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Feral Information Systems, Shadow Systems, and Workarounds – A Drift in IS Terminology

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Abstract

The aim of this article is to explore and investigate the differences in the terms 'feral information systems' (FIS), 'shadow systems', and 'workarounds'. We have conducted the research by using 41 scientific articles selected based upon the most-cited literature on Google Scholar as well as internal references. Subsequently, an analysis and a discussion of the central articles have been carried out to: 1) Show how each term has been utilized; 2) discover similarities and discrepancies; and 3) verify our findings through existing case studies. The results of the analysis indicate that there is reason behind the differences between the terms. This study, even though not conclusive, has uncovered a deeper problem regarding the usage of IS terminology within the IS field of research.

Keywords: Feral information systems; workarounds; shadow systems; information systems; ERP systems.

1. Introduction

'Feral information system' (FIS), 'shadow system', and 'workaround' are terms used to characterize various aspects of information systems (IS) and the related work processes that are beyond management control. A feral information system can be defined as "... any technological artefact (e.g. spreadsheets) that end users employ instead

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of the mandated Enterprise System...” [13]. Shadow systems can be characterized as systems that “... covertly replicate the data and functionality of formally sanctioned systems...” [1], and workarounds can be described as “... informal temporary practices for handling exceptions to normal workflow...” [9]. We will further explore these definitions in section 2.

The purpose of this article is to analyze the three related terms and the ways they are used to characterize user-controlled aspects of IS. Our research approach is based on a literature study with five research activities. Initially, we searched for literature; each selected article should focus on at least one of the three terms ‘feral information system’, ‘shadow system’, and ‘workaround’. Then, we analyzed the articles by means of a quantitative analysis of their mutual references in order to identify central articles. Next, we reviewed the articles in order to identify the characteristics of the terms, and, finally, we analyzed the articles with case studies to verify some of the characteristics found in the previous step.

This article is structured as follows: First, we provide preliminary characterizations of the three terms ‘feral information systems’, ‘shadow systems’, and ‘workarounds’. Second, we use a quantitative analysis of the articles to identify and select a set of central articles. Third, we review the selected central articles in order to provide final definitions of the three terms, and fourth, we discuss three central findings and some of their implications. Fifth and finally, we conclude the article and suggest directions for future research.

2. Preliminary characterization of terms

Terms like marvel systems, rogue systems, feral information systems, feral systems, skunkworks, shadow systems, and workarounds are used to describe various aspects of IS and the related work processes that are beyond management control. We have decided to focus on the three most widely used terms: feral information systems, shadow systems, and workarounds. The purpose of this section is to provide preliminary characterizations of these terms.

2.1. Feral information systems (FIS)

FIS can be defined as separate systems developed individually or collectively by users to support their business processes. Several studies have been conducted to find the cause of the emergence of FIS. The discrepancies between the capabilities of formal IS and user requirements can cause an agility gap [1]. This gap leads to local and individualistic development to circumvent the deprivation of operational competencies [11]. When the information provided by the formal systems lacks accuracy and reliability, users tend to develop FIS [12]. These issues lead to the development of FIS in various parts of organizations, as each unit has its own localized, explicit knowledge [5, 6]. There is also a possibility that the feral systems have been developed quite some time before the implementation of a formal IS. Thus, it is classified as legacy systems. In this case, the cause of development of FIS is the lack of an IT solution at all [7]. Misdirection in change management can also lead to the development of feral systems as exemplified in a study where a reward system actually encouraged employees to work against the formal system [6].

2.2. Shadow systems

A shadow system is described as an alternative to the existing system formally supported by the organization [1]. Moreover, shadow systems have both positive and negative outcomes and are a result of a gap between the requirements from the stakeholders and the implementation of the ERP system [2]. These gaps are filled by the shadow systems. The systems also rely on few people for maintenance, because little, if any, documentation exists. This is called the “hit by a bus”-scenario. Shadow systems are described as systems that are “… shadows of the ERP system…” [1]. A shadow system is maintained in the shadows, replicating the functionality of the formal ERP system. By filling the gaps, it provides stability at the cost of control and resources used on replication of functions and data. There is a stigma surrounding it, as it is seen as a way of defying management.

2.3. Workarounds

There are three types of workarounds: harmless workarounds, hindrance workarounds, and essential workarounds [4]. Harmless workarounds occur when a system is not used as intended; however, the result of the changed interaction does not have a negative impact on or change the accuracy of the captured data. Hindrance workarounds take place when the intended use of the system is perceived as being too time-consuming, burdensome or difficult. Essential workarounds are workarounds necessary to complete the user's task. After the implementation of a new ERP system, the user is likely to perform hindrance workarounds due to a lack of experience in the new system. The user might even perceive the workaround as an essential one due to his/her lack of insight into the capabilities of the implemented ERP system.

Table 1: Summary of shadow systems, feral information systems, and workarounds

Shadow systems	Systems which replicate in full or in part data and/or functionality of the legitimate systems of the organization [2]. Covertly replicate the data and functionality of formally sanctioned systems [1].
Feral information systems	An information system [computerized] that is developed by individuals or groups of employees to help them with their work, but is not condoned by management nor is part of the corporation's accepted information technology infrastructure. Its development is designed to circumvent existing organizational information systems [5].
Workarounds	When a path to a goal is blocked, people use their knowledge to create and execute an alternate path to that goal [8]. Informal temporary practices for handling exceptions to workflow [4].

3. Analysis of articles

In this section, we will present our analysis and the findings.

3.1. Quantitative analysis

The quantitative analysis of this research is based on 41 articles, each containing at least one of the terms 'feral information systems', 'shadow systems' and 'workarounds'. The purpose of this activity is to identify the differences and similarities of the three terms. We found it highly important to include as many articles as possible in order to provide a solid foundation for the identification of the central articles. This could also help to analyse how, when, why, and where each term was used. Most of the articles make use of the terms in different contexts, and for the same reason, we were encouraged to distinguish between the terms.

The research has resulted in a total of 41 articles, among which 11 related to feral information systems, 18 articles were about shadow systems, and 12 articles about workarounds. In order to show how the articles are interrelated and used, the network structure in Figure 1 is depicted. In the network, the different symbol sizes illustrate the relative amount of internal references that each article contains, i.e. the arrows coming in show that the article was used as a reference in those articles from which the arrows come.

Circles, squares, and rhombuses represent the terms feral information system, shadow systems, and workarounds, respectively. Furthermore, the number in each symbol is based on the amount of total citations from Google Scholar ranked from most (1) to least (43). It can be observed from the network that the articles with the same terminology build clusters or communities by referencing each other. However, at the same time, there are bridges between these communities meaning they are clearly not unrelated topics.

The network shows that article number 1 has only two internal references, even though it has 161 in total according to Google Scholar. This might be due to the fact that the article was published in "Journal of Organizational Change Management" which is a more established field of research. Another reason might be the limited time. Therefore, we could not have collected the articles with article 1 as their internal references.
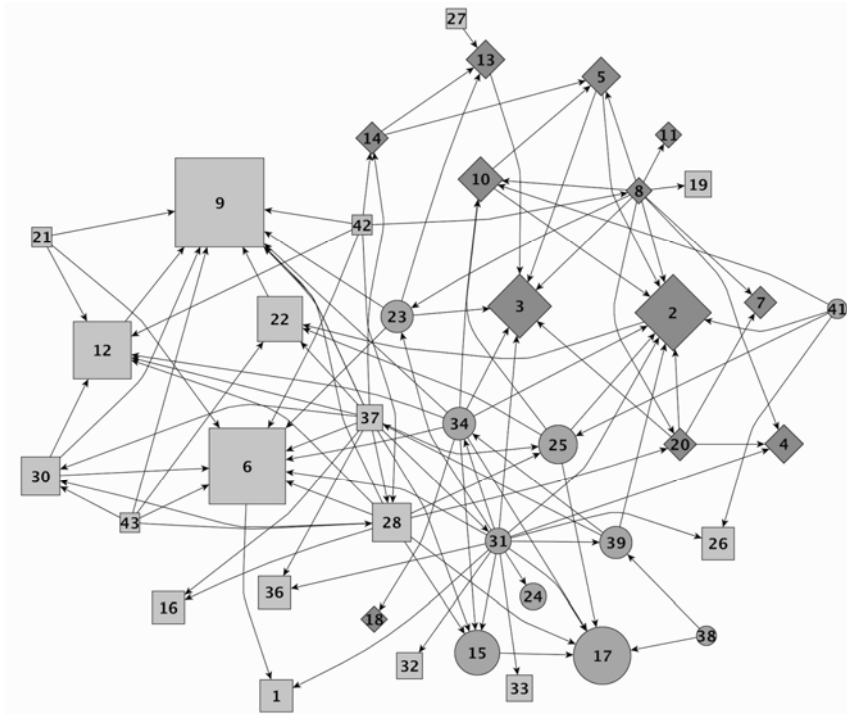
Figure 1. The network structure of feral information systems, shadow systems, and workaround literature

With limited time to conduct the research, we decided to base our qualitative analysis on two articles for each of the three terms. To be more specific, we used articles 2, 3, 6, 9, 15, and 17, which, according to the network structure, are also those articles that most commonly use the terms. Notable mentions are articles 31 and 34, both of which aim at bridging the three terms. The complete list of articles that we used for the network structure can be found in Appendix 1.

In summary, our network structure analysis of the three terms shows that the workaround term is the most used and popular term compared to the other two terms.

3.2. Qualitative analysis

The three terms are used to describe a misalignment between the IT aspect and the organizational aspect of the business, characterizing them as socio-technical systems [10]. These gaps are in the socio-materiality [10]. The gap exists because the users utilize the technological subsystem with a specific agency, e.g. their requirements, but due to the materiality of the technology (e.g. the implementation), the affordances they achieve do not fit their agency. These gaps can appear or evolve over time as the human agency changes across space and time, but the materiality sustains.

Both FIS and shadow systems seem to address the discrepancies between management decisions and user behavior. In shadow systems, they call it stigma or defying management, and in feral information systems, it is called power relations. The difference seems to be that the stigma is a result of the shadow systems while the power relations are described as one of the causes for the feral information system. Workarounds seem to be the only term mentioned for alternative uses of the ERP system without negative effects. It is also the only term where time consumption and difficulty are classified as specific issues. The notion of legacy systems as systems formally supported in the past or the systems existing before the introduction of a formally supported system seem to be unique for FIS. Both workarounds and shadow systems are used for primarily reactionary systems, e.g. systems that evolve after the introduction of ERP systems.

FIS and shadow systems are perceived to be more long-term than workarounds [8].

Table 2: Summary of similarities and differences between the terms

	Feral information systems	Shadow systems	Workarounds
Can originate as a legacy system	X		
Caused by time-consuming or difficult ERP system			X
Caused by misalignment between requirements and implementation	X	X	X
Associated with discrepancy between management and users	X	X	
Short term			X
Long term	X	X	

Table 2 sums up the differences and the similarities. There is a clear overlap between the terms which confirms that they are related. However, distinctions are also found, particularly between workarounds and the other two systems in the time aspect of short-term versus long-term. In addition, shadow systems appear to be the subsets of FIS with the difference that FIS can include legacy systems. To explore that relation further, more research on the subject is needed.

3.3. Classification model

We have mapped the articles on the dimensions of 'short term'/'long term' and 'technology'/'process' in an effort to verify some of the findings we found in our qualitative analysis. All of the 41 articles that based their research on a case study were analyzed. In the described FIS, shadow systems, or workarounds within the case studies, we aimed to identify two dimensions of the implemented system. The first dimension focuses on the system's technological attributes, i.e. if it included a technology or a process change. The second dimension aimed for the time attributes of the system, i.e. if it was a short-term fix or a permanent (long-term) solution. 26 of the 41 articles were referencing case studies. The identification of these two attributes in all 26 case studies was made through a scheme where the outlines of a technological change and a process change were defined. In this context, a technology change means the change or integration of a new technology to circumvent obstacles, whereas a process change means the change of the workflow by not using the intended system or circumventing it without technology.

Defining the short-term/long-term aspect was challenging. Here a system, which was not repetitively used and rather described as a quick fix than a solution as *short term*, whereas a system that was repetitively used over a longer period of time was seen as a long-term solution. We then integrated the articles in the matrix and changed from absolute to relative numbers. The result is illustrated in Figure 2. We found that 64% of the workaround articles using the term workaround tend to have a process change, while 67% of the FIS articles have a technology change. The picture in shadow systems seems less conclusive with a 56% in technology and 33% in process, while 11% is in the middle. There is no clear correlation for workarounds and shadow systems as to the short-term versus the long-term aspect. In FIS, 67% of the articles that have conducted case studies have been identified as a long-term solution. Summing up, we aimed to map the characteristics of the three terms based on their existence (short or long term) and approach (technological or process-related). From this, it can be extracted that workarounds address the process-related issues, whereas FIS relates to technological approaches, and shadow systems stands in between. In addition, both shadow systems and FIS are seen as long term, while workarounds are only a short-term solution.
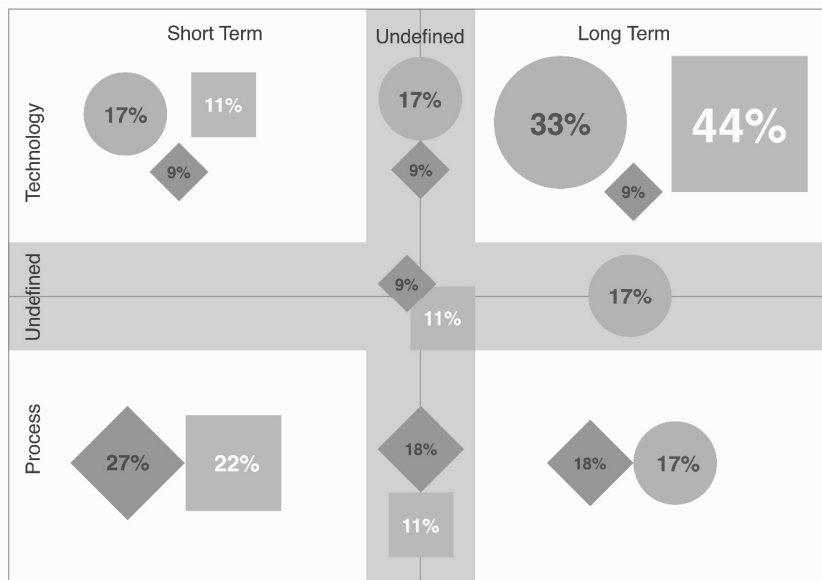
Figure 2. Classification matrix: Workarounds denoted by rhombuses, FIS by circles, and shadow systems by squares

4. Discussion

We can synthesize from the quantitative analysis that FIS, shadow systems and workarounds are related, but distinct terms. There are multiple facts proving this assumption. First, the analysis of the terminology used in the articles identified the dominating three terms. We tried to connect these terms via an analysis of the internal references between the articles. Here, the majority of links were found within the same terminology. These articles build clusters of authors using the same term. Second, we found several articles which are cross-referencing to different clusters and thereby bridging the terms. For the quantitative analysis, it means that there is a risk of overinterpreting the use of the terms by the authors, when they were not making a differentiation. This is a clear indication that the terms are linked.

It is worth noting that some articles using one term cite results from other articles that use a different term. Due to the fact that these authors do not address the different use of terminology, the validity of the results may be affected as characteristics may have been transferred between terms. The implication of this is that researchers need to be more aware of their terminology usage or risk loss of nuances due to concept convergence. We tried to quantify this convergence of the terminology in the classification matrix, where we analyzed the dimensions process/technology as well as short/long term. The results of classification support the assumption that the terms are distinct topics. The reason derives from the analysis of the case studies. In 26 different case studies, the tendency towards different poles of the dimension technology/process, depending on the used terminology, was noted. The dimension short term/long term, however, did not contribute to the findings. While the findings from the classification matrix might hint a tendency, the amount of data on which it is based is not sufficient for a generalization and thus not conclusive. Furthermore, the classification of the case studies is based on the individual assessment of the system in question and therefore, an argumentation based upon that is vague.

5. Conclusion

We have identified the two most central articles for each of the terms 'feral information systems', 'shadow systems' and 'workarounds'. Our network analysis shows that these articles should be the main starting point when working with one or more of the terms. Furthermore, we have identified differences and similarities between the terms as

presented in Table 2 from which we can gather that they are similar, yet distinct. Due to this similarity among the terms, scholars and practitioners alike are encouraged to consider which of the terms would fit their misfit the most and share these considerations with the reader. Finally, we have proposed a framework for discussing differences between the terms. This framework could be used to explore other characteristics in the field or explore the matrix (long term versus short term and process versus technology) in more depth. Moreover, IS professionals and researchers can use our work to identify central research articles about FIS, shadow systems and workarounds. Future work includes a more comprehensive literature study based on a rigorous search for and identification of relevant articles. Our results can be evaluated and potentially modified if a larger set of articles is analyzed by means of the techniques we have applied. Additionally, complementary analysis methods could be used to analyze the relations between articles and terms by means of e.g. linguistic analysis of the articles' textual content.

Appendix A. Analyzed papers

The following table contains all reviewed articles. The column "Ref" contains the number of references to the articles. The column "C" identifies articles that are based on case studies (N=No, Y=Yes).

#	Article	Ref	C
1	Shaw (1997). Intervening in the shadow systems of organizations. Journal of OrgChange Mgmt	161	
2	Ferneley and Sobreperez (2006). Resist, comply or workaround? An examination of different facets of user engagement with information systems. European Journal of Information Systems	154	x
3	Koopman and Hoffman (2003). Work-arounds, make-work, and kludges. IEEE Intell. Syst	100	
4	Pollock (2005). When Is a Work-Around? Conflict and Negotiation in Computer Systems Development. Science, Technology & Human Values	84	x
5	Azad and King (2008). Enacting computer workaround practices within a medication dispensing system. European Journal of Information Systems	64	x
6	Behrens (2009). Shadow systems. Communications of the ACM	59	x
7	Saleem et al (2011). Paper persistence, workarounds, and communication breakdowns in computerized consultation management. International Journal of Medical Informatics	44	x
8	Alter (2014). Theory of Workarounds. Communications of the Association for Information Systems	39	
9	Behrens and Sedera (2004). Why Do Shadow Systems Exist after an ERP Implementation? Lessons from a Case Study. PACIS 2004	39	x
10	Ignatiadis and Nandhakumar (2009). The Effect of ERP System Workarounds on Organizational Control: An interpretivist case study. Scandinavian Journal of Information Systems	34	x
11	Petrides et al (2004). Costs and benefits of the workaround: inventive solution or costly alternative. Intl Jnl of Educational Mgt	32	x
12	Jones et al (2004). The Rise and Fall of a Shadow System- Lessons for Enterprise System Implementation. ACIS 2004	31	x
13	Handel and Poltrock (2011). Working Around Official Applications: Experiences from a Large Engineering Project. ACM 2011 conference on Computer supported cooperative work	22	x
14	Debono et al (2013). Nurse's workarounds in acute healthcare settings: a scoping review. BMC Health Services Research	22	x
15	Kerr et al (2007). Power Relationships that Lead to the Development of Feral Systems. AJIS, 14(2).	21	x
16	Ortbach et al (2013). What Influences Technological Individualization? An Analysis of antecedents to IT consumerization behavior.	16	
17	Houghton and Kerr (2006). A study into the creation of feral information systems as a response to an ERP implementation within the supply chain of a large government-owned corporation. International Journal of Internet and Enterprise Management	16	x
18	Poelmans (1999). Workarounds and distributed viscosity in a workflow system. SIGGROUP Bull.	16	x
19	Eckerson and Sherman (2008). Strategies for managing spreadmarts. Migrating to a Managed BI Environment. [online] 1105 Media, Inc.	15	
20	Huuskonen and Vakkari (2013). "Did It My Way": Social workers as secondary designers of a client information system. Information Processing & Management	10	x
21	Silic and Back (2014). Shadow IT :A view from behind the curtain. Computers & Security	9	x
22	Rentrop and Zimmermann (2012). Shadow IT Management and Control of unofficial IT. International Conference on Digital Society	8	
23	Thatte and Grainger (2010). Feral Systems: Why Users Write Them and How They Add Value. In Fifth Pre-ICIS workshop on ES Research, St Louis	5	
24	Houghton and Kerr (2004). Understanding Feral Systems in Organisations: A case study of a SAP implementation that led to the creation of ad-hoc and unplanned systems in a large corporation. In 9th Asia-Pacific Decision Sciences Institute Conference.	4	x
25	Spierings et al (2012). What Drives the End User to Build a Feral Information System?. Australasian Conference on Information Systems	4	x
26	King (2012). The upside of shadow IT. Computerworld	4	
27	Quast and Hande (2012). Social Information Systems: The End of Shadow Applications?. ICEIS 2012 - International Conference on Enterprise Information Systems	4	
28	Zimmermann, S. and Rentrop, C. (2014). On the Emergence of Shadow IT-A Transaction Cost-Based Approach.	4	x
30	Rentrop, C. and Zimmermann, S. (2014). Shadow IT Evaluation Model. Federated Conference on Computer Science and Information Systems	4	
31	Tambo and Bækgaard (2013). Dilemmas in Enterprise Architecture Research and Practice from a Perspective of Feral Information Systems. IEEE International Enterprise Distributed Object Computing Conference Workshops	3	x
32	Petro (2016). On empowered users, rogue & shadow IT, stealth clouds and the future of corporate IT. [online] ITSM Portal	3	
33	Sherman (2006). The Data Shadow System Conundrum. Information Management	3	
34	Urus et al (2011). Post-ERP Feral System Taxonomy- A Manifestation From Multiple Case Studies. European Conference on Information	2	x

	Management and Evaluation		
35	Kerr (2008) Feral Systems and Other Factors Influencing the Success of Global ERP Implementations. In Enterprise Resource Planning for Global Economies, IGI Global	2	x
36	Noyes (2007). Shadow IT. Government Executive	2	
37	Zimmermann et al (2014). Managing Shadow IT Instances: Method to Control Autonomous IT Solutions in the Business Departments. Twentieth Americas Conference on Information Systems, Savannah	1	x
38	Burgess and Singh (2012). Using the social system of a supply chain to improve a focal organization's operating performance. Oper Manag Res	1	x
39	Spierings et al (2016). Feral Information Systems Viewed Through the Lens of Structuration Theory. 11th International Conference of Decision Sciences institute and the 16th Annual Conference of Asia-Pacific Decision Sciences institute	1	
41	Bækgaard et al (2014). Architectural Issues Related to Feral Information Systems. Managerial Implications	0	
42	Haag and Eckhardt (2015). Justifying shadow IT usage, 19th Pacific Asia Conference on Information Systems.	0	x
43	Myers et al (2015). The Impact of Shadow IT Systems on Perceived Information Credibility and Managerial	0	x

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