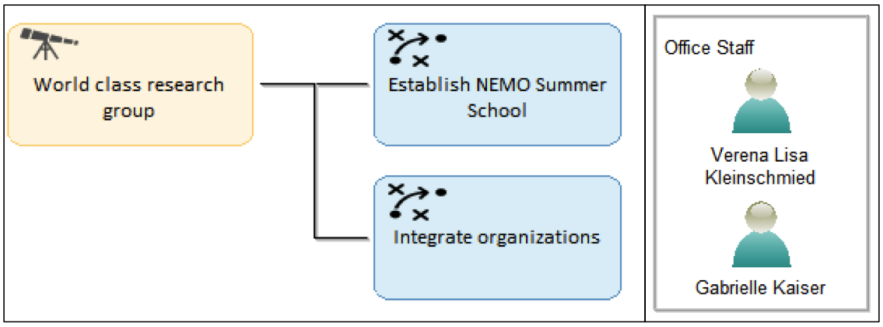


Figure 5. Vision and Strategy Model (left) and Resource model (right) of the Use Case

A weakness of the color code in its current form is that users cannot choose the percent range for green, yellow, and red encodings. Also, the weighting of likes and retweets is equal and not yet customizable by the user. Thus, like and retweet target must be set carefully. A low target could run the risk that the analysis and derived actions are misleading. Furthermore, if the status of a Content Item is accidentally set to "To be Posted" it could result in unintended or double postings. Therefore, an additional definition of clear guidelines and policies is important.

6 Conclusion and Outlook

The objective of this paper was to introduce a domain-specific modeling method for the alignment of enterprise knowledge in the form of social media strategies with data acquired from social media platforms. The modeling method is based on seven key elements for social media strategies identified by Effing & Spil [4] and has been realized on ADOxx together with a Java application for programmatically interacting with Twitter.

Future work will consider the implementation of further social media channels, for instance Instagram, Facebook, and LinkedIn. In addition, the model types Vision and Strategy and Resource will be extended with more advanced existing meta models. For this purpose an approach for the performance management of public health authorities could be considered by Fill et al. [5]. Also, the integration of statistical analysis tools could be of additional value for a more detailed processing of the social media data [7].

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