PERSONAL MOBILE TECHNOLOGY IN ASSET MANAGEMENT

Stefan Swanepoel
Custom Information Solutions, Pragma

Consider opportunities in asset management

Where personal mobile technology can improve cost management, reduce risk or increase asset performance.

What important personal mobile technology considerations should be reviewed before embarking on this journey?

transforming enterprises into digital business

Contents

1 Executive summary

Business leaders worldwide are buying into the concept of transforming their enterprises into digital business by leveraging Social, Mobile, Analytics and Cloud (SMAC) technologies. This is fundamentally changing the way businesses perceive themselves as they move beyond simply improving internal business processes through digitisation. With the Internet of Things (IoT) they are also starting to tap into a broader array of clients, service providers and digital devices residing at the edge of their networks.

We will focus on the personal mobile component of this digitisation drive within the field of asset management where this is already seen as an absolute requirement, rather than a luxury in applications such as field service work management. Here the benefits to be gained from increased data velocity, improved data accuracy and better control over a distributed workforce

is self-evident and players in this industry have little time to catch-up. Although the benefits are clear, there are numerous pitfalls which could detract from the success and value to be gained from embarking on a mobile enabled asset management journey.

This paper outlines the fundamental attributes of mobile solutions which help to create value within businesses and will also look at a few applications within the expansive asset management arena. It then explores some important aspects of mobile enablement which should be considered before implementing a mobile enabled asset management solution. This paper concludes with some examples of mobile solutions implemented as part of Pragma's enterprise asset management system (EAMS).

Social   **Mobility**   **Analytics**   **Cloud**

2 Value drivers

With the increased drive to digitise business through the use of mobile technology, the question in the minds of many decision-makers remains whether this will truly add value and also function within their organisations. Before considering the feasibility of implementing this in the workplace let's first cogitate on the potential value that asset managers can expect to obtain from embarking on a mobile enablement journey.

Personal mobile technologies gain their benefits from:

- The **portability** of devices and their built in **sensors and specialised functions** which facilitate the collection of digital information so that it can be transmitted to and from any location.
- The **reachability** of clients, staff, service providers and co-workers which enables collaboration and interaction.
- The **localisation** of devices through which their users' location and movement can be determined and managed.

The value of a mobile enabled asset management function within a business lies in the following areas:

2.1 Distributing digitised information

The quick and accurate **distribution of digitised information** to and from users wherever they are. Costs and risks arising from data capturing, decisions based on outdated information, miscommunications and lost information can largely be avoided if information is sent to and received from users through an auditable process where information is received and captured digitally at the point of use.

With the increased drive to digitise business through the use of mobile technology, the question remains whether this will truly add value and also function within organisations.

2 Value drivers

2.2 Contextualising information

The ability to **contextualise information** based on user location, movement, physical environment, personal condition or the asset being worked on. Controlling the relevance of information by contextualising it to the point of use through the user's geographic location or asset identity saves time and reduces the risk of using incorrect information. Geographic location could also be used to alert users to geo fenced safety risks. Wearable mobile technology, such as activity sensors and heart rate monitors could be used to monitor the user's well-being while performing strenuous activities thereby adding value to the organisation by improving the well-being of its staff.
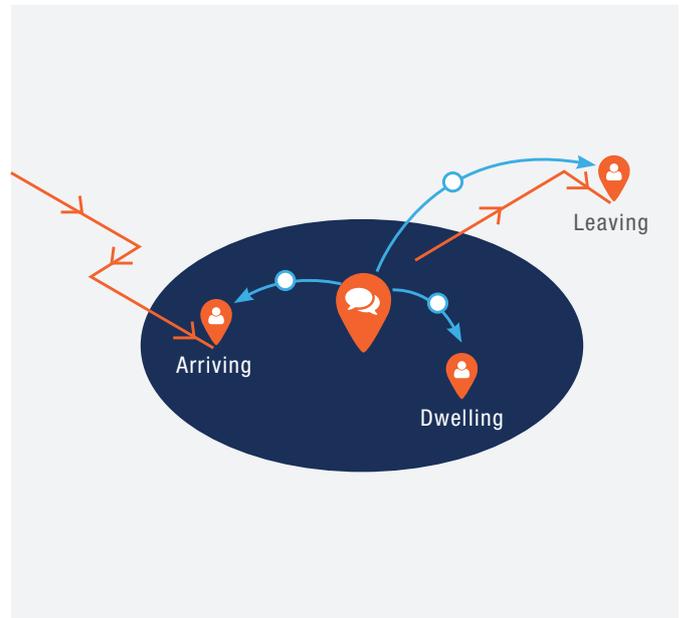
Fig. 1. Contextualising information improves accuracy and saves time
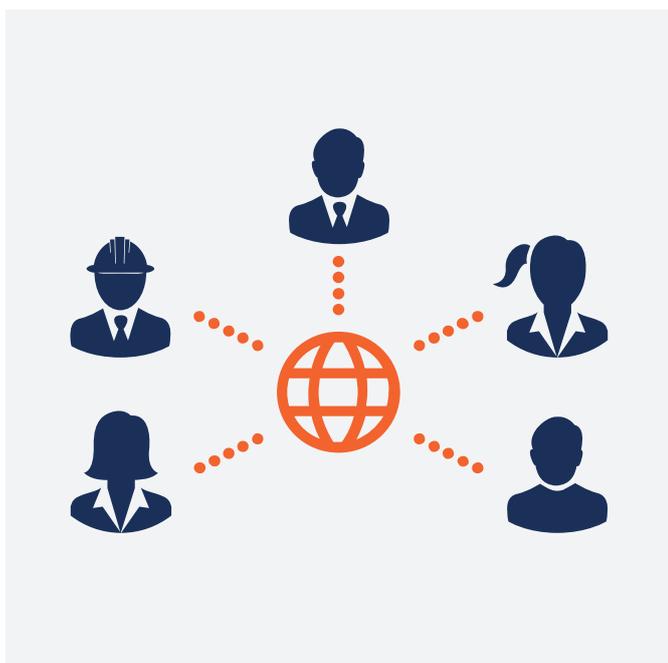
2.3 Collaborating through information sharing

The opportunity for users to **collaborate** through information sharing. Users can collaborate by having visibility into required work and interactively assigning and taking on tasks, adding value through more efficient work scheduling and allocation. Collaboration through posting work related questions immediately from the point of use to communities of practice could greatly improve the efficiency and effectiveness of problem resolution.

Fig. 2. Data velocity is improved through more effective user collaboration

2 Value drivers

2.4 Empowering users

The **empowerment** of users with information directly from the asset or other sources for on-the-spot decision-making. Mobile devices connected to the internet or able to directly interact with assets through wireless or wired technology can empower users with up to date information. Information such as current and historic asset condition measurements can be obtained directly from the asset whereas design information about the asset such as user manuals and drawings could be obtained from the internet or internal document management systems.
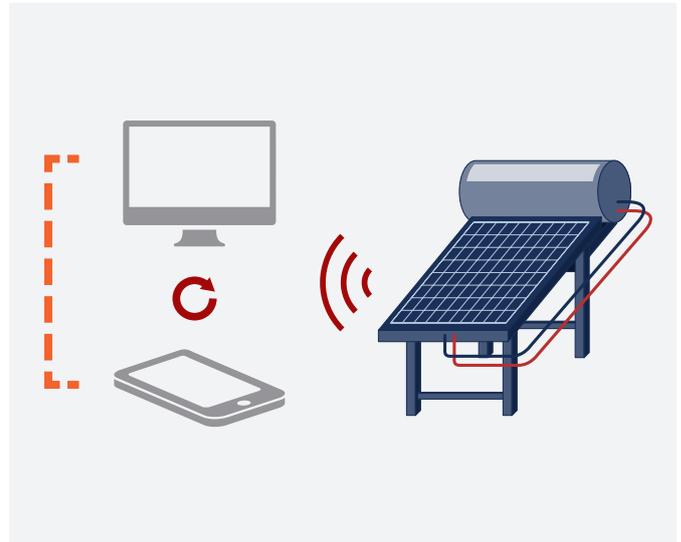
Fig. 3. Direct communication between the asset and user enables instant decision making
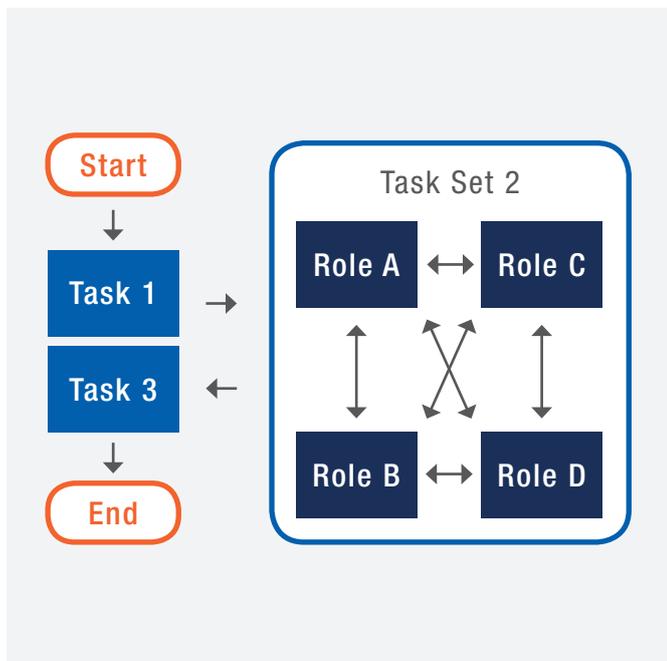
2.5 Improving control

Improved **control** regarding process adherence. Using mobile devices to distribute and receive information allows management to control these processes more tightly through predetermined workflows and transaction logs stamped with geolocation and time information for audit purposes. Improved control used correctly can drive out inefficiencies and reduce the risk of non-compliance.

Fig. 4. Incorporating intuitive workflow improves control

3 Feasibility

With the advances in technology and the wide acceptance of personal mobile applications in social media, banking, internet browsing, navigation, email, fitness tracking and claims processing the broader user community are becoming increasingly comfortable with the use of personal mobile devices to interact with other users, machines and business.

Although some studies have shown that many asset management functions are still performed through paper based processes, it is anticipated that this will rapidly change as: (1) younger entrants into the workforce and management positions show less resistance to a paperless world and (2) mobile hardware becomes better adapted to harsh working environments. The ever present concerns about poor connectivity are also addressed through increased availability of private wifi routers and mobile base stations. These combine with the improved offline capabilities of mobile applications which will allow even the most remote operations to utilise mobile technology successfully.

The feasibility of using personal mobile technology to improve the way assets are managed is therefore increasingly becoming a 'perceived' problem requiring willingness and firm, creative leadership to overcome; rather than a 'real' problem of technology and staff acceptance.

Although some studies have shown that many asset management functions are still performed through paper based processes, it is anticipated that this will rapidly change.

4 Mobile enabled solutions

As technology and its cost effectiveness improves, more innovative mobile enabled asset management solutions arise. Here we look at some of the more obvious solution themes which are already available from various EAMS and supporting third party vendors.

4.1 Work management

One of the prominent applications of personal mobile technology in asset management is in the **management of maintenance work** through a personal mobile device which focuses on creating, planning, recording feedback (eg work completion, measurements, spares, labour hours) and confirming completion of work orders in the field, while having access to relevant asset information to support these activities. This solution will make provision for integrated risk and permit to work (PTW) functionality and use integrated mobile technologies such as global positioning system (GPS), camera, audio recording, near field communication (NFC) and wifi to record information, communicate with machines and the internet.

4.2 Work request

Required maintenance work does not just arrive in an EAMS and the efficient **identification of required maintenance work** is a very important part of the complete work management cycle. It may, in some instances be required to provide feedback to the work requestor on the progress with work. Often maintenance work is identified by non-maintenance personnel. An efficient mechanism is needed to support 'crowd sourcing' of information where all stakeholders who interact with assets can raise new work requests – even if they are not initially registered as valid mobile asset management users. The requestor will not always know the exact name or code of the asset on which work is required and it will be important to supplement work requests with geospatial information and photos of the work required. This work request solution could be extended to source other information (eg asset meter readings, condition updates).

Fig. 5. More mobile enabled asset management solutions are becoming available

4 Mobile enabled solutions

4.3 Material management

Maintenance related inventories are stored in a variety of locations ranging from formal, well controlled stores to inventory carried by mobile field workers. The control and accuracy of stock levels and locations can be greatly enhanced through the use of mobile applications which support **material management** through order fulfillment data recording, issues and returns of spare parts, stock transfers, cycle-count support, spare part lookups, barcode printing and scanning. Having this up to date information available for 'mobile stores' located with the field worker vehicle can greatly improve control and avoid situations where technicians are waiting for spare parts while their colleagues have the required spare parts in their vehicle just a few kilometers away.

The control and accuracy of inventory levels and locations can be greatly enhanced through the use of mobile applications which support **material management**.

Fig. 6. Ongoing risk management performed using a mobile device

4.4 Risk management

The management of asset related risk is a key requirement in the ISO 55000 standard. Mobile technology can play a key role in the continuous **identification, quantitative assessment and treatment of risk.** As with work requests, mobile devices could be used to register new risks, potential or actual incidents and near misses. Mobile devices can also be used to perform perpetual equipment criticality analysis during staff interaction with assets while they have access to the latest failure statistics for the asset and the relevant asset class easily available. Physical areas with increased risk levels can be geo fenced. Users could be alerted, based on their current location when they enter these areas, while operators can be made aware of the user's presence in the area.

4 Mobile enabled solutions

4.5 Asset identification and verification

Management of assets can only take place once they are known to exist, and for many organisations with inaccurate asset registers this can be problematic. Mobile devices provide an ideal platform for **recording and verifying asset information** such as geospatial location, condition, design attributes, numbers, condition and images.

Fig. 7. Keep an updated asset register with the help of mobile devices

4.6 Staff management

Accurate **staff and contractor information** is critical when assigning work. It is firstly important to know that the person has the required competensies to perform the required work and secondly if the person will be available at the required time to perform the work. While this information is often available in the human resource modules of enterprise resource planning (ERP) or EAMS systems, it is seldom accesible to staff, especially if they do not have access to a dedicated computer. Staff also seldom have a view of work planned for them (eg completed labour hours), leaving them in a disempowered position regarding proactive participation in the planning and efficient use of their time.

4.7 Performance logging

While larger enterprises employ advanced control systems to manage the operation of their assets, smaller organisations still rely on performance data such as downtime, quantities produced during shifts and **reasons for losses** to be recorded in paper based systems which are only transferred to production management systems after the fact. Mobile devices provide an ideal opportunity to record this data directly in a digital format through devices carried by operators or devices which are fixed on the factory floor.

4 Mobile enabled solutions

4.8 Pre-start checklists

Mobile solutions where machine operators have the opportunity to record **pre-start inspection information** for mobile and fixed assets presents a good opportunity to establish timely and accurate asset condition and usage information. With this information being submitted to the EAMS on a continuous basis, maintenance personnel will be in a better position to identify and react to problems early. Information that could be captured by operators includes pre-start inspection pass/fail results, meter readings and measurement data.

4.9 Business intelligence

Up to date asset **management performance measures** are important on all levels of business and a complete EAMS mobile solution should include the capability to allow simplified data analytics to be accessed from a mobile device.
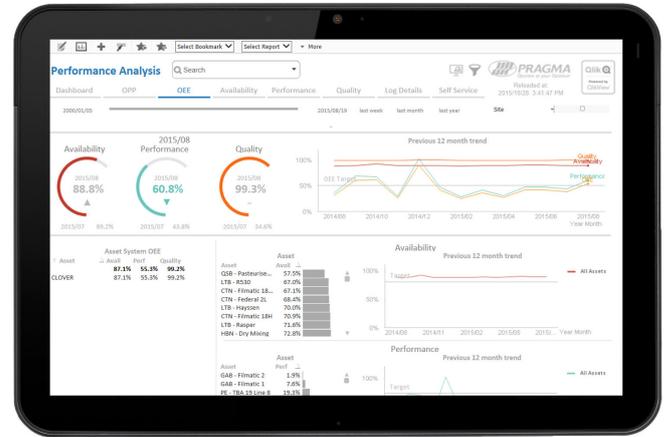
Fig. 8. Asset performance can now be analysed on an ongoing real time basis

4.10 Asset management

The abovementioned areas of mobile asset management enablement covers a large portion of typical asset management activities. In future, as the lines between desktop and mobile devices blur users will require **more asset management activities to be available through their mobile devices.** This will most likely include the management of the asset register, including tasks and associated spare parts through their mobile device.

5 Mobile EAMS selection

With all of the benefits which could be obtained from using personal mobile technologies in the asset management world, organisations could rush into a mobile asset management implementation, but first there are some important considerations which should be applied. Organisations should be cognisant of the following when choosing a mobile solution:

- Look for an enterprise vendor that has developed and offers its own mobile interface. Using a third party mobile solution will be a burden with multiple contacts, contractual agreements and technologies.
- The underlying EAMS should be well integrated in the ERP as such that finance, materials and human resource information is available from the EAMS from where the mobile solution obtains its information. A solution where the integration between different ERP modules and the EAMS needing to take place within the mobile platform is not recommended.

- Bidirectional visibility between maintenance and material management is critical. The maintenance technician should have a real time view of the availability of spare parts while the material management staff need to have a real time view of stock demands.
- Mobile work orders and human resources functionality should be integrated. This will allow efficient scheduling of available workers with full consideration of their availability and competencies.

With all of the benefits which could be obtained from using personal mobile technologies in the asset management world, organisations could rush into a mobile asset management implementation, but first there are some important considerations which should be applied.

6 Device selection

In addition to selecting the most appropriate mobile EAMS solution for the organisation's requirements – attention should also be given to selecting the most appropriate mobile device(s). This will play an important role in the successful uptake of the mobile strategy and the ultimate benefits which can be gained.

General consensus is that no single solution will meet every asset management function's needs. One approach maintains that an ideal device mix is necessary. For some organisations this may consist of personal devices used in tandem with other corporate-sponsored mobile devices.

6.1 Form factor

The form factor for mobile devices has seen significant changes over the past ten years. Rapid advances in technology and affordability of new products are constantly bringing new applications to the user. As a result, there is no simple answer to the question regarding an optimal form factor. Where, until recently, most industrial users had to choose between 5" to 10" screen size devices, the increased affordability of wearable technology, where users can be presented with high definition information appearing at their fingertips in augmented reality glasses, is likely to change current best practices yet again.

With many companies still stuck on paper based systems, only 'standard' mobile devices such as smartphones (5"/6"), phablets (7"/8") and tablets (10") will be taken into consideration

> The general consensus is that no single solution will meet every asset management function's needs. One approach maintains that an ideal device mix is necessary.

in this white paper as it is expected that the uptake of more advanced technologies are still relatively far into the future.

10" devices are generally considered too large to carry around in industrial applications. The improved screen resolution and usability of smartphones on the other hand will fulfill the requirements of many mobile device users.

There are however exceptions, especially in asset management functions where users may require the extra screen sizes offered by 7"/8" devices. Some of these exceptions include:

- Users completing complex forms such as inspection tasks with supplementary images where the context of specific inputs is important.
- Review of detailed images or diagrams during the completion of work.
- Freehand updates on images.

6 Device selection

A 2015 study conducted among Pragma clients indicated 7" tablets to be the preferred form factor for asset management clients. This is in line with expectations for clients which will perform more complex tasks on their mobile devices.
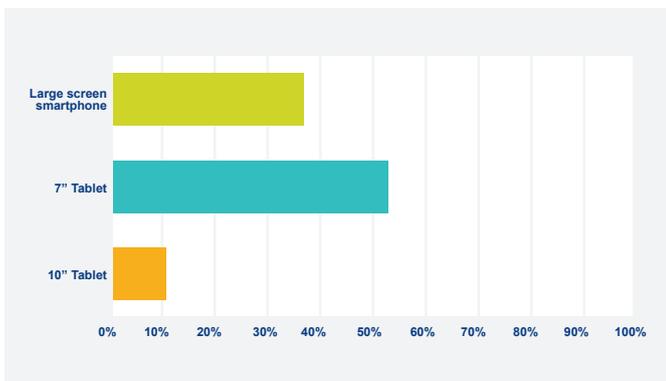
Fig. 9. The 7" Tablet is voted as the preferred form factor

6.2 Operating system

There are currently three dominant mobile device operating systems which should be considered when selecting a device: Apple's iOS operating system, Android and Microsoft's Windows Mobile.

The choice of operating system plays an important role in:

- The availability of hardware devices supporting the selected operating system and the subsequent suitability of hardware devices for the environments where the mobile technology can be used.

- The opportunity to implement a bring your own device (BYOD) mobile device ownership strategy, where devices from multiple users could use different operating systems.

Ruggedised and intrinsically safe devices are almost exclusively available with Windows Mobile or Android operating systems. There are however many suppliers of ruggedised cases for devices from all operating systems, which makes the use of an iOS based device possible.

If a mobile device in a specialised environment is not required and BYOD ownership strategy is adopted, it is highly likely that the mobile solution requirements should support both Android and iOS operating systems.

A 2015 study conducted among South African Pragma clients indicated Android to be the preferred operating system for asset management clients. Industry trends however do show that iOS is also used in several industrial applications in combination with suitable ruggedised cases.
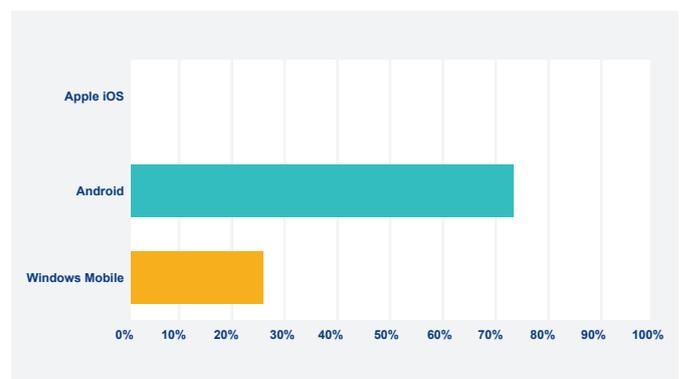
Fig. 10. Android is voted as the preferred operating system

6 Device selection

6.3 Hardware platform

The available hardware platform choice available is limited by a number of factors which are listed below. All of these factors should be carefully considered as the total cost of ownership of a device may vary greatly from the initial purchase price when life expectancy, support, impact on business due to unreliability is considered. Hardware platform selection considerations:

- Statutory requirements applicable to the device at the place of use (eg requirements to be intrinsically safe)
- Environmental requirements for the device to operate reliably (eg dust proof, drop proof, scratch proof)
- Electromagnetic compatibility requirements
- Expected life and continued support
- Battery life, support for exchangeable batteries and docking stations

- Support for peripheral devices (eg GPS, barcode scanning and near field communication)
- Availability and cost of suitable ruggedised cases
- Operating system version compatibility.

The available hardware platform choice available is limited by a number of factors which can influence the feasibility of using such platforms.

7 Mobile device management and ownership

Careful consideration should be given to the ownership and management of mobile devices used in an organisation's business processes as these devices now play an integral role in ensuring successful business operation.

Mobile device management (MDM) is the process used to ensure that staff remain productive and do not breach company policies while using mobile devices in the completion of their daily activities. Some aspects which should be assessed as part of MDM includes the distribution of applications and potential upgrades as well as the distribution of data and configuration settings for all devices.

Standards for MDM and various enterprise solutions exist in support of this requirement. Equally important for the proper management of devices connecting to corporate networks, is ensuring that users have the correct devices to fulfil their daily activities. Device selection has been covered in an earlier section of this paper, but let us consider device ownership, which is another important aspect of ensuring that users have the correct devices to do their work. There are a number of strategies for device ownership and management of mobile devices for enterprise use, as illustrated below.

Each of these strategies have positive and negative qualities and for many organisations a hybrid model would yield the optimal solution, where different strategies are applied for users with different needs. The table below lists some of the positive and negative points regarding each strategy which should be taken into account when selecting an approach to device ownership.

Hybrid Models

COCE	COPE	BYOD
• Corporately owned, corporately enabled (COCE)	• Corporately owned, personally enabled (COPE)	• Bring your own device (BYOD)
• The company owns the device and does not allow incorporation of personal applications on it	• The company supplies and owns the mobile device, but enables personal use by employee	• The employees bring their own device to the workplace for use and connectivity on the corporate network

7 Mobile device management and ownership

COCE	COPE	BYOD

COCE

POSITIVE

- Confidence that the device is fit for purpose
- Opportunity to acquire devices at discounted prices when purchasing in bulk
- Tightly managed security
- Simplified device and application management – less hardware and operating system variants to support

NEGATIVE

- Restrictive from a user perspective leading to potential resistance to adoption of mobile strategy
- Since the device is company owned, users might not apply the same care in safeguarding and handling the device

COPE

POSITIVE

- Fewer device types simplifying compatibility and support issues
- Potential for simplifying security measures
- Potential device acquisition cost savings
- Improved control
- Fit for purpose devices

NEGATIVE

- Fewer choices to the end user leading to some resistance but less than COCE strategy
- Since the device is company owned, users might not apply the same care in safeguarding and handing the device

BYOD

POSITIVE

- Users take personal responsibility to care for and safeguard the device
- Users buy into the mobile strategy as interacting with the corporate applications becomes a natural extension of their daily life inside and outside of working hours
- Simplified device procurement through delegating this activity to the user

NEGATIVE

- Users will not typically own specialised devices required for harsh or hazardous environments
- Security, software distribution and compatibility are very difficult to manage
- Users expect compensation for the use of their personal device for work purposes
- Users purchase devices and data contracts individually there is no opportunity for bulk discounts
- Processes need to be developed to compensate users for data usage
- Complex support process that needs to deal with a multitude of different device issues

8 Mobile technology applied in Pragma's EAMS solution

Pragma recognised the importance of mobile enabled asset management some time ago and has offered a Windows Mobile based work management solution ever since. This solution has great flexibility and depth of functionality and can be used in both mobile and static platforms.

With the increasing popularity of the Android and iOS operating systems, the current development drive within Pragma is towards the establishment of mobile solutions for these operating systems.

Further research among the Pragma client base indicated a higher preference towards the Android operating system. This, combined with the availability of a wide range of commercial and industrial devices for this operating system prompted Pragma to focus initial development efforts on this operating system. The underlying software stack is however developed to allow swift release of iOS ready applications if market demands change.

Current mobile asset management solutions offered by Pragma focuses on two high value add asset management activities, namely the identification and verification of assets and the management of maintenance work. While the Windows Mobile based On Key Express solution offers deep work management functionality, the focus of this paper will be on the two new Android based solutions which are integrated with On Key.

8.1 Asset identification and verification

The Asset Identification and Verification (AIV) business process is aimed at assisting clients in answering the following questions regarding their assets:

- Which assets do I own?
- Where are they located?
- What are their characteristics and attributes?
- Is my asset register compliant with applicable legislation and standards?
- Is my asset register accurate and verified to my auditor's satisfaction?

Current mobile asset management solutions offered by Pragma focuses on two high value asset management activities, namely the identification and verification of assets and the management of maintenance work.

8 Mobile technology applied in Pragma's EAMS solution

Collecting all of the aforementioned information for large numbers of assets can be a daunting task if managed through spreadsheets and paper forms completed by various field workers. The Android based mobile application used by Pragma simplifies this process by seamlessly integrating with its own EAMS, On Key, to verify and update existing asset records while collecting the required information to add new assets to the asset register. The application allows various field workers to collect and verify information on mobile devices, greatly simplifying the distribution of information to be verified and importing updated asset data.

8.2 Work management

The On Key Work Manager mobile application addresses the need for sending accurate work requirements and related documents to maintenance staff and receiving real time updates from the user about the progress with work. The application includes the following functionality:

- Feedback on the completion of work, including completed forms and sign-off by the client is received from the maintenance staff at the point of work.
- The relevance of information is controlled by sending only work orders and documents meant for a specific user to their device.
- The completion of work order feedback is work flowed with various status updates to improve control, ensure process compliance and completeness of data.

- Images and documents with technical information can be linked to the asset (attached to the work order).
- Templates, such as permit to work or risk assessments, can be attached to a work order sent to a user. These documents can be pre-populated with work order information for ease of completion.
- Documents are seamlessly shared between the On Key server and the mobile device while control is provided to the mobile user to manage the download of large files.
- The application can seamlessly work online and offline.
- GPS coordinates are recorded to verify that work feedback was recorded on site and that it is has been performed on the right asset.
- Device integration enables quick access to other mobile device functionality such as email, telephone and maps.
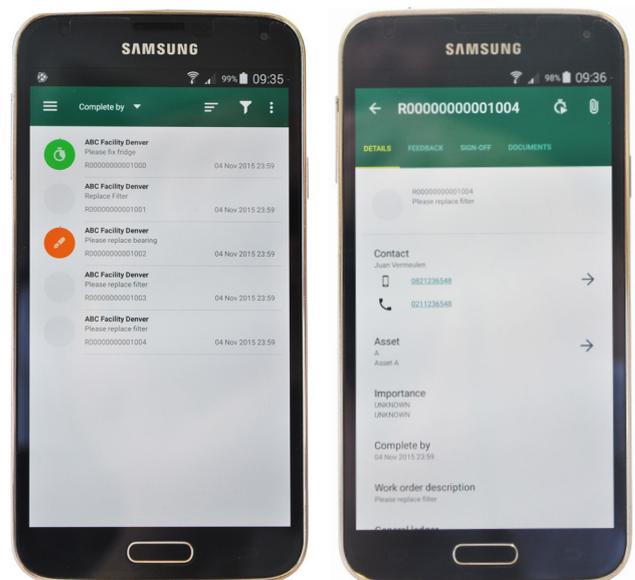
Fig. 11. The Work Manager application enables the tradesperson or field engineer to complete a work order and give immediate feedback at point of work

9 Conclusion

The rate at which business processes are being digitised is rapidly increasing and this trend is also becoming visible in the asset management world. Personal mobile technology plays an important role in this process and responsible asset managers can no longer ignore the requirement to join the process of digitising the asset management functions which they are responsible for.

Various case studies and agreed best practices have demonstrated the value which can be obtained from mobile enabled asset management processes.

Technology advances with resulting cost reductions are placing this within the reach of many asset owners and managers. Although the value that could be obtained from embarking on a mobile asset management journey is quite clear, there are many potential pitfalls which could result in the failure of such a strategy.

Careful consideration should be given to EAMS selection, device selection, device management and ultimately device ownership. Two new mobile applications introduced with Pragma's On Key system have been discussed as examples of how mobile technology could be used to improve data velocity and accuracy in asset management.

Responsible asset managers can no longer ignore the requirement to join the process of digitising the asset management functions which they are responsible for.

9 About Pragma

Established in 1990, Pragma is an engineering company that delivers enterprise asset management solutions to asset-intensive industries. A privately-owned company, Pragma employs 580 employees all working to give clients total peace of mind.

We take pride in the software tools and management practices we have developed to help companies in the mining, manufacturing, local government, distributed facilities and original equipment manufacturing sectors perform at their peak while balancing asset performance, cost and risk.

Headquartered in South Africa, Pragma has a global footprint with regional offices and representation in Brasil, Europe and Mexico, while partnerships with various companies around the world allow us to take our services into many more territories.

SAP® Partner
Open Ecosystem

Microsoft Partner

Contact us for more information

Europe

Pragma Netherlands BV
Kerkweg 10
3603CM Maarssen
Tel:+31 30 686 6980
General Manager: Henk Wynjeterp

South Africa

Pragma Building, DJ Wood Way
Bellville West, 7530 Capetown
Republic of South Africa
Tel: +27 21 943 3900

Brasil

Estrada Municipal do Roncáglia,
no 370, Bairro Roncáglia
Valinhos, São Paulo
CEP: 13272-721
Tel: +55 19 3800 3500

Mexico

Calle Armando Birlain Schaffler
2001 – Torre 1 – Oficina 1128 Central Park
Centro Sur Querétaro CP. 76090
Tel: +52 442 290 24 55