Looking Beyond Acquisition: Total Cost of Ownership and the Role of Enterprise-Class Devices

Organizations looking to cut expenditures will frequently opt for lower cost…non-rugged mobile computers for applications that are better served by rugged devices. Given the high current failure rate (38%) of non-rugged mobile computers, this includes a broad collection of mission-critical enterprise mobility applications.

–VDC Research

The high cost of using consumer-grade hardware for enterprise-class needs
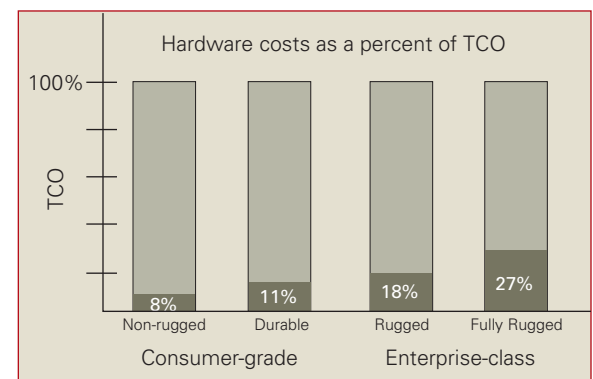
For companies investing in mobile technology, consumer-grade PDAs and smart phones have undeniable appeal. At one-half to one-third the price of enterprise-grade hardware, buyers may be tempted to accept the high failure rate, thinking they would have to replace a consumer-grade device three times over (which feels unlikely) before they could justify the cost of buying a more rugged, enterprise-class device.

This simple analysis can be deceiving—and ultimately expensive. Hardware acquisition and replacement costs pale in comparison to the true costs of a device failure in a business setting. For consumer-grade devices, more than 90% of the total cost of ownership (TCO) comes after the initial hardware purchase (figure 1).[1]

By far the largest contributors to TCO in a business setting are the lost productivity, and more significantly, the lost revenue opportunities, that result when a mobile device fails. Depending on your industry, a device failure* can result in:

- a second trip to complete a service call, doubling the cost of service
- a missed sale
- a delay in payment on goods you've delivered
- gaps in regulatory compliance

Figure 1

Hardware costs as a percent of TCO

	Consumer-grade		Enterprise-class	
	Non-rugged	Durable	Rugged	Fully Rugged
	8%	11%	18%	27%

TCO axis: 100%

*Defined as a mobile device requiring some level of help-desk or technical support.

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Not only do consumer devices fail up to four times more often than enterprise-class devices,[2] but each failure results in longer stretches of lost productivity and more IT support time to resolve.

The second largest contributor to TCO is IT support. Resolving field problems is only one aspect to consider. On this task, companies report spending more than an hour to resolve each consumer-grade PDA failure vs. 37 minutes for a rugged PDA, on average.

Additional IT support costs accrue from the lack of enterprise-class remote device management, battery management and security for consumer-grade devices. Most significant, though, is the cost of upgrades and ongoing hardware and software support for an enterprise-wide deployment of hundreds or thousands of mobile devices, with complex integration into the backend systems that field workers rely on for their daily work.
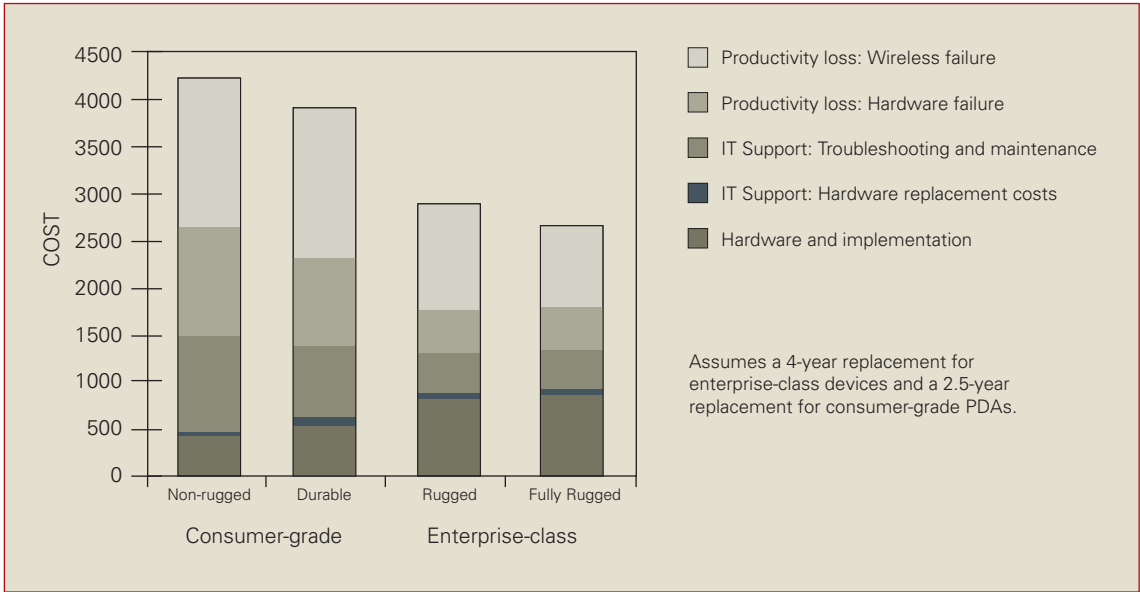
Hardware repair or replacement costs come in at a distant third compared to these other factors. Even here, enterprise-class devices have one advantage:

56% of hardware failures are likely to be covered by warranty, vs. 35% for consumer-grade devices. Manufacturers of enterprise grade devices also tend to offer service options that include comprehensive coverage (even for normal wear and tear) with guaranteed turn-around times—eliminating "surprise" repair costs and reducing the cost of maintaining large spare pools.

Figure 2 shows the total cost of ownership for consumer-grade and enterprise-class handheld computers, based on a VDC research study[3] covering retail, transportation/distribution, manufacturing, government, field service, professional service and health care service industries. Using this model, the initial acquisition, implementation and replacement costs average $500 – $700 for consumer devices and $880 – $900 for rugged devices (annualized five-year costs). **The average total cost of ownership, however, is less than $2,900 per year for enterprise-class devices compared to more than $4,000 for consumer-grade PDAs.**

Figure 2

Assumes a 4-year replacement for enterprise-class devices and a 2.5-year replacement for consumer-grade PDAs.

Legend:
- Productivity loss: Wireless failure
- Productivity loss: Hardware failure
- IT Support: Troubleshooting and maintenance
- IT Support: Hardware replacement costs
- Hardware and implementation

Source: VDC Research report, Total Cost Of Ownership Models for Mobile Computing And Communications Platforms, Second Edition, David Krebs. June 2007

> VDC's analysis of failure rates, replacement costs and productivity impact suggest that these factors are undervalued in most TCO analyses.

The need to estimate a realistic total cost of ownership (TCO)

In 2007 fewer than one in three companies reported using TCO analysis in their mobile computing purchase decisions.[4] This was confirmed by a 2009 Motorola Enterprise Mobility study showing only 30% of companies in the Americas (49% in Europe and 41% in APAC) used at least one financial analysis method, primarily TCO or ROI analysis, to guide their investment in mobile and wireless technology.[5]

VDC concluded that some companies forgo TCO analysis and opt for consumer-grade devices because they underestimate the hazards to which their mobile devices will be exposed, and therefore their rugged needs. And even among companies who use TCO analysis, most dramatically underestimate the failure rates, replacement costs and productivity impact on their business.

What cost dependability?

As organizations port more line-of-business applications to mobile devices, workers increasingly rely on these devices to perform essential daily activities. The impact of a device failure is much greater than simply being unable to check email or take calls. For example:

- **Overtime and extra trips.** A service technician repairing a heating unit at a customer site needs to look up a diagnostic procedure. Peering into the unit, he reaches for his consumer-grade PDA and accidentally knocks it to the floor, breaking the screen. He locates a printed manual in his van and begins following the procedure, but after

some frustration realizes that the book is out of date. It's pushing 5 pm; he either has to work overtime or schedule a return call tomorrow.

- **Lost sales opportunities.** A telecom service technician repairs a business line at no cost to the customer per the service agreement. The customer asks for installation of an additional line "as long as you're here," but the technician's consumer-grade device integrates only with the service data base, not the quoting and order entry system. He leaves a message with his sales group. A sales rep returns the call later that day, but the customer is too busy to discuss it.

- **Missed sales calls.** A sales rep has five appointments scheduled in his day. He uses a GPS application on his consumer-grade phone, but this power-hungry app drains the batteries before his fourth appointment. Lost, he is late for the appointment and has to cancel his last appointment, hoping to reschedule it next time he is in area.

- **Compliance issues.** A gas company employee at a remote station goes to enter proof of inspection using his PDA over a commercial wireless network. Poor network coverage in the area prevents him from getting a connection. He fills out a paper form and brings it back to the office, where it is entered into the system some days later. A misinterpretation of the tech's handwriting could cause regulatory compliance questions down the road.

As Figure 2 shows, the cost to the business of these lost opportunities is far more significant than the money saved on the initial hardware purchase.

The differences between consumer and enterprise devices

Choosing the right rugged level for the intended use reduces device failures and total cost of ownership. In this section we compare consumer grade handheld computers and PDAs (non-rugged as well as "durable") to enterprise-class (rugged and fully rugged) hand held devices. For this paper we will focus only on handheld computers and PDAs.

CONSUMER-GRADE		ENTERPRISE-CLASS	
Non-rugged	Durable	Rugged	Fully rugged
Handheld computers, smartphones and PDAs intended for consumer use	Consumer-grade devices enhanced with integrated accelerometers, spill-proof keyboards, etc.	Meets IP-63 standards. May include rubberized edges to absorb impact from drops, metal construction, sealed case to resist dust and liquids, integrated peripherals	Meets MIL-STD 810-F and meets or exceeds IP-64 standards

TCO in context of today's business environment

Cybercrime is big business. To breach corporate networks, attackers are moving beyond Internet or email-based viruses, botnets and Trojans to wireless-specific schemes: rogue APs, wireless phishing, Evil Twin, man-in-the-middle and several others. The cost of maintaining wireless security should be factored into TCO. The cost of a breach should, at the very least, be considered. These include tangible costs such as lawsuits and regulatory fines, as well as damage to a company's reputation and the resulting impact on customer retention and acquisition.

Downsizing and the "jobless recovery" have affected nearly every industry. Mobility tools can help a smaller workforce maintain productivity by increasing the individual's versatility and efficiency. In the field, service techs can up-sell if they have access to quoting and sales systems. Both sales and service people can make more calls per day, with less wasted driving time. Automatic transmission of repair, tracking and compliance information into the back-end systems eliminates the cost of paperwork and improves accuracy. Companies can satisfy customers faster—building loyalty and reducing cost. A device failure reverses these benefits and adds to employee frustration.

Tight credit or a reluctance to take on risk means cash flow is more important than ever. Mobility devices can speed payment and reduce days sales outstanding (DSO) with credit/debit card readers for on-site payment, or printers to generate on-the-spot invoices. Saving cash by investing in less-than enterprise grade hardware can limit cash flow later if the devices are not designed to meet the needs of the environment.

Many companies are conducting complete operational evaluations to **identify areas of waste.** Mobile solutions—with their proven benefits in worker efficiency and improved customer service—present a real opportunity for companies to emerge from the downturn with a new competitive advantage over their competitors.

Ability to withstand heavy use

Besides their low initial cost, consumer-grade devices have the appeal of familiarity as they are widely used in business for voice communications and mobile email, especially by sales people. They also feature sleek and trendy designs.

While fine for making calls or checking emails, these devices are not designed to stand up to constant use, all day and every day. The average annual failure rate is 38% for non-rugged devices, more than three times higher than for enterprise-grade devices (11%). Even in environments that are not especially harsh or challenging, such as health care settings, consumer-grade devices (including durable devices) fail at twice the rate of rugged devices. For environments such as field service, their failure rate is up to four times higher than rugged devices.

Figure 3 shows failure rates for rugged devices, consumer devices and smartphones for several vertical industries. The primary sources of failure were related to environmental issues: exposure to extreme temperature fluctuations, water/moisture/humidity, excessive vibration, and sometimes EMI exposure.[7] Data do not include lost productivity due to temporary issues such low battery or the need to "re-boot" the device, which occur more often with consumer-grade devices.

What about smart phones?

As smart phones proliferate, organizations are looking to port more line-of-business applications to these devices. Smartphone limitations are similar to other consumer-grade handheld devices. They are the least expensive devices to deploy (measured as the sum of purchase, peripheral integration, training and warranty expenses), but fail the most often, cost organizations the most when failures occur, have the shortest lifespan, and are twice as likely to be stolen as the average handheld or notebook.

Interviews confirm what the data shows: users tend to underestimate the hazards their mobile devices will be exposed to, and therefore their ruggedness needs.

– VDC Research

Figure 3 – Average monthly failure rates and time spent to recover per failure for several vertical industries.

RETAIL

avg monthly failure rate: 1.8%, 2.5%, 2.8%

	rugged	consumer	smartphone
Internal time spent per failure (minutes)	38	65	62
Lost productivity per failure (minute)	46	72	74

FIELD SERVICE

avg monthly failure rate: 2.3%, 3.8%, 3.9%

	rugged	consumer	smartphone
Internal time spent per failure (minutes)	38	64	71
Lost productivity per failure (minute)	44	77	81

GOVERNMENT

avg monthly failure rate: 2.5%, 4.2%, 4.6%

	rugged	consumer	smartphone
Internal time spent per failure (minutes)	36	62	74
Lost productivity per failure (minute)	42	77	80

MANUFACTURING

avg monthly failure rate: 1.8%, 3.3%, 3.3%

	rugged	consumer	smartphone
Internal time spent per failure (minutes)	37	65	70
Lost productivity per failure (minute)	40	75	85

HEALTHCARE

avg monthly failure rate: 2.0%, 3.7%, 4.7%

	rugged	consumer	smartphone
Internal time spent per failure (minutes)	37	66	70
Lost productivity per failure (minute)	43	78	82

PROFESSIONAL SERVICES (INCLUDING SALES)

avg monthly failure rate: 2.0%, 3.8%, 4.1%

	rugged	consumer	smartphone
Internal time spent per failure (minutes)	35	70	64
Lost productivity per failure (minute)	42	82	82

TRANSPORTATION / DISTRIBUTION

avg monthly failure rate: 2.1%, 3.2%, 3.5%

	rugged	consumer	smartphone
Internal time spent per failure (minutes)	36	64	64
Lost productivity per failure (minute)	38	67	75

Source: VDC Research Report, Total Cost Of Ownership Models For Mobile Computing And Communications Platforms, Second Edition, David Krebs. June 2007

Functionality and ergonomics for business use

Companies deploying consumer-grade devices for business often deploy multiple devices to meet field workers' needs: a cell phone for voice, a mobile computer for data applications, a GPS system for turn-by-turn directions and more. Buying and supporting multiple devices increases hardware acquisition costs and multiplies support costs: multiple devices and operating systems; monthly service fees from multiple providers; multiple warranty contracts and replacement/upgrade cycles are just a few of the factors.

Enterprise-class devices deliver more value by combining the functionality of a cell phone, consumer-grade PDA and GPS unit. They integrate robust voice and data functionality, advanced data capture—such as bar code scanning or RFID, signature/image capture—and GPS into one easy-to-carry package designed for all-day business use. Peripheral devices such as mobile card payment processing or mobile printers drive additional business value and can be selected based upon the individual needs of the organization.

Ergonomics are critical to the success of any device deployment—with the goal to minimize training requirements and streamline worker adoption. Unlike consumer grade devices designed for the masses, many enterprises offer flexible options designed to accommodate the task-workers' needs. A good example would be keypad options ranging from QWERTY keyboards for free-form text entry to calculator layouts for heavy numerical applications and phone keyboards for heavy call use. Touch screens with pull-down menus streamline data entry and ensure greater accuracy. Such considerations improve worker productivity, minimize training costs and reduce the probability of damage due to misuse.

Power to run complex applications

Consumer-grade PDAs are designed to run fairly simple consumer applications such as email, usually one application at a time[†]. They typically lack the processing power and memory to handle multiple or compound business applications. Business users may find the devices becoming slow and unresponsive as they encounter memory leaks and other conflicts. This software failure has the same impact on productivity and revenue as a hardware failure.

Let's look at a field service example of a compound application:

A mobile field worker arrives to repair a dishwasher. He needs to order a part, and sell an extended warranty if appropriate. His handheld device provides all the information he needs on one screen, through a compound application integrating with three distinct backend business systems: CRM for the customer's address, ERP to check inventory and order parts, and a third system for service contract management.

In a recent deployment, a major service organization developed a similar custom mobile application to connect their 5,000 field service employees to their backend business applications. In side-by-side testing, the mobile application performed as required on an enterprise-class PDA. It failed to run at all on the device they had hoped to deploy: a consumer-grade PDA already popular with its employees for mobile email.[8]

[†] I.e., applications or platforms designed to integrate with multiple enterprise backend systems or the enterprise BUS.

Ease of provisioning and device management

Next to productivity costs, the largest costs associated with mobility are physical deployment and day-to-day management of the devices. These costs are higher when IT personnel must physically touch a device to prepare it for initial use, update software and troubleshoot problems. Enterprise management systems for remote device staging, provisioning and management reduce TCO by speeding deployment, ensuring that devices are running the most current applications and operating systems, and enabling rapid troubleshooting of issues so that users remain productive.[9]

Management systems for consumer-grade devices lack the depth and breadth of services inherent in enterprise-class management systems. Some key services and features include:

- Staging via bar code scanning, cradle or a pre-defined staging network, with template-based configuration for automation

- On-demand staging with central execution via a server or local execution via a laptop

- SMS-based staging for WWAN with ability to establish a secure tunnel via VPN

- Customizable management system for control of aspects specific to the organization's devices, such as mobile printers and wireless LAN settings

- Customizable user messages to enable creation of native language messages, guiding end users through steps and eliminating confusion or delays

- Robust back-up and restore functions

- Asset management with customizable views and asset names to simplify search for mobile devices based on attributes relevant to the enterprise

- Command and control to perform actions on a device or a set of devices

- Remote wipe/lock with local and remote policies to meet varying security requirements

- Status reporting with compliance summary views

- Data collection and analysis: collect metrics from mobile assets and categorize data collected for ease of access and statistical analysis

Battery management

Enterprise-class hardware designers place much greater emphasis on battery management than do consumer-grade device vendors. With consumer-grade devices, the health of a battery is typically determined by trial and error. Users discover that a fully charged battery did not last as long as expected, and may not remember to report that fact at the end of the shift. Potentially unhealthy batteries often end up in a pile in the back room for analysis and testing. This is a time-consuming, costly and imprecise process; forcing managers to purchase a larger battery pool to ensure an adequate supply of healthy batteries for end users.

In contrast, enterprise-class devices are now offering innovative features such as batteries with built-in indicators to report state of charge and overall battery health. This enables more cost-effective management of the battery pool. Users start the day with a battery capable of providing full-shift support. The IT department gets maximum lifetime from each battery, reducing acquisition costs and the burden of disposal or recycling.

Other features unique to enterprise-class devices include a strong focus on backroom management. For example, universal charging racks designed for compatibility with future generations of a device will reduce the capital and operational costs of replacing cradles, battery chargers, cables and other accessories with each upgrade.[10]

Power-efficient software applications

Software developers also pay more attention to maximizing battery life when designing enterprise applications. For example, GPS applications designed for consumer devices are typically four to five times bigger and use more battery power than GPS applications designed for enterprise devices and for interface with other mobile applications. With nine in 10 field workers reporting getting lost once a month, GPS can reduce driving time up to 63% per week,[11] enabling more sales or service calls—but only if it's available all day.

Streamlining IT support, reducing user downtime

Enterprise-class devices with robust device management platforms streamline device maintenance, reducing IT support time and end user downtime when compared to consumer-grade devices. Here are a few of the tasks involved in provisioning, ongoing software updates and maintenance, and tech support and inventory management.

Provisioning
- Order a new device from stock or carrier or supplier
- Provision the device with or without user intervention
- Activate the device with carrier transfer of phone numbers and SIM info
- Deactivate the old device
    - Update stock for out-of-use unit
    - Manage warranty information, return unit for repair if applicable
    - Manage disposal including data removal

Provisioning and ongoing software updates and maintenance
- Assign software packages to devices, users or groups
- Manage multiple versions of each application
- Distribute software packages based on device characteristics
    - Distribute applications and updates over the air via LAN
    - Distribute multiple, sequenced files within a single package
    - Automatically segment large files for staggered delivery to optimize network bandwidth
- Apply automatic updates over the air without requiring user input
    - Ability to use special rules and file differencing techniques
    - Ability to perform update silently in the background
- Perform pre- and post-installation operations during software distribution
    - Ensure support for all standard files supported by each OS (CAB, XML, etc.)
- Install / uninstall applications, delete registry settings, delete or update files

Tech support
- Remotely view system info, kill or activate processes on mobile device
- Remote hard or soft reset of device
- Issue remote commands in real time
- Delete, copy, receive and send files remotely

Inventory management
- Hardware and software inventoried on connection to home server
- Track inventory collection dates/times

Wireless access flexibility and security

Enterprise-class devices feature multi-modal solutions with both WLAN and WWAN, allowing companies to access the lowest cost wireless available[12] whether inside or outside the "four walls." This can reduce overall communications costs.

More significant is the ability to access secure virtual private networks (VPNs) designed for mobility. Most companies invest heavily in IT security for office employees and laptop users, but a majority of mobile devices such as smartphones and handhelds do not comply with government regulations or organizations' internal IT security policies. These often represent the network's weakest link.

Virtual Private Networks (VPNs) based on Internet Protocol security (IPsec) and Secure Socket Layer (SSL) have long been used for secure remote access, but do not perform well in a wireless environment with limited bandwidth and unstable connections. Enterprise-class devices are beginning to integrate new "mobile VPN" technology, based on Transport Layer Security (TLS) and optimized specifically for low-bandwidth networks and mobile devices. Highlights include:[13]

- **Security.** Mobile VPN provides authentication, encryption and data integrity. It offers the security needed to protect the mobile workforce while providing access to the data they need in the enterprise's backend systems.

- **Seamless roaming:** Mobile VPN allows users to remain continuously connected as they cross network boundaries and use different radio access networks.

- **Session persistence with transaction recovery.** This eliminates the need to re-authenticate or restart the application after a lost signal, change of network type, or hibernation mode. It also recovers all the data from the session.

- **Low battery consumption.** By allowing a device to hibernate without impacting productivity, the mobile VPN prolongs the time between battery charges and extends the total life of the battery.

- **High data compression.** Advanced data compression provides up to 60 percent higher throughput than with regular VPNs. This allows applications to run effortlessly when accessing data over low-bandwidth networks, and can result in lower data fees.

- **Optimized for mobile device CPU and memory.** Mobile devices typically have less processing power and memory than laptops. Mobile VPN technology uses much less processing power than the traditional VPN technology, improving speed and extending battery life. Memory footprint requirements are several times less than traditional VPNs, preserving the limited storage space for applications.

Lifecycle management and upgrade paths

Consumer devices are designed for obsolescence every six to nine months. This means more frequent buying and provisioning cycles, as well as more time spent disposing of old devices in compliance with security, environmental and financial regulations.

The driving factor with each new generation of consumer devices is change: aspiring to be "the next big thing" often leads to radically new designs and new ways of working. Frequent change is not an optional situation for business users, where a re-designed keypad may necessitate increased training and help-desk support, with a productivity dip as users re-learn how to perform tasks.

In contrast, enterprise-class device vendors place a high priority on smooth upgrade paths for users and IT managers. New models are designed for interoperability with older devices and backward compatibility with existing applications and operating systems. Particular attention is paid to integration with the enterprise's backend systems, which may include CRM, ERP, sales and dispatch systems.

Vendors of enterprise-class hardware typically work closely with their customers, sharing a roadmap of future developments and helping to ensure that the customer is well prepared for coming releases. Such attention to lifecycle management and upgrade paths insures that a company's initial hardware and software investments are protected over the long term.

How to Start a TCO Analysis

Good TCO analysis brings out the "hidden" or non-obvious ownership costs that might otherwise be overlooked in making purchase decisions or planning budgets. As detailed in this paper, TCO analysis should consider not only the acquisition cost but also the cost of deployment, support, lifecycle management, and lost user productivity (both downtime due to device failure, and inefficiency due to platform slowness, lack of functionality, poor ergonomics, etc.).

TCO analysis is not a complete cost/benefit analysis. Strictly speaking, TCO pays no attention to business benefits other than cost savings.

Therefore a TCO analysis can be enhanced by some level of Return on Investment (ROI) analysis. ROI statements should provide an accurate representation of business value, appeal to the shared decision making model, be believable, and capture the total investment. And, they should define business value along the three key dimensions of *how much, how soon, and how certain*.

An effective TCO or ROI statement should provide a good executive summary as well as complete detail on all benefit statements and underlying assumptions, parameters and costs. Details on the methodology are key for those who did not participate in the process.

Typical TCO and ROI Categories

This chart illustrates typical TCO considerations and ROI business value measurements for a field service organization.

Total Cost of Ownership (TCO) Considerations	Return on Investment (ROI) Business Value Measurement
• Acquisition costs 　– Mobile device cost per unit 　– Cost of peripherals and accessories 　　∗ WWAN Card 　　∗ Barcode scanner 　　∗ Vehicle DC adapter 　　∗ Batteries 　　∗ Rugged case 　　∗ Vehicle mounts 　– Spare pool % and costs of spares with accessories • Carrier airtime data package and voice package • Staging costs on initial deployment • Hardware maintenance costs 　– Warranty costs 　– Cost of repair or replacement • Software maintenance and support costs including deployment of updates, security • Software development and integration costs • Lifecycle management costs including hardware and software upgrades • Training and training materials costs	• Increase in service tickets or calls completed per day • Increase in work orders completed • Avoidance of staffing increase due to automation 　– No additional staff needed to process additional orders 　– Increase in dispatcher to field team ratio • Reduced number of rescheduled calls • Increased first time fix/resolution ratio • Increase in completed repair orders or service tickets and/or reduction in: 　– Mean Time To Repair (days): 　– Repair Order Backlog 　– Late Completion % • Improvement in service margins • Improved field service technician utilization • Reduction in days billing outstanding 　– Reduction in billing days due to payment at site, or within # of days • Anticipated up-sales of product or services • Improved employee productivity and satisfaction • Improved customer satisfaction and retention

Summary

Hardware acquisition and replacement costs represent as little as 8% of the total cost of ownership when deploying a mobility solution for the enterprise. Companies must consider the impact of lost productivity and revenue opportunities from a device failure, as well as ongoing IT support costs.

For the majority of field mobililty applications, enterprise-class devices offer a clear total cost advantage due to their lower failure rates, integrated business functionality and lower ongoing support costs. Enterprise-class devices enable higher productivity, the ability to capitalize on additional revenue opportunities, and more efficient ongoing support with business-focused platforms for device management, battery management, security, upgrade paths, back-end integration and more.

For More Information

To find out how Motorola can streamline your field service operations, please visit us at www.motorola.com/ business or call 1-866-617-4522.

About Motorola

Motorola offers true end-to-end mobility solutions that include: a comprehensive portfolio of mobile devices with extensive wireless communications capabilities; affiliations with the leading wireless public network providers; a portfolio of private wide area and local area network infrastructure; a partner channel delivering best-in-class applications; and a complete range of pre- and post-deployment services to help you get and keep your mobility solutions up and running at peak performance. And when you choose Motorola, you choose the strength only an industry leader can offer, with proven technology in successful customer deployments in many industries around the world.

Footnotes

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