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Using innovative approaches when analyzing information systems (IS) failure stories

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***Abstract*—We are living and functioning in an ever-changing environment where technology plays a big role – in businesses and in individuals' lives. Often information systems have to support a variety of these functions. However, failures within these systems are evident and often reported on. In this paper, certain results of a study are discussed where case histories were investigated in which IS stakeholders were asked to share their experiences concerning the development and use of an Information System (IS). They shared stories from their own perspective and context within the organization, focusing on failure situations. These narratives were analyzed making use of three approaches and taking into account the views of multiple-user groups. The contribution of this work was to use a multi-perspective lens in order to gain insight into different users' experiences, to interpret the complexity of the situation, and to listen to the often small voices of lower level users. The benefit of using multiple analysis approaches is improved sense making using the accounts of users in innovative and diverse ways and in doing so central elements can be focused upon when new systems are developed.**

Keywords*— *Information systems, software, failure, success, retrospective, living story, antenarrative, narrative, analysis, project, sense making, complexity, management of computing and information systems, social practice

I. Introduction

The Information Technology (IT) field with all the involved stakeholders repeatedly experiences information system failures. Financial losses are suffered, time is wasted, good reputation is lost, negative publicity is experienced, legal costs can be high and in the worst case scenario, humans may lose their lives [9],[21],[24],[28],[31]. The media disseminates information regarding this phenomenon when they often report the grim stories of failed IS projects - projects that do not meet the time or budget constraints, or do not deliver the expected functionality. Very often frustrations are experienced by role-players if systems fail, do not live up to expectations or are unavailable at times. These negative consequences are by no means comprehensive, but serve as the drive for continuous inquiry and research into IS failures. Very often the research into this field results in the identification of numerous factors contributing to failures, however, success factors are also identified [17],[29],[23],[36]. The Standish Group's findings in their 'Chaos' reports on successes, failures and challenges over a number of years are also often reported upon [16],[22],[34].

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These and other reports indicate the prevailing problem of IS failures that is still experienced in a variety of contexts. This study focuses on an IS in an academic environment that was perceived as having problems. This paper reports on an interdisciplinary study that was conducted to investigate failure stories of stakeholders indicating that innovative methods can be used in order to make sense of these often complex situations where multiple users are involved. The research question can be stated as: "*How can narrative methods be used to make sense of failure stories of information systems stakeholders?*"

The structure of the paper is as follows: in Section 2, background information on the information systems failures and investigation methods are discussed. In Section 3, the methodology followed in this study is summarized. Results and interpretations are given in Section 4. In Section 5, recommendations that can be considered are proposed. In Section 6, the paper is summarized and the contributions are concluded and potential future work is presented.

II. BACKGROUND

In the discipline of project management, we often we see projects as successful when the triple constraint of scope, time and cost are met [32]. There are, however, many other ways in which a software product or information system (IS) can be measured for success, including quality, availably, user-friendliness, etc. For the purpose of this paper, an IS failure is regarded as *'an information system experiencing problems in any of the areas of time or cost restrictions or user requirements not met, or ways that users judge a system; if it is not to their satisfaction, whether during development or during operation' [13].*

There is a plethora of reports and studies on IS and project failures that have been investigated and analyzed. These cases occurred throughout all continents and across public and private domains. Examples include [9],[10],[15],[19],[33]:

- eNATIS (Electronic National Traffic Information System) in South Africa, 2007;
- '22 people wrongly arrested in Australia due to failures in new NZ $54.5 million courts computer system', 2011;
- UK airports grounded; due to failed software that had to track and plan incoming and outgoing flights in one of the world's fullest airspaces, hundreds of flights were cancelled, delayed, or diverted, 2014.

Stakeholders labeled these types of case as: IS failures, disasters, challenged systems, runaways, death-march projects, development failures, etc. Many computer users can relate to these descriptions as these are not isolated cases and can be experienced in everyday life.

The Standish group altered the definition of successful projects to a modern resolution of on time, on budget and with satisfactory results of all software projects [22].

In project management, the lesson-learned report is part of the reflection after working on projects in order to document the issues that need to be remembered for a next time. However, it is frequently only team members who are involved in this activity and sometimes - because of time constraints - this post-project report is not done in sufficient detail.

Researchers over many years have investigated the failure phenomena and put forth several possible ways to improve this situation. Investigation approaches include quantitative and qualitative approaches. The following list indicates some examples of approaches used:

- Identifying lists of factors leading to failure, e.g. risks, project management practices, internal and external factors [20],[23],[27].
- Lyytinen and Hirschheim [26] state that IS failures are multi-facetted and complex and propose that IS failures be studied as dynamic processes that can be shaped by the stakeholders' actions taking into account how stakeholders make sense of the problematic situation.
- Fortune and Peters [19] describe the Systems Failures Approach, which draws on system concepts where the aim is to conduct a systemic interpretation of a failure or potential failure taking into account contextual information.
- Project management approaches can also be used where an example output is the identification of critical factors.
- Interpretive approaches and interaction approaches are also specified by researchers where context and social issues are of importance [11],[13],[19]. These approaches are derived from the social sciences and are based on the notion that reality is socially constructed, and people make sense of reality through the interpretation of data.
- Dalcher [11] and [12] suggest the use of narrative methods where the project, stakeholders, environment, politics and other issues are taken into account when studying an IS failure situation. A case study approach can then be used to explore interactions between people, their feelings, possible bias and their understanding of a situation.

Failure events are communicated by users and all involved stakeholders via stories of their experiences with the IS. The metaphor of 'story' implies that people create order and construct texts within particular contexts. Narrate means to impose order on the flow of stakeholders' experience trying to make sense of happenings. Past activities are linked through narratives but also show how individuals understand those actions [30]. Supporting the use of narratives when looking at failure and success are [1],[18] suggesting that the narrative methodology offers a more 'fully interpretive' understanding of system development. Narrative inquiries are situated around experience that occurred in an environment [35]. Humans help shape the environment in which they are. Narrative inquiry can be conducted in several environments and originally the social sciences were influential in this type of work, including disciplines, such as psychology, psychotherapy, education and history. This study, however, focuses on the IS failure field. Sense making does not only focus on the individual alone; indeed, it is a social practice. Businesses have networks of shared meanings and interactions, as well as divergent ideas that might give indications for additional considerations. [29] and [8] also add to the view that sense making is both a collective and individual method and at times there may be competing stories in a certain situation.

Sense making is also not always straightforward. Cues are extracted from a situation in a specific context, from personal dispositions and from different voices. This issue of context is echoed regularly in the narrative field [2],[4],[8],[30],[29]. Sense making is also about plausibility, coherence and reasonableness. It is not easy to derive one truth from an experience and there can be more constructions of reality [25]. From the above it is evident that narrative is interwoven with sense making. This supports the use of narrative approaches in this study where the experiences of different stakeholders in information systems are investigated. For this paper the following description for narrative is used: '*Narrative refers to stories that stakeholders recount from experiences they were part of in order to 'open up' the activity that they had or what they are still in or what they envisage for the future' [13].*

This interdisciplinary study focused on two main fields, namely information systems (specifically, information systems failure) as well as narrative theory stemming from the social sciences. Narrative analysis approaches were therefore borrowed from another field and applied to the accounts/stories of information systems stakeholders in order to make sense of their experiences about IS failures. The usefulness of three broad narrative approaches will be discussed and reflected upon. In the next section, a summary of the research methods used for this study is given.

III. METHODOLOGY

A. Research methods for this study

The interpretive philosophical stance fits the nature of this research where IS stakeholders' perceptions on IS failure and their accounts of the events regarding an IS are taken into account. Every stakeholder may have his/her own story of what went wrong and the role of the researcher is to listen open-mindedly to as many stakeholders who were involved as possible, or as necessary, and attempt to interpret what was said and what was actually meant.

The case study as strategy was used as it provides insight into a social setting which can be unique to that situation. This strategy was suitable in this study because insight into the failure phenomenon area was gained. The term 'case history' was rather used as the failure situations happened historically and investigations took place after the events [11]. Semi-structured interviews were the main method of data gathering.

A complex IS was identified, which consisted of 19 subsystems and certain stakeholders had expressed their

dissatisfaction when using these systems. Permission was obtained to investigate this setting, thereby complying with the confidentiality of data and participants. Interviews were scheduled with 11 stakeholders on all levels of operation. Different subsystems were included for these cases, e.g. marks, yearbooks, recordkeeping, etc. This was done to get diverse accounts of their experiences with the IS. The ages and experience levels of stakeholders fluctuated. The organization was an academic institution in South Africa with different campuses spread geographically over a few hundred kilometers. There were internal and external groups involved in the development, maintaining and use of the system. Different groups included:

- Users (U) on ground level, e.g. secretaries and financial staff.
- Super Users (SU) taking care of internal queries from the users and either handling it themselves or escalating it to the IT department or to the external company.
- Information technology (IT) staff handling the reported problems themselves or giving it over to the external company (EC).
- Externally an outside company (EC) responsible for new systems development and new functionalities.

A pilot study was first conducted to test the interview process and methods, e.g. recording and transcribing of data. While and after transcribing the interviews, the data were analyzed using three narrative approaches. The researcher found it necessary at times to go back to listen to the original recording of the account to make sure of what was said or implied. Notes were made by the researcher, issues highlighted, lists of themes were constructed using spread-sheets to do mapping of specific issues and between accounts. Lines were drawn between different stakeholders' accounts and perceptions. Specific narrative elements as identified in literature were used as an initial framework for analyzing the data. Issues were grouped into topics and categories for specific groups. The framework was adapted during the process in order to construct a multi-perspective framework for analyzing user accounts. The analysis and mapping using three lenses was an iterative process resulting in valuable information about the usefulness of narrative methods in this setting.

Whilst searching for methods several narrative approaches were studied and compared and reviewed. The work of Clandinin and Connelly [8] was influential in order to come up with an interview agenda. They propose a '*three-dimensional narrative inquiry space where the interaction, temporal and situational aspects are being studied'* [13]. The views of Boje [2] were also instrumental in this work on the analysis approach level. He "stretched" the traditional narrative approaches to use antenarrative methods to open up opportunities for the researcher where stories are not seen as linear with a proper beginning, middle and end. Antenarrative includes fragmented, nonlinear and multi-perspective stories.

In the next three subsections aspects of the broad narrative approaches used in this study are summarized.

B. Retrospective narrative analysis

The phenomenon under discussion (IS failure and users' stories) is analyzed in terms of certain elements including structure, plot, beginning, middle and end, characters and so forth. Du Plooy [14] describes literary theory as a narrative approach and states that when a text is analyzed and interpreted, the following types of element and aspect in the text are identified: events, actors or characters, time and place, language and words used, and psychological, political and ideological issues. This is a classical way of doing narrative analysis and making sense looking back and identifying certain elements within accounts.

C. Living story analysis

The second approach that was chosen for narrative analysis in this study is living story. This is a post-classical approach where narrative is treated as a living story looking at elements such as movement, multi-voices, networks and non-linearity. Context is important and there seem to be turnings and morphing of stories between accounts – as if there is a collective force of authors [3]. Here accounts are viewed not as proper with beginnings, middles and ends. Often only fragments are voiced and they are polyphonic at times. In Boje [6] it is argued that stories have "*aliveness*", whether they are expressed or not. Clandinin [7] adds to this by stating that living story helps to understand and explore human relations and practice.

D. Antenarrative analysis

Antenarrative was initially introduced by Boje [2] to "stretch" the traditional narrative approaches to include incoherent and unstructured accounts. Antenarrative was used to include pre-stories – before a proper narrative is constructed. Later, prospectiveness was added to include forward-looking aspects in the situation [4],[5]. What can be shaped in the future or what are prospects? Examples of elements of this approach are prospectiveness, dynamics, non-linearity and little stories. This post-classical approach is the third analysis method that was used in this study.

Having looked into the three broad narrative approaches that were applied in this study, a framework of the initial elements that were used in the analysis of accounts was constructed. It must be stated that narrative analysis is not straightforward and no one truth exists or no absolute results are possible. Each context and research setting is different and the researcher and participants have an influence on the setting and outcomes. This framework was then adjusted and improved throughout the analysis and interpretation process. The final framework can be obtained in [13]. In the next section, results from the various analyses done in the study are presented.

IV. RESULTS

As this paper is limited in size, only certain results are shared in this section. The method here will be to give an excerpt or exemplar from the accounts of stakeholders, as well as a summary of results from all three approaches used.

A. *Retrospective*

When looking at stories retrospectively, they are analyzed as narrative meaning stories that have a beginning, middle and end (BME) or are whole and linear. Certain elements are identified as stated in Section 3.B.

SU2: "I knew less than the users did - especially in the beginning. It probably took me twice as long as SU1 to go and test and solve the problem. I had to literally tell the user to explain to me what you did. Step A, I went here and right clicked, I did this and that... and I have to say that I got along great with all of them. There was drama with the system and the switching over to Java and the falling over of the system at month end... I admitted it straight forward, I played open cards with them: I need your support to help me. And I immediately got help from them. They understood and there were problems, sometimes there was a lot of pressure because it wasn't just their system that gave them problems, it was my system as well that gave problems. So sometimes it was just if, if you don't know your system well, the problems, some of them take you so much longer to solve."

'Analysis: These examples show the retrospective nature of the accounts. They look back from the time of problematic issues to the current state where they are handling everything much better. There were times when the Super Users struggled to find the origin of errors in order to improve the situation and solve the problems. SU2 also asked for help from more experienced people, thereby contributing to better service delivery. She was also humble enough to ask the users to explain their problems to her step by step. Certain systems or phases of the new system stood out to be more problematic, e.g. conversion to Java.'

From a retrospective narrative approach different issues and concerns from the stakeholders' own perspectives were raised when reflecting on their personal IS experiences. The following are examples of such main elements of all the stakeholders, however, not shared by all of them:

- Satisfaction with system
- Got help from persons in order to survive the new IS
- Had to work very hard to achieve success
- Forged mergers impacted their workload
- Acknowledged problems and mistakes
- Lessons learned
- Solutions offered
- Loyalty towards the system
- Problems, such as training and testing
- Success and failure aspects

The value of the retrospective approach was that certain main foci and elements emerged by analyzing the stakeholders' stories.

B. *Living story*

Living story is about the movement in the now, the unfolding of relationships and interaction of the stakeholders' experiences. It is about own perspective, the here and now, the dynamics of the role-players and the setting and of how stakeholders cope in the present.

SU1: "Yes – at the moment the system has a lot of errors and as people are developing it, the system is not really becoming stable because as you develop a new thing, it affects another part of the system. We therefore have priority lists of the errors that have to be fixed for, say, registration in January, and we handle it as it becomes apparent. If it is a crisis error, it is moved to the top of the list. So the system is continuously busy developing. We are not yet at the point to say that everything is working 100%. Not at all, not close."

'Analysis: The above excerpt appears to have "presentment" (in current time). It shows what is going on at this moment and the system continues to emerge. The system is also without an ending - still being developed. The sense making here is that there are references to activities that are not finalized. There is a pathway from past through present, into future.'

When compared to the previous approach we get evidence that the living story lens looks deeper and more voices are heard in this situation. Problems are highlighted and interpersonal and intra-organizational issues became apparent that would not have been possible with a classical approach. It became obvious by analyzing the accounts of the different groups how the stakeholders survive with everyday challenges in the "here and now" in this living environment.

C. *Antenarrative*

As seen in Section 3.D antenarrative is amongst others about prospective sense making, taking into account contextual information and multi-voices. Complex patterns of collaboration can form where fragments of stories link to other fragments, restorying the pieces into new logic. Moving patterns may be seen that could lead to improved sense making.

SU1: "I feel that we are busy all the time, it feels as if everything flows together, as if there aren't any in-between phases. But when it was implemented, because it was so new, it felt strange, until you became comfortable with it. It took me a year to become comfortable with the system. Where we are today you know exactly what to do, I don't think there is anything in your part of the system that even the EC can tell you about. In the future, there is something new with the new functionality. I don't see myself going away from where I am now. I enjoy what I do throughout the month. I enjoy having control of the student system, the financials, and every day is a challenge. It is interesting."

'Analysis: In this passage we can see the turn from retrospective narrative to an antenarrative (in the future). It seems that SU1 is predicting or forecasting – she does not want to go away. She also accentuates the fact that she is very comfortable with the system – she knows it very well.'

We can see from the above excerpts and analyses that the antenarrative approach was supportive to identify prospectiveness and their feelings about their future regarding the system. The smaller voice is also heard, errors are identified and lessons learned are put forth, thereby influencing the future (development and operation) of the IS.

D. *General*

From the narrative analysis process various lists of elements were drawn up and mapped. Two of these included lists of success factors and failure factors. The shared success factor between all groups of users was USER SATISFACTION. The shared failure factor between all groups of stakeholders was COMMUNICATION. Both these are non-technical factors. It is interesting to note that the Standish factors on success and failure also include user

concerns in the top 10. Many other success factors were identified, including: good technology, availability of the system, meeting of specifications, giving expected results, independent use of system, empowering users, etc.

Some other failure factors that the stakeholders shared were: Inadequate testing, inadequate training, side effects, specifications unclear, programming errors, system not flexible, etc. The order of these lists is random. Some of the factors came from only certain groups of the stakeholders. It could be seen that technical issues were mostly raised by IT and development groups, whereas problematic issues with the use and frustration with response times and continuous changes were uttered by ground-level users. Therefore, the context of each stakeholder influences the perspective of the user.

On an alternative level it was seen that emotions were part of the stakeholders' engagement with the system when feelings and attachment towards the IS were shared with the researcher, e.g. "*You feel that you need to protect it, we put a lot of hard work into it*" and "*It is close to my heart*."

The complexity of the system under investigation also emerged whilst analyzing the accounts. By using more lenses, the stakeholders' issues surfaced as interrelatedness, networks, the complexity of the system within its environment, pressures and forces working in on the system internally and externally, changes that occur in the system and within the stakeholder groups and with the environment. This shows the dynamics of the system according to the stories of the stakeholders. Nothing is static; the system lives and needs to adapt to changes. Stakeholders need to adjust to changes. Possible sense making of this complexity was achieved by analyzing the accounts of the IS stakeholders in post-classical narrative ways. The discussion in this section shows only some of the results from this study. For a comprehensive discussion the reader is referred to [13]. From the various analyses certain recommendations materialized, which are shared in the next section.

V. RECOMMENDATIONS ON IS DEVELOPMENT

By using a multi-lens when analyzing IS stakeholders' accounts, several contributions were made. The methodology of investigating IS failures was enriched, narrative theory was used in a new application area and information systems practice was offered guidelines for developing new systems.

On the level of information systems practice, the following guidelines emerged from the stakeholders' accounts [13]:

- *'Listen and talk to all the stakeholder groups to elicit a collective requirement set for new systems – even though their views may be multi-voiced. All perspectives must be incorporated.*
- *Context is important – developers should know and get familiar with their clients and their environment.*
- *Attain buy-in and establish trust for all the involved stakeholder groups.*
- *Communication lines between stakeholders – e.g. for error-reporting, should be considered and made simple.*
- *If external stakeholders are involved, make sure that they are available in the specific physical environment where the system is being used – especially during new versions or new deployments.*
- *The development lifecycle phases should be reconsidered for each project and planned and implemented for the specific context and role-players, e.g. how will testing, training, users' manuals etc. be handled in this environment, with these stakeholders in order to get optimal interaction and value from the system for the benefit of the client.*
- *Empowerment of users is of essence. How will the IS – the end product – aid to reach this goal?*
- *Be careful and mindful about who is contracted into a project. Language and communication and culture do contribute to successful outsourcing.*
- *No system will ever be perfect – acknowledge this fact.*
- *Views on what constitute success and failure within IS may differ between different stakeholders in a system.'*

These guidelines could be used for subsequent systems development in certain contexts. In the next section the paper is concluded.

VI. CONCLUSIONS

This paper presented a summary and various findings of a PhD study done when classical and post-classical narrative approaches were applied to analyze the accounts of IS stakeholders' experiences.

The classical narrative approach was useful to identify characters, plots and other elements when retrospectively looking into the situation when analyzing the stakeholders' stories. Certain main themes emerged from each stakeholder group. User satisfaction stood out as a success factor, whereas inadequate bad communication was highlighted by all groups as a failure factor. The theory of living story offered richer insight into this phenomenon of stakeholders' experiences of their involvement with an information system. Multi-voices were heard, cycles of coping with changes and challenges were identified, interdependency between systems and role-players were recognized. The small voices were heard and acknowledged. By using antenarrative theory is was possible to identify prospectiveness that was articulated by the stakeholders throughout their accounts.

The value of this study is that this research indicated that the IS discipline has to incorporate not only the main voices (e.g. managers, CIO, etc.) in a situation, but also the small voices (ground-level users) when new IS developments are undertaken in order to enthuse and elevate IS stakeholders on all levels. By retrospectively considering previous IS endeavors, stakeholders can share their experiences of what went wrong before a new IS is planned and developed. It could also be of assistance for developers and designers when stories and ideas are shared by stakeholders about the current IS. Reflecting on future IS possibilities might also be valuable to developers to gain a better understanding of stakeholders' perspectives on IS and their future needs. These three lenses contributed to improved sense making. Narrative analysis

could in innovative ways support IS developments in a pre- and post-project way. It is seen that importing methods from another discipline (social sciences) might add to IS research methods. Future work that may flow from this research includes using additional analysis methods, such as other qualitative, as well as quantitative approaches and applying the framework in another setting or application area, such as security incidents.

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The shared success factor between all groups of users was USER SATISFACTION. The shared failure factor between all groups of stakeholders was COMMUNICATION. Both these are non-technical factors. This study shows that methods from other domains (social sciences) can be used and applied within IS research.