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## **Feral Systems: The Likely Effects on Business Analytics Functions in an Enterprise Resource Planning System Environment.**

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### **Abstract**

*This paper looks at a case study of an Enterprise Resource Planning System (ERP) implementation in a geographically dispersed utility company and the approach by middle management to several problems perceived by them to be problematic. Their approach was to develop systems outside the implemented ERP. These are referred to as feral systems and the implication of these in terms of effective business analytics (BA) are discussed. The paper contends that despite the extremely effective databases and sophisticated modules for business analytic functions within most ERP's, middle managers are still in the "just in case of an incident" mode of inventory management and data entered in their own feral systems may be significantly different to the inventory levels recorded in the main ERP. The implications to accurate forecasts from BA modules are also discussed.*

### **Keywords**

Enterprise Resource Planning Systems, Business Analytics

### **INTRODUCTION**

This paper continues with the concept of "feral Systems" proposed by Kerr, Houghton and Burgess (2007) by placing it in the context of their effects on the efficiency and accuracy of the business intelligence (BI) or business analytics (BA) functions within the enterprise resource planning system (ERP) environment of a large organisation. Kerr, Houghton and Burgess (2007) discussed the feral systems phenomena and provided some explanations for the reason for their development in terms of power imbalances within the organization. In particular, (Kerr, Houghton and Burgess 2007 pp. 142) have defined feral systems as "an information system [computerised] 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 organisational information systems".

This paper concentrates on feral systems and how their development and use with respect to reporting inventory levels could result in a different supply and demand analysis outcome. It is a contention in this paper that the inventory levels in feral systems could be vastly different to the centralized ERP levels. It is suggested that acknowledgement of these feral systems by upper management may improve the accuracy and effectiveness of BA initiatives within *Utilcom*, the focus of the case study. It is also contended in this paper that these (hidden inventory) levels are quite substantial and this is due to the need by middle managers of the assurance of ready accessibility to inventory items in times of an emergency. This requirement at *Utilcom* could be associated with the organisation's culture of the "hero" manager who can restore services very quickly after an emergency.

Feral systems are argued to be those mechanisms which circumvent regular systemic procedures to the extent that they create alternative means of accessing data. Previous research (Houghton and Kerr 2006) has found that feral systems are developed (usually by the managers themselves) to provide information to middle managers about inventory levels in a "just in case" fashion rather than the "just in time" approach advocated by many value or supply chain software modules within the ERP environment.

Just in time management refers to the practice of keeping 'just enough' stock in inventory as is required for the day to day management of the enterprise (Stalk 1998). On the other hand the JIC approach highlights the 'just in case' practice of keeping an emergency supply 'just in case' in is required. The two are valid responses to emergent phenomena and are probably different ends of the productivity paradox. In particular, SAP is noted for it's ability to optimise processes (Holstrom 2000; Scheer and Haberman, 2000).

For example SAP provide information about the benefits of their BA modules in the following way "Online analytical processing, data mining, and alerts provide a foundation for accessing and presenting data, searching for patterns, and identifying exceptions." (SAP 2008). While these terms in themselves do not indicate that this particular module is a device for JIT or JIC management practice, there is no shortage of literature that highlights SAP's analytical and process driven capabilities. As Soliman and Youssef (1998) argue, SAP is not *just* a tool for optimising inventory... it's a process driven 'reengineering' tool, that is often used to create new change processes (Martin and Cheung 2000) and move an organisation towards such optimisation on much bigger scale (Larsen and Myers 1998). Perreira (1999) also argues a similar point stating that SAP reengineering process should be used to *change* organisational culture towards the process optimisation built into SAP. This stems from the efficiency driven research agenda from Hammer and Champy (1993). It does not then require a massive intuitive leap to see that the process minded methodology inherent in the literature and SAP also highlights an underpinning lean manufacturing ideal (Al-Mashari and Zairi 2000). Others like Quattrone and Hooper (2001) have made similar assumptions.

Space does not permit the discussion on how process minded methodology drives lean manufacturing processes and this discussion is outside the depth of this paper. JIT drives at efficient processes through the use of a device like SAP in order to 'optimise' inventory and business processes as well. This is noted in Huang et al, (2001) who argue that a the desire to use an ERP is linked to the concepts of inventory optimisation. It is therefore a fair argument to make in reference to SAP that it relies on the lower order concepts of JIT and JIC.

These terms indicate a "just in time" approach to inventory management, however middle managers are often concerned about the effective operations of their section and as such like to have controls (plan B's) in place in case there is an emergency. This often leads to tensions between centralized management of inventory and the "just in case" approach many middle managers feel they need in order to give them a comfort zone for emergency situations.

Due to the increasing numbers of ERP implementations and with increasing emphasis on supply chain management and customer relationship management and subsequent data warehousing, there are increasing opportunities for the BA functions within ERP systems to be used to produce forecasting and other models to help businesses to make better decisions. (Shanks, Seddon and Willcocks 2003). For example Arnott and Pervan (2005 page 71) report that "The business intelligence (BI) movement of the late 1990s changed the direction or emphasis of EIS [executive information systems] by focusing on enterprise-wide reporting systems" The research shown in the paper we are presenting here indicates that, with respect to inventory management and forecasting, even if the BA functions within an ERP system were used more effectively, their usefulness may not be as good as expected due, in part, to the "just in case" approach to inventory management that appears to be adopted by middle management in some organisations.

Other research into ERP implementations have identified various impacts of ERP use and the authors of this paper suggest that some of these factors could be indicators that the feral systems phenomena may also be prevalent in other companies. For example, Rikhardsson and Kræmmergaard (2006, pp. 36) report that a study of six Dutch companies revealed that "the impact of ES [ERP] implementation and use are seldom fully predictable by management. The ES [ERP] can be seen as an organizational actor in its own right; to a large extent, it influences values, culture, behavior, processes and procedures of other actors in the organization". This paper contends that the impact described above also affects the way employees try to cope with the changes and that it is very difficult for many employees to suddenly change their values, culture, behavior, processes and especially their procedures for doing things. It is during this difficult adjustment time that the development of feral systems or the continuation of existing feral systems occurs.

Other research provides indicators of employee dissatisfaction with ERP implementations and we contend that this situation of unrest and dissatisfaction is a breeding ground for feral systems development. For example, although feral systems are not explicitly stated, the research reported by Rikhardsson and Kræmmergaard (2006, pp. 41) indicates a level of dissatisfaction amongst employees. Statements such as" All the companies mentioned that the time after going-live was characterized by user insecurity, changes, brush fires, frustration due to errors in system set-up as well as unfamiliarity with the new system" and "Some mentioned that the actual challenge was not always to get the software and hardware to work properly but to change employee behaviour and attitudes" leads to the possibility of the development of feral systems and the resultant problems with reporting and data analysis. Although Rikhardsson and Kræmmergaard (2006) did report improved IT functions

within the study companies, it is contended that this was reported in terms of the accounting parameters associated with the authors' discipline while the research reported in this paper relates to operational management within a geographically dispersed utility company. This difference in perspectives with respect to success is emphasized through the ERP implementation at *Utilcom*. The *Utilcom* implementation was initiated by accountants within the company and changes in accounting procedures and reporting to activity based costing were a major consideration in the decision to implement the ERP in the first place.

In other research, Gattiker and Goodhue (2004) used organisational information processing theory to determine factors that affected the local-level costs and benefits of ERP implementations. These researchers found that two organisational characteristic, namely interdependence and differentiation were related to activity coordination and information flows. Gattiker and Goodhue (2004) also determined that if differentiation between sub units was high then the organisation had to make compromises with respect to the ERP implementation. It is conjectured in this paper that many companies do not make the necessary compromises or changes to the basic "plain vanilla" version of the ERP due to the high costs associated with any modification. It is circumstances such as this that encourage the development of feral systems and this is demonstrated in the case study with *Utilcom* which has a high level of sub unit differentiation due to their large network infrastructure, the decision to implement the ERP with no modifications and their culture of "just in case" inventory.

Recent literature has questioned the strategic advantage the use of information technology (IT) has claimed to provide to companies. For example the well publicised Harvard Business review titled "Does IT matter?" by Nicholas Carr (Carr 2004) has resulted in a great deal of debate by both practitioners and Information Systems academics alike with respect to the advantages the technology can offer. The authors believe that IT can provide massive competitive advantages through BA by providing forecasts of future trends and analysis of existing trends in existing databases; however this advantage could be severely depleted if the data in the centralized ERP is not accurate.

This paper looks at interviews from a case study organisation that demonstrates circumvention of the ERP system in favour of this "just in case" approach to inventory management. The study demonstrates that informal reward structures are in place that encourage this behaviour. The implications to organizations can be enormous from the perspective of inaccuracies in centralized data resulting in reductions in the effectiveness and accuracy of business analytics such as data mining and forecasting. The authors wish to highlight that the following case is not indicative of all inventory management systems an neither is it likely to be the only 'feral' system. The case is supplied as an example of this phenomena in light of recent developments in the sphere of business analysis. More to the point, other feral systems could exist (and indeed the authors have highlighted this in Previous work – see Houghton and Kerr 2006, for example) in the context of this organisation. What follows is a descriptive empirical case study that points towards the possibility of a long term trend (see Eisenhardt 2008 for a better discussion on the nature of using multiple cases to prove theory) yet the available evidence to the authors at the time of this research suggests that further research would be needed until reasonable conclusions could be drawn. What follows is a description of inventory management practice as noted in one instance. As the authors have reported elsewhere (see above) other feral systems are likely to exist in this particular organisation.

### **The Case Study**

The case study is "a large, asset rich transport utility" called *Utilcom* (a pseudonym). The research at *Utilcom* was qualitative in nature with interviews with key stakeholders in the supply chain being conducted. The corporation has an annual turnover of over 2 Billion dollars (AUD) and employees over 13,000.

*Utilcom* implemented the ERP, SAP R/3 in 2005. The company was one of the last to change from R/2 to R/3 due in the main to the large investment they had made in terms of modifying the R/2 software to suit their own business processes. It wasn't until SAP told *Utilcom* that R/2 would no longer be supported that they finally decided to upgrade. *Utilcom* also decided to not to make the same error with respect to R/2, rather they implemented R/3 with the aim of modifying their business processes to suit the software. The implementation was designed to improve reporting and other functions including providing business intelligence capabilities. The modules involved in the implementation were: financial; material management; logistics; forecasting and planning; materials resources planning (MRP); human resources; information systems including executive information systems; project management; and office integration.

### **METHOD**

This research uses an interpretative case study approach (Klein and Myers 1999, Walsham 1993). It attempts to gain insights into the social aspects of the recording of information in the supply chain within *Utilcom*. This

research can be facilitated by a case study approach (Stake 1995; Yin 1994) using a combination of evidence sources as also advocated by Klein and Myers (1999). The sources used in this inquiry are described in Table 1.

Table 1 – Data used for this case study

Source	Sources used in this case study
Documentation	Intranet postings, company annual reports and reports by the information technology section of <i>Utilcom</i>
Participant observation	During the three month period at <i>Utilcom</i> , one of the authors participated in training and conversed with personnel within <i>Utilcom</i>
Interviews	The semi-structured interview approach was used

The research project was conducted as two stages. The first stage was designed to develop an understanding of the workings of the supply chain and how factors such as social, technical and political factors interacted with each other. This first stage involved 31 semi-structured interviews with key stakeholders along a supply chain associated with *Utilcom* and pointed towards concerns about the future usefulness of the yet to be implemented SAP R/3. The second stage (conducted a year after the SAP implementation) consisted of 16 semi-structured interviews conducted with previously identified experts in the *Utilcom* supply chain. These experts were identified as key personnel within the supply chain by the research team and in consultation with the General Manager of the supply division of *Utilcom*.

The expectations of the new implementation were manifold and the supply division of *Utilcom* considered SAP R/3 to be a useful system for determining inventory levels and transactions across the whole supply chain. However, the results from interviews conducted during Stage 1 of the research showed that some concern was expressed about understanding the day-to-day operations of the supply chain.

## RESULTS

This section is divided into the results from the three data sources shown in Table One.

### Documentation

The documentation at *Utilcom* portrayed a positive slant to the ERP implementation and none of the publicly available documentation mentioned the use of relevant modules of SAP for BA. Intranet postings were available to all employees at *Utilcom*. There were no negative comments about the SAP implementation and no information was given about the possible strategic use of the system.

### Participant Observation

One of the authors spent three months at the headquarters of *Utilcom* and this time enabled him to observe the implementation process of SAP. This period of study allowed the research team to more fully understand the underlying history of the SAP implementation. The relationships developed and observations made over the three month period at *Utilcom* enabled the authors to gain an appreciation of the broader context of the ERP implementation through the insights of this author's involvement. This enabled a degree of relationship building with the actors within *Utilcom* and allowed for a better interpretation of the meanings within the interview transcripts.

The participant in the observation is an experienced researcher with an appreciation of both qualitative and quantitative approaches to research within the Information Systems discipline. He was on academic study leave while undertaking the participant observation during this case study and had some knowledge of the problems of ERP implementations at *Utilcom* through his association with a general manager at *Utilcom*. The participant was able to attend meetings and training sessions in the organisation. He was also able to have informal discussions with staff.

The meetings covered many aspects of inventory control within the supply (shared services) division of *Utilcom* as well as the upcoming SAP R/3 implementation. Informal discussions related to concerns about how the help desk could handle "go live" day and the fact that many operational staffs were still not trained. Other discussion points included workarounds for training and these included repeatedly hitting the return key in order to speed up the training process. This technique appeared to be adopted by many and the training sessions became a non thinking mechanical process in order to speed up training and allow the worker to get back to work or go home as soon as possible.

## Interviews

Interviews were semi-structured and open-ended in nature with questions expanding on emerging themes asked as required. The initial 31 interviews (the first stage of the research) were conducted before the implementation of the SAP R/3 and the remaining 16 were conducted a year after implementation. Coding of the relevant theme was completed by the open coding method (Nueman 2003). This involved organizing transcript passages into concepts and emerging themes by looking for a consistent pattern. Insights from this first series of 31 interviews led to the following research question:

How effective is the current ERP approach in providing a method for employees to obtain data relevant to their own job requirements?

The Stage one interviews indicated that many of the staff at *Utilcom* was not fully convinced of the usefulness of the ERP implementation. This was emphasised in many occasions during both the first and second stage interviews and led to many “work-a-rounds” by staff. This identification of “work-a-rounds” led the authors to the concept of “feral systems” (Kerr, Houghton and Burgess 2007).

The second stage of interviews again used the semi-structured approach and expanded on the themes identified in the first stage of interviews.

## Feral Systems and Business Analytics Initiatives

As mentioned earlier, the feral systems phenomena has been established in earlier research, however the context with respect to inventory management and the possible implications to BA have not been discussed in much detail. The existence of feral systems in *Utilcom* was first established when middle managers were talking about what they referred to as “grass stocks”. That is stocks of inventory parts that were kept in places other than warehouses for the “just in case” emergency situation. Records of these grass stocks were usually recorded on spreadsheets or databases entirely separate from the ERP system.

The case study interview transcripts revealed many cases of these grass stocks or hidden inventory. For example in the second stage of the research in response to the question “So you think that SAP has some doubtful figures?” a respondent answered

*“That’s what I’ve been led to believe from speaking to various people who are right into SAP which is an avenue I don’t pursue but the figures seem to be different in a business warehouse to an SAP type figure. Queries get run and you get results, the level of confidence just isn’t there.”* (Lower Manager – analyst)

Other comments such as “Patterns are not easy to find (no smart tool to find patterns in the data like missing inventory etc.)” and “Missing inventory because of ‘under the counter’ just in case and “a lot of grass stocks (hidden inventory items not shown in the central inventory)” indicate a misunderstanding or mistrust of the system and the reports it produces.

Other examples include statements by middle management (an engineer)

*“... I rely heavily on we’ve got a diary that tracks all material usage on a daily basis so it will have on there how many [of the product] we unloaded today so Bruce will come in write in the diary in what section, how many lengths of [product] he does. That diary then goes into a database internally within here and onto a spreadsheet ...I do the inventory audits probably once every 3 to 6 months ... sort of thing.”*(Construction Engineer)

This statement indicates a high level of internal information systems (feral systems) are developed and used to either supplement the SAP system or replace it. In either case there is not certainty that the information will be recorded centrally in the ERP

The use of feral systems was further confirmed in Stage 2 interviews when the researcher mentioned the feral systems concept, respondents recorded statements such as;

*“Yes that’s a very good point and the people that make these feral systems will have no end of argument about why they are needed and yes there may be justifications but at the end of the day if everyone goes down their own little track with their own systems we are going to be in the same position as we were before we implemented R3”* (Upper level manager)

Other respondents indicated that feral systems may not be as much of a problem as indicated and that they could be confused with other reporting tools, for example;

*“Certainly we've pulled data out of SAP and put it into Access databases or Excel spreadsheets to do various manipulations so to that extent yes we are doing that but I don't see them as feral systems. I see those as different reporting tools” (Upper level manager - commodities)*

On the other hand the same respondent indicated that he could see problems with feral systems in certain cases where there was little or no visibility for the organisation, for example:

*“At the other end of the equation there are a number of customers who are doing their planning outside of SAP so there is no visibility for the organization because their planning exists in Excel spreadsheets or access databases and isn't rolling up into any corporate plan so that does create a problem” (Upper level manager - commodities)*

And

*“(Interviewer) The information from [supervisors], how does that information come? Is it stored in [enterprise] system?(Interviewee) [no] stored in email and excel. But can be referred back to. (Interviewer) Is that shared with others or not. (Interviewee) No not really.[we use] emails and telephones.*

In the selected quotes above, none of the interviewees perceive a need to get information back into the main ERP system for either forecasting or knowledge management purposes.

## DISCUSSION

The attitudes shown in this research appear to support Carr's contention that IT is treated as an infrastructural technology<sup>1</sup> (at least by *Utilcom* but we suspect in many other Australian companies) and that in many cases business is guilty of assuming that the opportunities for gaining competitive advantage will be available indefinitely and without any strategic use of available BA modules. The fundamental concern with Carr's thesis is that if IT is treated as an infrastructural technology, the promises of competitive advantage will not flow through; in other words, just because a company has the technology, it doesn't mean that it will benefit from it unless it has a well thought out plan that will ensure IT is used to its maximum competitive advantage and not just as a commodity.

The authors believe that IT is more than simply an infrastructural technology, unlike the railway and electricity examples outlined by Carr (2003); IT doesn't just work by plugging an appliance in or running a locomotive along a railway line. Other important human factors need to be considered and while these same factors were of concern with the introduction of railways and electricity, the technology was far less complex. For example, the improvements in decision making that accrue from the use of BA technology are far more abstract and intangible than the use of an electrical appliance, facilitated through plugging into an electrical circuit. The development of an IT strategic plan that includes the use of BA is an essential aspect in ensuring that the technology can deliver the promised strategic and competitive advantage that has been promised by much of the information systems literature. If Australian businesses wish to remain competitive in world markets, they need to adopt world's best practice with respect to the use of BA approaches.

This research may provide an insight into potential problems with BA approaches using centralized ERP modules as it appears that the “real data” maybe different to the data reported in the ERP system. If this is the case then forecasts and other BA outputs from data mining, on-line analytical processing and other explanatory or predictive models will also be inaccurate. In the case shown in this study, the ‘grass stocks’ have been around for quite some time and this has been reflected in forecasts over a substantial period of time. It has been estimated by the general manager that a great deal of inventory has been hidden and that *Utilcom* has excessive amounts of hidden stocks that are kept away from the central inventory database. The problem is that this has resulted in a continual over ordering of excessive stocks in a “just in case” mode of operation rather than the “just in time” approach that is proposed by BA as being best management practices.

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<sup>1</sup> Carr defines IT as an infrastructural technology in that it needs to be shared and can not be used in isolation. In the early stages infrastructural technology is restricted and therefore provides the user some competitive advantage, however as the previously scarce resource becomes more available, it loses its competitive advantage and becomes ubiquitous and eventually a commodity that everyone has and hence offers little if any competitive advantage (much like electricity is provided as a service)

### Limitations

One of the major limitations of this study is that the site is now closed. It is hard to say with any degree of certainty what the host organisation has done about feral systems. At the time of this writing, they are implementing training schemes to better educate employees about inventory management practice and they are investing money in better practice in this regard. However, how successful it has been or will be has not been divulged to the researchers.

Secondly, there is a limitation in access the researchers had in understanding the interactions between customers and the focal firm. More to the point, there wasn't a whole lot of time to understand the interactions as access to the other sites was not permitted. There was no access granted to a major supplier of inventory so we were not able to validate the existing arrangements or processes that were under commercial confidence.

Lastly, the case study itself is only one case. As Yin (1994) notes and Eisenhardt and Graebner (2007) confirms, data can be induced from a single case for the purposes of generalisation but it's better to have a long running sample of cases to see if patterns replicate and expand the general themes found in the single case. The authors wish to pursue similar cases in other organisations to see if the same phenomena confirms the experience of this case before further generalisation is possible.

### CONCLUSIONS

For BA to be effective in an organisation, the fundamental information systems principles of accurate and robust databases must be in place. Many companies spend vast amounts of money in terms of ERP implementations to ensure that their databases are accurate and robust enough to allow the development and use of strategic tools such as forecasting and other BA principles. However, just because the infrastructure is of a high standard, it does not ensure that the data contained in the database is accurate. This research indicates that many social issues need to be considered also. Issues such as rewards given to employees and mistrust of the centralized ERP have resulted in development of systems independent of the ERP. We have called these feral systems. An awareness of these systems is essential for upper management as complete and blind trust in the BA coming from the ERP may lead to misleading results and errors in forecasting that may have wide ranging implications for the organisation.

An awareness of the feral systems phenomena can help upper management more fully understand the reason why the output from BA tools may be inaccurate. An appreciation of the factors that lead to the development of feral systems and the resultant inaccuracies in recording true inventory levels can lead to improvements in job training and modifications of reward mechanisms that could encourage "just in case" inventory.

There is no conclusive proof of the presence of feral systems in other organisations but there is certainly a great deal of circumstantial evidence to indicate its presence. Other research indicates continual employee dissatisfaction with ERP implementations. This is often associated with the decision by companies not to make changes to the ERP to fit their existing business processes but a preference to change company processes to fit the ERP. These factors, as well as a reward system that still encouraged the keeping of excess inventory for the just in case emergency were the main reasons for feral systems development at *Utilcom* and we suspect the situation is similar in many other organisations.

While it is accepted that many organisations overcome initial difficulties with ERP implementations and in time are able to take advantage of the full functionality of the system. The authors suggest that with the increasing number of mergers and acquisitions occurring in both the private and public sectors worldwide, the problem will continue well into the foreseeable future.

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