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An evaluation framework for the selection of a mobile policing information solution

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Abstract:

The bureaucratic nature of UK policing is currently being challenged. Following a Government initiative to equip 10,000 police officers with handheld computers by the end of 2008, the Government has invested £50 million into implementing mobile information management systems (MIMS) into UK police forces. This presents challenges including how to appropriately identify and prioritise user requirements to select from competing solutions. The paper develops an evaluation framework to evaluate objectively the diversity of solutions available, in order to ensure that the chosen MIMS solution best meets the needs of police organisations. The framework was developed through an empirical study within the Leicestershire Constabulary. This involved collecting qualitative data regarding user requirements via a focus group with operational officers who already had experience of using a MIMS. Firstly, a stakeholder analysis technique was used to identify, evaluate and address competing user requirements. Secondly, a feature analysis technique was employed to evaluate various MIMS solutions in an unbiased manner. Finally, the framework was verified through interviews and observation. Findings from the verification stage suggested the use of the framework had contributed to a relatively successful implementation of a MIMS. This involved the use of mobile data terminals in response vehicles with full access to systems utilised in the station, thus allowing 'anytime anyplace' crime recording; the Constabulary is the first in the UK to do so. The paper contributes to the domain of evaluating information management solutions and user requirements by creating an evaluation framework that can be used by police forces and other similar organisations looking to adopt, design and evaluate a usable mobile information system (MIMS).

Keywords:

Evaluation, information management solutions, policing, mobile information, evaluation framework

1. Introduction

1.1 Background

The Leicestershire Constabulary is a UK police force comprising over 2,300 police officers and 1,200 police staff, all responsible for providing a policing service to an area of 2,500 square kilometres. A key goal of the organisation is to become information led, concentrating resources where the Constabulary's impact on vulnerability, offenders and criminality will be most effective to the benefit of all (Leicestershire Constabulary, 2007). In order to achieve this purpose, specific information and know-how is required. Currently all crime-related information is managed via a paper-based information management system and is considered to be sub optimal in terms of effectiveness. Police officers arriving at a crime scene will document details of the crime onto a paper-based form, which often comprises duplicate information. This form is then faxed to the crime-reporting bureau, where trained operators create a crime record on the local electronic crime and intelligence information management system.

Recognition of evident bureaucracy within UK police forces has prompted recent debate in the news about the necessity for mobile information management in policing. Arnott (2007) has suggested that police need more mobile information technology. This debate was recognised in a speech by Gordon Brown who called for 10,000 police officers to be equipped with handheld computers by the end of 2008 (Carvel, 2008). In order to achieve this goal, £50 million of UK public money is being invested into an initiative for mobile information technology within UK police forces (Public Technology, 2008). Consequently, all UK police forces are working towards adding a mobile component to their information management systems.

It has been estimated that mobilisation of information could save as much as £800,000 a year for the average police force (Mills, 2008). The move from paper-based systems to mobile computing represents a radical change to policing, as it breaks historically embedded norms. This presents a major challenge to introducing a MIMS into policing. The drivers and significant gains to doing so means it is imperative that the correct solution is chosen, from the many on offer via software suppliers.

In order to manage the change process from paper to mobile information management, a framework for evaluating user requirements and features of various MIMS within the market is required. This framework enables a representation of often competing information required in the objective decision-making process.

1.2 Context

The literature presents the view that a large part of all information technology projects are cancelled, over budget or late (Ward & Daniels, 2006). Frisk (2008) implies one reason for the failure of such projects is that evaluation has been poor. Evaluation can be defined as 'the act of measuring or exploring some property of a system, the result of which informs decision-making concerning that system in a specific context' (Ammenwerth, 2004: 1289). Similarly, Andersen and Jensen (2007) suggest that 'evaluations help managers to refine an IT implementation based on the understanding of its performance'. Despite the importance of evaluation, it has been suggested that evaluation has centred on technical aspects and economic evaluation methods, such as return on investment. It has been argued that these methods lack consideration of stakeholders and the context of the information technology system (Ammenwerth, 2004; Klecun-Dabrowska & Cornford, 2001). Stockdale & Standing (2006) contend that despite the plethora of evaluation methods available, there are few examples of frameworks from which to build an integrated evaluation strategy.

In other cases, IT investments can be evaluated holistically through an interpretative approach, which uses the stakeholders' perceived value of an information system (Frisk, 2008). Several authors have developed different interpretative evaluation frameworks. For example, Stockdale & Standing, 2006 developed a context, content and process framework (CCP), which excludes technical measures and instead takes into consideration the social and political factors within an organisation. Similarly, Remenyi and Sherwood-Smith (1999) developed a five-stage benefit management model, which involves stakeholders in the evaluation process. . Frisk (2008) applied the CCP framework (see Figure One) within the Swedish Fire and Rescue Service. The research found that rather than simply discovering poor performance from an income statement via the economic approach, CCP could provide a deeper understanding of the effect of technology investment from different stakeholders. However, the way the outcomes from these two methods are presented appear to limit effective decision-making. Despite the two methods recognising the need to focus on stakeholders, it appears that they do not effectively balance stakeholder needs, unlike the stakeholder analysis method. Further explanation and justification of the stakeholder analysis method is given in the following section.

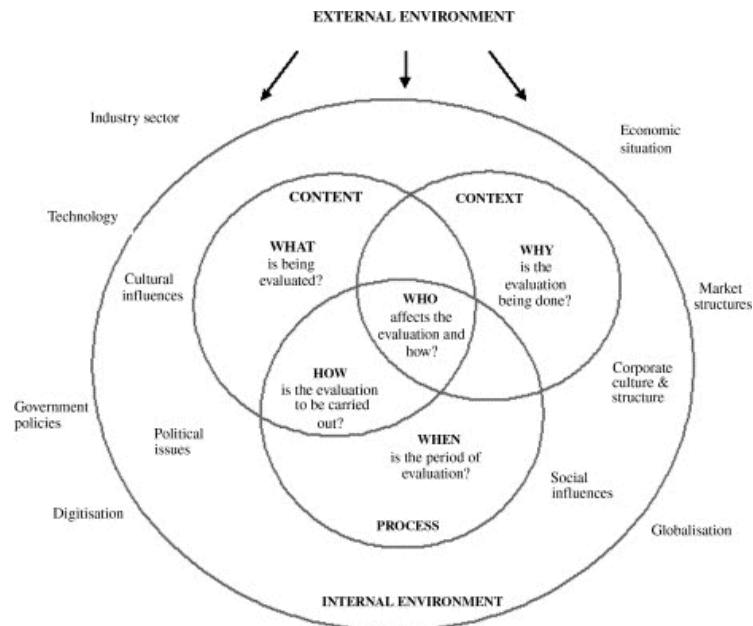


Figure 1: The CCP framework (Stockdale & Standing, 2006)

Within the literature, appropriate methods are available to evaluate an IS. For example, DESMET selection criteria can be applied to ensure selection of a reliable and unbiased evaluation method (Kitchenham *et al*, 1997). DESMET forms the theoretical basis for developing the framework, and is discussed further in the following section.

2. Research Methods

2.1 Research Domain

Table one shows the research domain. The Leicestershire Constabulary was selected via convenience sampling. Employees within the Leicestershire Constabulary were sampled, including operational officers, project managers and a selection of stakeholders who are not directly involved in frontline duties. These were selected using a purposive sampling technique, which can allow the researcher to pinpoint people where it is believed that they will be critical for the study.

Table 1: The research domain

Phase of framework	Number of participants	Officer rankings
Focus group	Nine participants	<ul style="list-style-type: none"> • 2 Sergeants • 1 Inspector (MIMS project manager) • 1 Chief Inspector (Crime and Incident Reporting manager) • 4 Police Constables • 1 IT Analyst (MIMS technical support)
Stakeholder analysis	As per focus group; user requirements identified from the focus groups are categorised alongside any other stakeholders that were not involved in the focus groups	As per focus group
Feature analysis	As per focus group; user requirements identified in the focus group are evaluated against solutions, ten MIMS solutions were evaluated.	As per focus group
Interview and observation	Five participants	<ul style="list-style-type: none"> • 1 Assistant Chief Constable • 1 Chief Superintendent (Head of the Operations department) • 1 Superintendent (Deputy Head of the Corporate Development department) • 1 Chief Inspector (Crime and Incident Reporting manager) • 1 Inspector (MIMS project manager)

2.2 Developing the Evaluation Framework

Table one shows the methods used in each phase of the evaluation framework. This section details and justifies the use of these methods.

2.2.1 Focus groups

It is viewed that focus groups promote participation, communication and allow the use of a team, where each member has a different background of expertise (Gorman & Clayton, 2005; Flood & Jackson, 1991). This may be of benefit when gathering user requirements for the MIMS, as various individuals from differing operational and technological backgrounds can be brought together. Gorman & Clayton (2005) suggest that in a group situation 'many people are prompted to suggest ideas which might not occur to them on their own'.

In order to identify competing user requirements a focus group was held with a total of nine operational police officers (see Table One). Although a questionnaire would have been useful to allow wider sample coverage and a more representative picture of user requirements, these may have been difficult to capture via closed questions. Therefore it was felt a forum for open discussion should be provided.

The focus group aimed to explore current experiences with MIMS. Specifically officers recorded positive and negative aspects relating to performance, reliability, usability, interface, security and data quality. Ideas were recorded in silence on post-it notes, allowing each expert to contribute equally. These were then grouped accordingly.

2.2.2 Stakeholder analysis

Stakeholder analysis comprises of two stages: identification of project stakeholders via brainstorming (as outlined by Pouloudi & Whitely, 1997) and evaluation of the importance of these stakeholders (Pan, 2005). The latter stage involves categorising stakeholders into four main groups (see Figure Two). The value of this over a simple list of stakeholders is that it assists the project manager in maintaining relationships with the correct people. The influence of certain stakeholders that may be detrimental to the project can be mitigated, and this may therefore ensure the key business needs are

met. In figure two, the x-axis shows the extent to which a stakeholder could gain from a project and the y-axis shows the ability of a stakeholder to affect the success of a project (De Chazal *et al*, 2002a).

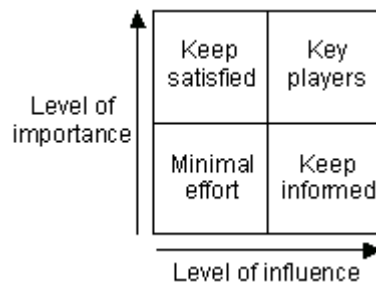


Figure 2: Stakeholder impact/ probability matrix (adapted from Olander, 2007)

The implementation of MIMS has attracted interest from various stakeholders within and outside the organisation, who express specific needs about the project. These needs are often competing with one another and it may be difficult to fulfil everyone's wishes. It is therefore important to ensure that stakeholders are managed and the most significant stakeholder needs are met. By doing so, the key business requirements drive the IT decisions, a view held by several authors (Rubenstein *et al*, 2001; Zolkos, 2005; Weerakkodoy & Hinton, 1999).

The method presents information in a format that aids effective decision-making, unlike other similar methods such as those described by Mason & Mirtroff (1981) and Mirtroff & Linstone (1993). It may be argued that interpretive approaches, such as the CCP and benefit management models, do not fully satisfy the need to balance differing stakeholder perspectives. Additional methods such as those offered by Mason & Mirtroff (1981) and Mirtroff & Linstone (1993) present information in a numerical form, which requires technical background knowledge of the tool in order to interpret the information. Phillips (2003) corroborates the objective of the paper, stating that a stakeholder analysis tool allows better representation of information for decision-making. The tool allows representation of who has influence on decision-making and who benefits from the project outcomes. This may provide more effective axes for decision-making than other approaches available.

Olander (2007) suggests that stakeholder analysis has proved to be valid in successfully managing several construction projects. Within the information systems arena, Rolls Royce has previously applied the analysis method in supporting its strategic IT decision-making (De Chazal *et al*, 2002a). Similarly, the method has shown to be useful in understanding failure of e-commerce solutions, where it was found that incapability to recognise external suppliers as key project stakeholders led to underestimation of an influential role in a project (Pan, 2005). Despite previous research illustrating the value of the stakeholder analysis in evaluating IT solutions, it does not appear to have been applied to an MIMS policing context.

2.2.3 Feature analysis

Following the identification of the most important stakeholder needs, the second phase of the framework is to evaluate these needs against various MIMS within the marketplace. To do this a Feature Analysis method was adapted. Feature analysis forms part of the DESMET methodology, which offers quantitative (surveys, experiments) and qualitative (feature analysis, benchmarking) evaluation methods, depending on what is being evaluated. Quantitative methods require a measurable value that is expected to change (e.g. benefits), whereas qualitative methods are suitable where intangible benefits or few past performance indicators exist (e.g. MIMS) (Kitchenham, 1996). DESMET provides a set of criteria for selecting an appropriate evaluation method (Table 2). Since MIMS solutions are being evaluated and compared, the latter three options in Table 2 were rejected and feature analysis was used. This eliminated the need for prerequisites (e.g. measurement).

Table 2: DESMET selection criteria (Griman *et al*, 2006)

What is evaluated	Evaluation method	
1. Comparing tools and solutions	Feature analysis Benchmarking	Qualitative
2. Comparing solutions that automate tasks against manual tasks	Observation	Quantitative
3. Generic methods	Case study Survey Experiment	
4. Specific methods	Case study Survey Experiment Feature analysis	

Feature analysis was used firstly because it is based on identifying the requirements that users have for a solution and mapping those requirements against the features of a number of alternative solutions. According to Hyland (2002), this aims to avoid the system with simply the most features being selected. Suppliers within the marketplace supply vast amounts of information concerning the technical and non-technical specification of MIMS. Feature analysis was selected secondly as it averts the need for senior management to read through this information or statistics during the decision-making exercise. The output of the feature analysis can be presented in a single table or bar chart. Senior Chief Officers within the Police Force have to understand continually large quantities of data in order to make necessary decisions. The graphical breakdown may reduce the level of information overload. Where high profile public money is being spent, senior management critically need to select the most appropriate MIMS. Therefore it is important that solutions are evaluated in the most effective and objective manner. It was believed that feature analysis met this need via its advantages, which appeared to carry more weight than other evaluation methods.

For the research, feature analysis was adapted according to a sequence of seven steps prescribed by Kitchenham (1996):

1. Select candidate solutions to evaluate
2. Identify the user requirements
3. Prioritise features with respect to the user requirements by using a scoring system
4. Agree on a scoring system that can be applied to all the features
5. Carry out the evaluation to determine score the solutions against the criteria
6. Analyse and interpret the results
7. Present conclusions on the evaluation to decision-makers.

The researcher evaluated a list of requirements (identified via a focus group) against features of various MIMS (identified through reviewing sales literature and meeting with suppliers to look at prototypes). This process is used when screening several tools (as is the case for this research). Kitchenham (1996) suggests that case study and experimental approaches may also be used when there are fewer tools to trial. A 'weighting scale' was used as the scoring system for each specific requirement; the higher the weighting the more essential the requirement, to develop a list of 'must have' and 'nice to have' features for MIMS. Weightings were added to the MIMS requirements on a 0 – 100 scale:

- 10-30: Useful
- 40-70: Important
- 80-100: Essential

According to De Chazal (2004b), having a classification below "useful" is not considered to be informative, as identified requirements are, by definition, useful.

The weightings for each requirement were determined from discussion in the focus group, and based on the requirements that provided greatest potential business efficiency savings. The features were categorised into a number of areas including software functionality, user-friendliness, information management effectiveness, ergonomics, security and cost.

The available features in each solution were compared to the list to generate a total score for each solution; the greater the score the better the solution met the requirements. If a solution did not have the specific requirement it was scored 0. This information can be disseminated via tabular form or graphical form.

2.2.4 Verifying the Evaluation Framework by Interview and Observation

The evaluation framework was tested in order to ensure that it met the needs of management. To do this, interviews were conducted with five participants (see Table one). Interviews also explored the preferred representation of results amongst participants from the feature analysis phase of the framework. Observation was also conducted to observe management reaction to the framework as a decision-making tool.

Interviews were selected over quantitative methods such as questionnaires because, as suggested by Denscombe (2003), face-to-face interviews allow the interviewee to develop ideas and speak more widely on issues than in a questionnaire. Interesting responses can be followed up and underlying motives can be investigated more deeply, along with indications from non-verbal cues (Robson, 2002). Observation allows the researcher to investigate the actions and behaviour of people within a natural context, and provide useful insights (Robson, 2002). In this case the reaction to the framework as a decision-making tool was observed. This was used to complement the interview data (Robson, 2002).

3. Findings

3.1 Focus group - MIMS user requirements

The focus group identified that duplication of effort and time wasted are key issues for officers using the current paper-based system, as the forms were designed for scanning rather than direct input of information. Officers agreed that a MIMS would enhance the gathering and recording of information: details can be inputted directly onto the crime information management system rather than at the end of a shift. This speeds up the business process and removes inaccuracies in double keying, thus allowing for better information management in terms of more complete, reliable and accurate information. Officers suggested that an ideal MIMS should allow faster data input, such as prompts and drop-downs, as the system would be used in tense situations. Such an interface would also contribute towards improving the level of data quality, as information is captured 'as it happens' and 'incidents can be updated straight away'. Recording information via a MIMS was felt to be clearer than hand written information. Officers suggested a standard keyboard with which to enter information; a touch screen keyboard was viewed problematic. The screen size and keyboard type must be large enough to display and input information.

In the focus group officers expressed concern over performance and speed of access to information. There was consensus that a good network speed and an integrated interface to retrieve/ input information were essential to avoid system failures and to provide a richer picture of a situation. Officers also suggested a single log on would reduce the number of passwords required.

With regards to security, officers expressed the requirement to balance the need to prevent officers from repeatedly having to enter security codes when the ignition is turned on and off, but also to make the data secure. The units themselves must be protected from theft and the data must be secured by a way of blanking the screen from 'prying eyes'. With light to the recent losses of government held personal information (Harrison, 2008) this is an important issue. An electronic audit trail was felt to be useful in providing data security. Concern was also raised over communication with the public: diverting attention to data entry rather than focusing on the victim.

3.2 Stakeholder Analysis - Evaluating competing user requirements

In a large organisational structure such as the Leicestershire Constabulary a stakeholder analysis proved to be beneficial in managing competing requirements. Figure three shows the stakeholder

analysis for the research. It is evident that the key players for the project are largely the operational officers. Their actions and level of user acceptance will affect the project's ability to meet its objectives and the devices will affect the way they do their job. It is therefore important to develop good rapport with officers and prioritise their needs, as identified via the focus group (section 3.1), rather than those of senior management. As a result, a bottom-up approach to implementation was recommended. The other important group of stakeholders are those that should be kept informed, as these are a source of risk to the project. For example, trade unions may see the mobile devices as a source of job cuts, which may create a negative influence on the project. An awareness of this allows the MIMS project manager to place emphasis on nurturing relations with this group.

High importance/ low influence	High importance/ high influence
Airwave (radio) manager Information portal designer Crime Input Bureau	Operational officers MIMS project manager Process reengineer IT analyst MIMS developer for Armed Response department MIMS developer for ANPR department Chief Officers MIMS suppliers
Low importance/ low influence	Low importance/ high influence
Operational sergeants Inspectors outside the project Road transport department Procurement department	Training department Corporate development department Governmental bodies (e.g. Home Office National Policing Improvement Agency) Corporate communications department Trade unions

Figure 3: Stakeholder analysis for the MIMS project within the Leicestershire Constabulary

3.3 Feature Analysis - Evaluating MIMS solutions against business user requirements

Having identified the most important and influential stakeholders and their requirements, it was necessary to find an appropriate software solution to implement these requirements. This was achieved by applying a 'feature analysis' evaluation methodology (see section 2.2.3).

A 'wish list' of features for MIMS was produced as a result of the focus group findings. These requirements were weighted to provide a prioritised user specification against which features of software solutions could be evaluated (as detailed in section 2.2.3). The bar chart in Figure four shows the overall scores for the various software solutions, which is based on calculations that were determined by following the guidelines in Table two. It is possible to see at a glance which solutions are suitable for the Leicestershire Constabulary; there are two choices that fully meet the requirements – Solution six and Solution eight. The final decision was based on the cost of implementation and the reputation of the supplier.

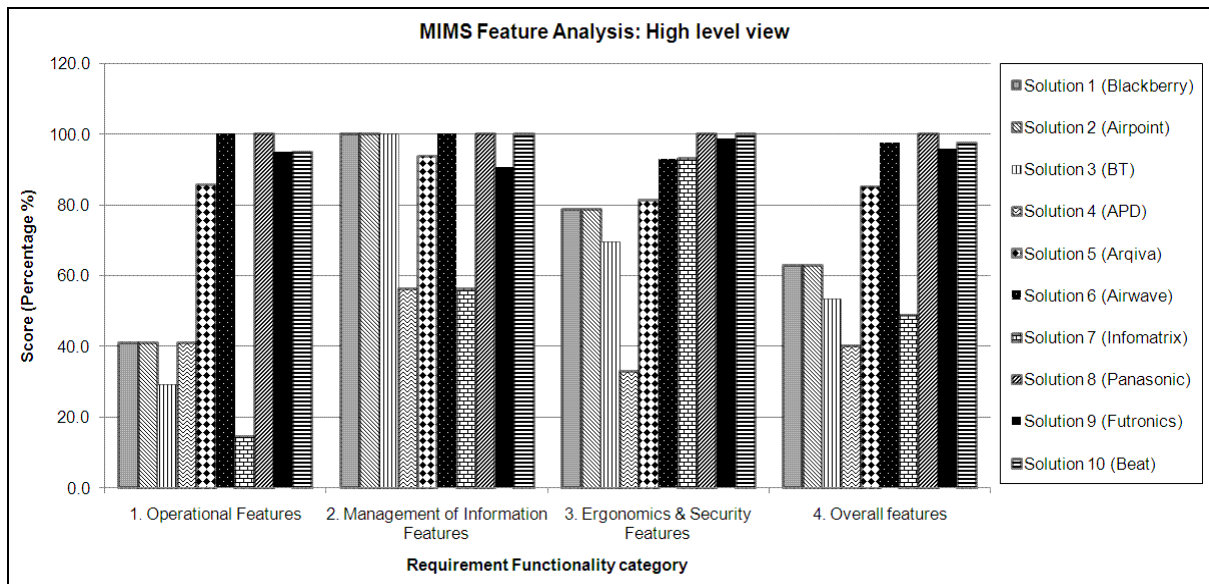


Figure 4: MIMS feature analysis results – graphical format

3.4 Interview and Observation

The results of the interviews suggested that the experience of using the feature analysis phase of the framework was well received by management at the Leicestershire Constabulary. The framework has greater simplicity and visual representation of information for decision-making than statistics. Statistical presentation of information may be difficult for management to appreciate value and limitations of various solutions. The comparison of user requirements against software capabilities provided a useful analysis, as it was clear to see where the advantages and disadvantages lay with each system. Senior management participating in interviews favoured the feature analysis framework because it reduced the need to read through a mass of information about each MIMS solution to arrive at a final decision. Instead the feature analysis integrated the all the necessary information into a single table and chart. Findings from the interviews and observation suggested that management preferred the graphical representation rather than the tabular format. This is because the graphical representation eliminated the need to read through the numbers in the table and thus improved the efficiency of decision-making. Senior management also felt that the feature analysis tool provided sound evidence to explain the reasoning for selecting a particular MIMS solution rather than basing decisions on a hunch. This was beneficial when the Constabulary sought funding for the chosen MIMS from government bodies.

In addition to the feature analysis phase, the focus group and stakeholder analysis phases of the framework were particularly favoured by the project manager and the IT analyst of the MIMS. The project manager commented that the stakeholder analysis phase was invaluable in balancing different needs. Both the project manager and the IT analyst concurred that the focus group allowed them to identify additional requirements that could have been omitted if solely management had produced the user requirements. Doing so may prove to be beneficial in the long term in maximising user acceptance and minimising project failure.

Overall, the findings suggest that the evaluation framework was well received by management. This is mirrored by findings in Rolls Royce (de Chazal, 2002a) and evaluating geographic profiling solutions (Rich & Shively, 2004). Within this research, the graphical output of feature analysis enabled senior managers to make strategic decisions quickly and effectively, as opposed to presenting management with statistics. This could suggest that the evaluation framework may prove to be effective in other organisations. Further research may seek to apply the framework within different contexts to test the validity of this statement.

4. Conclusion

From this research, an evaluation framework has been developed to enable evaluation of mobile information systems. The evaluation framework consists of:

- a focus group to identify user requirements,
- stakeholder analysis to ensure the most important and influential stakeholder requirements are met in order to minimise resistance to change and evaluate competing needs,
- feature analysis to evaluate potential MIMS solutions against user requirements in an unbiased manner,
- interviews and observation to verify the framework.

The framework builds on existing frameworks in the literature, which stress the importance of considering stakeholder needs, but do not suggest how such needs can be managed. The framework was applied within the Leicestershire Constabulary, an organisation looking to evaluate and select an appropriate mobile information management solution (MIMS) for management of crime related information.

The use of a stakeholder analysis and feature analysis proved popular with senior management, as it allowed more effective dissemination of the pros and cons of each system, rather than using statistics or long reports. This also ensured that business requirements were driving the final IT decision, rather than senior management who may not necessarily have a full understanding of operational needs of officers. Little work has been done to deploy such a framework within a policing environment, where senior officers are faced with large quantities of data to make decisions regarding numerous potential initiatives. By presenting information in a graphical format this initiative went from being a potential to an agreed proposal. However, it must be noted that the interpretivist nature of the research means that the data has been interpreted by the researcher to add meaning. Therefore the research may carry some subjective views rather than factual information, so may not be generalisable to other contexts.

The results from the interviews and observation suggest that development of an evaluation framework can add to effective decision-making within the field of evaluating information management systems for any organisation, as requirements can be customised to suit the organisation. The framework was used to implement a mobile data terminal solution successfully with full access to systems accessed in the station, thus allowing 'anytime anyplace' crime recording; the Constabulary is the first in the UK to do so (BBC News, 2008; Enderby Eye, 2008). The paper contributes to the arena of evaluating information management solutions and user requirements by creating an evaluation framework that can be adapted by police forces and other organisations looking to adopt, design and evaluate a usable mobile information system (MIMS). The use of an effective evaluation framework such as the one suggested in this paper can minimise the chances of IT failure, by ensuring selection of the appropriate system from the outset.

Although the initiative has been given the go-ahead from senior management there needs to be acceptance from an operational level. For the initiative to be successful, consideration must be given to the potential issues associated with implementing mobile data into a well-established organisation with established work practices and processes, since this involves significant cultural change. This highlights a subject for future research and further studies are planned to evaluate the impact of the implementation of mobile technologies through gaining an understanding of how officers view the proposed mobile data units and the how the capture of traditional information will be affected by the new mobile data units.

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