A Multi-functional Information Leitstand for Top-Management - A Proposal

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ABSTRACT

Demand pull and technology push as well as recent initiatives by market-leading software companies indicate that the science of information systems needs to take a new run at the upper layers of management. One of the reasons is the growing importance of external and qualitative data for decision-making. In addition, companies need to communicate more actively with their stakeholders. As a direct consequence, the workload of management and functional departments in charge of information dissemination has increased. Thus, we need to power up the efficiency of information logistics processes. Acknowledging that full automation cannot be a goal of the foreseeable future, the paper focuses on a semi-automated approach – what we call the Multi-functional Information Leitstand. The concept we propose is based on a number of experiences we made while developing an Editorial Leitstand as well as others for distributing stakeholder information and consulting trusted third parties.

Keywords: Information Dissemination, Information Supply Chain, Leitstand, MIS, Personalization, Stakeholder Information Systems

1. MOTIVATION

Both demand pull and technology push factors signal that information systems development for planning and controlling on the top-management level should be revisited. Some reasons for this can be found in [1]. The following list comprises the most important triggers for our research activities:

(1) Extracting information from operational systems and condensing them adequately for different layers of management has always been a major concern of electronic data processing. Traditionally, this sort of problem was addressed by Management Information Systems (MIS) research. Another goal is collecting and filtering external data, transferring them to the proper functional areas, storing and retrieving them. This is an important function within the large field of knowledge management. Thus, the root of the problem lies in delivering the right amount of information to the right recipient. Already nine years ago a profound worldwide empirical investigation of Reuters [2] found that 44% of a total of 1,300 managers think the costs of gathering information exceed the benefit. More recent studies like the one of Farhoomand and Drury [3] prove that the results of Reuters might still be valid, and that today instead of having become fewer, problems abound.

(2) Following creativity theory which states interesting insights into a problem may be achieved when turning it inside-out, we also focus on disseminating information from the firm to its environment. Addressees are stakeholders who either influence the company's performance or get influenced by it according to [4]. We are nearing Stakeholder Information Systems (SIS) that partly use the same data as MIS.

(3) Yet another idea is to take advantage of the internet-based concepts and tools originally developed for online market research and give managers the opportunity to consult experts and trusted third parties ahead of making a major decision. Here we can also find some similarities with quantitative risk analysis.

Quite a few intermediate forms have emerged in between the wide range of "full automation" and "personal fulfillment of tasks", where humans and computers jointly work on achieving their common assignments. Characteristic examples are process control, production planning and control, work places of logistics dispatchers as well as help desks typical for customer care departments. The technical means for these intermediate solutions is the leitstand (LS).

Over the past couple of years, the mentioned requirements found their way into various concepts for information leitstands that have been investigated following a design research approach introduced by Nunamaker [5]. These are:

(1) an Editorial Leitstand (ELS) to collect external and qualitative management information, which has been incorporated into the software bundle SAP Strategic Enterprise Management (SAP SEM™),

(2) a Stakeholder Leitstand (SLS) to disseminate relevant information to stakeholders of all kinds,

(3) a Consultation Leitstand (CLS) to efficiently request know-how and opinions from experts while working on a particular problem.

2. RESEARCH GOALS AND METHODOLOGY

Research results and practical experience showed that some functions of these different leitstands were indeed overlapping. All three contain functions that present overviews of available information sources, access specialized search engines, store information and offer mechanisms to filter streams of data. Similar skills are required for operating the leitstands. In addition, interesting areas for improvement were discovered. Results of a poll conducted using the CLS may be fed into the ELS and compared to external studies of market researchers and financial analysts.

Building on these synergies it seems advantageous to aim at the one, integrated leitstand. Therefore this paper first describes the already available individual leitstands which are partly prototypes and partly already components of software products. Based on the former research we present the results of a conceptual design study, where we cluster common features of the different approaches and develop an integrated model of a Multi-functional Information Leitstand (MLS). The paper focuses particularly on shared functions, shared requirements towards personnel, and an integrated software architecture.

3. RELATED WORK - PRIOR LEITSTAND CONCEPTS

Editorial Leitstand

Combining internal and external as well as qualitative and quantitative information to support decision-making is getting more and more crucial. Today, we can quickly accumulate external data by means of the Internet. Before integrating them into a planning and controlling system, however, these data need to be edited as their quality and quantity are subject to change. Not intending to merely exacerbate the information overload problem, we need a tool to help us with gathering this kind of information and supplying it to the proper recipient afterwards.

Our approach is the ELS for management information, which partly adapts processes characteristic for publishing companies.

Due to the fact that the ELS filters and refines crude data to produce management information, it may be compared to an industrial manufacturing process. Typical functions for information delivery have been identified and put into logical relation using a value chain analogy (figure 1).

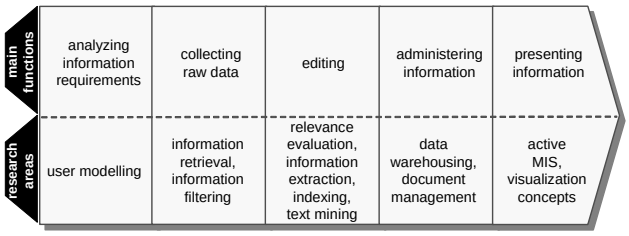

Figure 1 Value chain of information logistics

Meier explores the research areas listed on the bottom pane in more detail describing the state-of-the-art in both academics and business [6].

Core functions in this leitstand are filtering incoming documents for interesting facts and assigning them to internal data according to their context. This complex task requires a text-based analysis and cannot be fully automated for the time being. However, there are a couple of areas where the system can help with preparatory work and assist a human editor using text mining techniques as examined by Meier and Beckh [7].

To help users with finding the right key words for documents, the ELS suggests categories for a possible mapping. These are not only confined to words that are part of the document. By calculating a similarity index the system knows where similar documents were assigned to in the past and makes recommendations thereupon.

Information will be filtered in two different phases. First, potential extracts need to be identified and subsequently they will have to be captured. Before doing so, the document will be semantically analyzed. Furthermore, time-based relative terms like "last month" will be transformed to absolute statements like "March 2005". A rule base enables the ELS to also recognize terms relating to certain events, e. g., a "cooperation" with its attributes "type of cooperation", and names of the participating companies. The underlying module learns these rules by monitoring actions of the editor. Firstly, he has to define what an event is. Secondly, he fills the corresponding data fields by copying parts of the text with the help of context-sensitive

capturing. The system stores these activities and tries to derive new rules. Soderland [8] gives a more detailed explanation of the kind of applied rules.

Stakeholder Leitstand

Ever since the relationship between a company's value and its reputation was discovered, stakeholder information systems have been continuously gaining importance. CFOs have broadened their scope of active communication from financial analysts and journalists to other stakeholders, as published by Edelman, Inc. [10]. In other words, everyone having an interest in the company might add to its value and should therefore be communicated with.

On the same token, improving the process of information logistics brings about the possibility to streamline processes in the area of middle and upper management: One SLS of a major German stock listed company originated from the speaker of the board of directors having found out how much time he spent talking to analysts over the phone. Based on the Pareto principle it made sense to actively supply 80% with personalized information and only take care personally of the remaining 20%.

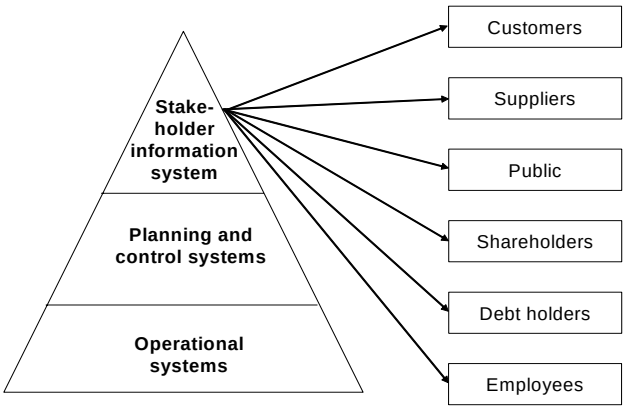

Figure 2 Positioning of SIS

The SLS amalgamates ideas from public relations all the way to functions like customer and supplier relationship management as well as employee, investor and creditor relations (stakeholder relationship management) as presented by Mertens and Stößlein [11].

A futuristic vision could be that the SLS replaces today's advertising campaigns, which have been losing importance according to a recent study by Mercer Management Consulting [12]. Budgets are re-allocated toward personalized communication. Austrian energy-beverage maker Red Bull spends 70% of its marketing budget on getting a hold of the teenage target audience this way.

The project AIDAR described in [13] primarily covers information logistics for stakeholders. Neither strategic and organizational nor economic issues are omitted. Special emphasis was put on the design of a knowledge base, containing categories of information requirements of stakeholders linked to roles and company characteristics. Furthermore, we have evaluated our concepts with prototypical applications, both in laboratory studies and in practice.

Our analyses build on magazine articles, polls, news, published interviews, case and success stories of companies and academic publications. For that reason Stößlein [14] analyzed the stakeholder information presented on the websites of 245 companies.

The SLS makes use of situation models, role concepts and user profiles. The situation model defines what information a company must offer to stakeholders. The term situation encompasses the industry the company is a part of, the phase of the life cycle and other factors.

The subsequent application of the role concept narrows down the messages a stakeholder gets in his initial portal to information he really needs based on the role's description. This again depends on impartial factors like job descriptions and know-how. The user profiles personalize the starting portal according to personal preferences.

We summarize our results in so-called "intelligent" checklists. They represent a foundation for developing portals, messages and questionnaires and may be adapted to the situation of the company, the role as well as the user.

The starting points for information logistics towards stakeholders are legal reporting duties. An example is the disclosure of financial data and requirements imposed on companies by the Sarbanes-Oxley Act.

To comply with this is especially difficult for small and medium sized firms which get overwhelmed with the multitude of legal information requirements. A study by Katzensteiner [15] revealed only very few websites fulfill legal requirements.

More details about the implementation and use of the SLS can be retrieved on the Internet at http://www.aidar.de.

Consultation Leitstand

As the name implies, this leitstand serves as a means to quickly gather expert opinions to back up forecasts or be able to better gauge the risk involved with a decision. The risk analysis of Hertz is the starting point. The basic idea is to obtain multiple input values for a computation, e. g. an investment calculation. Instead of churning out one single target value a simulation module presents the results in terms of variances. Management can now see how unsure these experts were when formulating their opinion and thus get a "good feeling" about the risk involved.

Eventually, we face a typical behavior often witnessed with management: Before making rigorous decisions the executive consults trusted experts to ask for their opinions and estimates.

A generalization of the above introduced idea leads us to the following decision-support system concept. As an example, we will walk through the fictional restructuring of the spare parts logistics process of a South American health technology manufacturer. The strategic question is whether or not the Quito-based distribution center should be closed down and hospitals in Ecuador be supplied from Bogotá in the neighboring Columbia. Academic disciplines like Information Systems, Operations Research and Logistics Management already provide a wide-range of instruments to support typical logistics analyses. Besides, the situation requires additional material upon e. g. reliability of traffic infrastructures in various South American countries and information about experiences with the cultures involved.

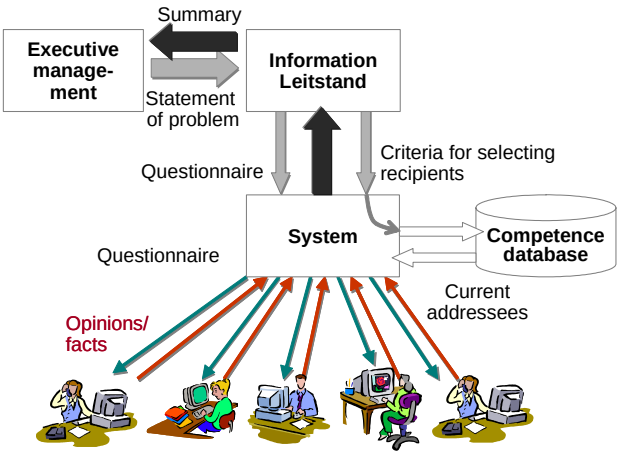

Figure 3: Consultation Leitstand

For this kind of decision it is helpful to maintain a "know-who database" on competencies. It maps areas of knowledge and experiences to key members of current staff and former employees. The system may now query these data using a combination of parameters. In our case we could seek persons with at least half a year's business experience in either Ecuador or Columbia.

As a first step, the leitstand would have to transfer the pending decision-problem into an online-questionnaire that is to be transmitted to appropriate recipients. "Questionnaire-Engines" developed for online-marketing activities could take charge of this. Then, the experts will give their opinion in a formalized way as Yes-No combination or a more detailed rating. They might also indicate they have some kind of extra information that could be of further assistance.

The leitstand staff considers the answers and summarizes the results of the little "opinion poll" for the management. Repeating this process all over again regularly with the same questions would pave the way for moving toward a Delphi approach.

4. THE PIECES PUT TOGETHER: THE MULTI-FUNCTIONAL INFORMATION LEITSTAND (MLS)

Besides the fact that all three principles employ the idea of a leitstand, they also share common functions as well as requirements toward personnel.

The following list of commonalities suggests that joining the three leitstands into one single, enterprise-wide concept will let us reap some beneficial synergies.

Commonalities of the leitstands

Shared Functions: These functions are part of ELS, SLS and CLS:

(1) Metadata on sources (source profiles, know-who collections) need to be prepared as well as role and user profiles must be set up and maintained.

(2) Information requirements have to be transferred into executable queries or search terms.

(3) Quantitative results of a search or query need to be refined using statistical methods.

(4) Qualitative results need to be edited to extract summaries, eliminate double entries and redundant passages, group like messages or refine unstructured texts for storing.

(5) The system must be based on an adaptive architecture and be able to "learn" appropriate sources, addressees and modes of presentation.

(6) The goal is to identify events that trigger information logistics processes.

Shared requirements towards personnel: These shared functions lead to joint requirements toward staff working with the Information Leitstand. In general, every time the computer cannot move on all by its own, the user will have to assume control. These kinds of problems will occur when new decision-situations arise or if new topics and sources come up. Thus, the main requirements are:

(1) They must oversee internal and external information sources and build up corresponding directories.

(2) They have to be aware of information requirements of individual recipients and business functions. Therefore they need to know their way around role concepts and user profiles.

(3) They must be able to translate verbal information into machine-readable form.

Concept of the Multi-functional Information Leitstand

Figure 4 characterizes the MLS as "turntable of information". Depending on role and concrete situation, the information needed at a particular site will be connected to multiple heterogeneous sources.

Besides preferences, situations as well as related tasks and competencies make up the demand for information. The MLS transforms this demand into formalized queries and fires them against selected sources.

We differentiate two kinds of sources. Passive sources deliver only once upon request. Buying a market research document via micro purchase may be an example. Conversely, active sources permanently deliver information all on their own that match preset profiles of interests, e. g., news tickers that can be subscribed to either for free or for a monthly fee. Yet another type of source is the human expert who will help preparing for decisions or communicating to stakeholders.

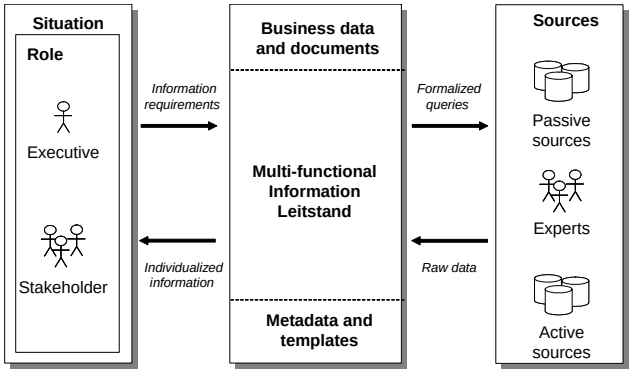

Figure 4 The MLS brings together sources and points of action

***Functions*:** The following table lists basic functions of an MLS with their respective use cases:

Basic functions	Use case
Collecting, organizing and storing information requirements	Preparation of information retrieval for typical decisions and messages to stakeholders
Configuring and adapting company-specific knowledge bases	Maintenance of 1. Role and user profiles 2. Metadata of sources 3. Report templates
Transforming information requirements into machine-readable form	1. Queries to internal data sources and external services 2. Ad-hoc consulting of experts
Billing and settlement activities	1. Micro purchase of external data 2. Processing transactions with an information market 3. Management of indirect costs
Filtering relevant content	1. Extraction of relevant facts from large databases and documents 2. Refinement of polls and studies according to best statistical practices 3. Summarizing of texts
Mapping descriptors of internal classification schema	Adding key words to results of queries
Submitting individualized messages	1. Sending exception alerts to executives 2. Informing stakeholders
Generating individualized portals	1. Management portals 2. Employee portals 3. Stakeholder portals

Figure 5 Basic MLS functions

Architecture: By grouping these basic functions and the respective data we get to the architecture of an MLS as represented in Figure 6.

The multi-stage information filtering principle of the MLS offers interfaces to sources and points of action (management and stakeholders). A report and message generator that extracts and connects relevant facts stands at the core. Furthermore, there exist metadata of sources and points of action, templates for roles, reports and typical messages as well as for business data and documents.

The classification of sources explained above (active and passive sources as well as human experts) corresponds to three interface components on the source-side. Passive sources require a query component that interprets settings stored within a user profile and translates them into the syntax required by the targeted source. The questionnaire engine has a similar function, but instead of using the source profiles it gets its data from the know-who database. A given demand for information in a user profile will be first transformed into a questionnaire. Thereafter the system forwards it to selected people and automatically re-collects and evaluates the answers.

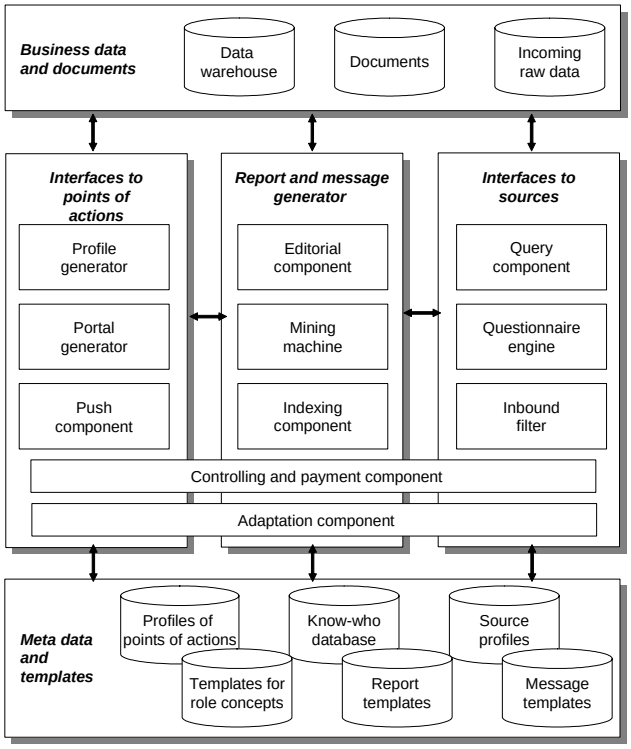

Figure 6 MLS architecture

The category of active sources requires an inbound filter that matches pieces of information found within the incoming data stream to requirements of single users or groups of users, e. g. defined in role models.

In urgent cases gathered information will be directly forwarded to the point of action. Normally, an incoming data folder will take care of storage of crude data. It supplies the various components of the report and message generator. The editorial component summarizes messages from different sources and formats them in a standardized way. A mining-machine helps with exploring the hidden facts within the data. After the mining runs an indexing component, that saves relevant facts according to an enterprise-wide classification schema. This has to be derived from the underlying data model of the data warehouse in conjunction with descriptors used with a document management system. Based on this, a profile generator produces user profiles that build upon each other like overlapping layers. The lowest layer contains basic profiles of external and internal addressees. Step-by-step the profiles will be refined with help of role definitions for certain functions. Eventually we reach the outer layer composed of personal preferences of single information recipients. Depending on the type of information delivery - push or pull - information elements will be either put down into a stakeholder portal or immediately sent to the requester via a push component.

A controlling and payment component overlays all mentioned areas. On the one hand it is used to pay for externally purchased bits of information. On the other hand side it allows to bill internal departments and points of action for their requests. This

enables us to at least get an idea of the system's performance toward efficiency and economic benefits.

Another cross-functional component serves to adapt the system to the permanently changing information requirements and source profiles.

5. CONCLUSION AND FUTURE WORK

In our investigation we found several starting points where the MLS contributes to improve effectiveness and the cost-benefit ratio of the information supply chain for top management. It serves to reduce the information overflow and enables companies to leverage resources for collecting and refining facts that are relevant for business decisions. The latter is achieved by bundling assets formerly tied up in individual, isolated tools (the three leitstands). It is thus possible to:

(1) make better use of the specialized know-how of staffing the leitstand,

(2) reduce maintenance of metadata structures,

(3) get around procuring redundant pieces of information,

(4) spot and remove any inconsistency more quickly.

As the separate elements have proven to be effective in various environments (e.g. the ELS is part of SAP SEM), the depicted system would not have to be designed and developed all the way from scratch. Instead, it represents a synthesis of these existing modules into one single entity. This fact also underscores the feasibility of such a project.

As was indicated throughout our work, a major issue is to classify triggers, roles and industries for an effective personalization of content. Despite some other research projects in this area, the involved legwork is lengthy and tedious. There are no low-hanging fruits.

It also became clear how important the enterprise-wide classification scheme is. Ontologies and reference modeling techniques for management information could prove to be helpful at this point.

However, one major obstacle to implementation could be the well-known acceptance barrier. Tasks and responsibilities from various functional departments would be amalgamated into the MLS and might cause nays-saying or even turf wars.

As is always the case with information logistics applications, calculating the return-on-investment will not be easy, but should not deter us from trying – an interesting and important area for more future research.

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