

Analyzing the Return on Investment for Indoor Positioning Systems

Michael K. Dempsey

The potential for an indoor positioning system (IPS) to help a health care organization save money, increase efficiency and revenue, and improve safety and satisfaction is driving many to consider an IPS implementation, particularly with the mainstream interest in RFID (radio frequency identification). There are, however, different types of RFID: passive and active, which is becoming equated to IPS; and other technologies (infrared, radio triangulation and radio fingerprinting, for example) used for IPS.

The focus of this article therefore is on the general principles for establishing and measuring return on investment (ROI) for IPS—principles that apply regardless of the underlying IPS technology or how it will be used. The goal is to enable a common approach so that a hospital can analyze different systems based on their unique circumstances to determine if and which solutions will yield compelling returns.

The reader will be introduced to hard (tangible) and soft (intangible) return analysis and the direct and indirect costs of acquiring and maintaining an IPS, and how these returns can come much more quickly than many expect. Both types of return will be analyzed for IPS-enabled applications in four categories, each of which will have various sub-applications: asset tracking, patient location, workflow analysis, and other potential applications.

The Return

Across these application categories, there are several ways an IPS could deliver measurable return, including:

Michael K. Dempsey is chief technology officer at Radianse, Inc. and has been in the field of wireless medical communications since 1984. He holds six patents in wireless medical device communications and has six more pending for indoor positioning.

An IPS may be able to send instant messages using SMS (short message service) to pagers or cell phones, which can reduce asset shrinkage by alerting appropriate personnel when patients or equipment move beyond preset boundaries.



- ♦ Reducing overbuying, rental, or replacement of equipment due to inventory inaccuracies, theft, and loss.
- ♦ Reducing exposure to penalties from the Joint Commission (JCAHO) or other regulatory auditing.
- ♦ Regaining staff time lost to equipment and supply hunting expeditions.
- ♦ Improving response times to patients.
- ♦ Reducing errors by generating an alarm if a patient comes within a certain distance of incompatible medication or supplies.
- ♦ Reducing lost billing opportunities due to the inability to accurately record when equipment is used on patients.
- ♦ Improving workflow efficiency by enabling hospitals to analyze location, timing data, and to identify bottlenecks.

Return is generally defined as a benefit achieved from an investment. Returns can be tangible, typically categorized as “hard returns,” such as a specific savings from reducing rentals or revenues increased due to the IPS enabling more patients to be treated. Returns can also be intangible, typically categorized as “soft returns,” such as increased clinician satisfaction based on charts being found more quickly and less time spent looking for equipment.

Are labor costs hard or soft returns? If full-time equivalents (FTEs) can be eliminated, it is clearly a hard return. More likely it is a matter of “found time,” which increases satisfaction, at the least, and makes more time for other hopefully higher-value tasks. This time can be spent with patients. Either way, for the sake of the principles set forth here, labor costs will be considered a soft return—valuable but not necessarily justification for purchase.

Furthermore, for the sake of this article, these and other returns will be categorized as follows:

| Hard returns | Soft returns |
|------------------|----------------------------|
| ♦ Revenue gains | ♦ Labor savings |
| ♦ Cost avoidance | ♦ Satisfaction improvement |

As a matter of course, this author recommends using hard returns to justify an IPS purchase, as they are easier to objectively measure and leave no question on the actual return. From there, soft returns will only increase the benefits to your organization. This does not preclude a health care organization from applying its own research to determine if an IPS can enable enough soft returns to justify or perhaps strengthen the case for an IPS implementation.

The Investment

One-time costs. The most obvious element of the cost of an IPS is the purchase price. For this article, assume the system costs the hospital \$120,000. To be accurate, this must include:

- ♦ Hardware (receivers, tags, servers, etc.)
- ♦ Software (server software, database fees, “per-user” fees, “per-tag” fees)
- ♦ Installation (fees associated with labor to install system and labor to find and tag equipment)
- ♦ Support and maintenance costs

Additionally, there may be integration tasks (to existing hospital IT systems, for example) that will fall to the

hospital and these must be considered. Any fees that IT imposes for network connections, shared server time, or help-desk support of end-user applications also need to be included.

Ongoing costs. Generally, IPS tags use replaceable batteries. The 12- to-18 month cost of batteries in some systems can be higher than the actual price of IPS tags in other systems. The cost to replace tag batteries divided by the actual battery life will yield an annualized battery cost per tag. In doing this analysis, be sure to use the actual battery life you expect; some IPS vendors quote very long battery lives but assume either infrequent update rates or that the tagged device never moves—both are typical invalid assumptions.

Ongoing costs must also include any yearly service contracts or software support fees the IPS vendor charges. These yearly costs are analyzed differently than one-time costs.

The Analysis

Step 1—Determine IPS applications. The first step in a return on investment analysis is to determine the application(s) for which an IPS will be used. This process works best when a cross-functional team (nursing, IT, clinical engineering, administration, security, etc.) is included in the decision-making. As noted in Table 1, asset tracking has many hard returns, and as such represents a logical initial application for IPS. Since asset management is generally under the control of the clinical engineering department, it may be easiest to manage.

Workflow analysis also has many hard returns, including increased revenue, which may make it appealing to hospital administration. However, workflow tends to have higher costs because achieving returns may require hospital or department processes and culture to change, which is time-consuming and difficult to measure. These factors may contribute to a longer ROI cycle.

Step 2—Request for proposal. Having identified the problems an IPS needs to solve, it’s time to request vendor quotes. At this point, it is essential that the capabilities of the IPS match the problem identified. For example, if a system is not designed to locate patients, it will not be able to support workflow analysis. Vendor charges need to be categorized as one-time costs and ongoing expenses. Your request should include the scope of the project and request a certain level of location accuracy that reflects the problems you need to solve.

Current Issues

Michael K. Dempsey

| | Hard Returns | | Soft Returns | |
|--|-------------------|----------------|---------------|------------------------|
| | Increased Revenue | Cost Avoidance | Labor Savings | Increased Satisfaction |
| Asset Tracking | | | | |
| Reducing lost equipment that results in more purchases | | √ | | |
| Reducing equipment rentals | | √ | | |
| Reducing “look time” and “could not locates” | | | √ | √ |
| Better equipment utilization | | √ | | |
| Allowing nurses to find equipment more easily | | | √ | √ |
| Consumables management | | √ | | |
| Surgical instrument management | | √ | | |
| Reducing delays in patient care due to lack of equipment | √ | √ | | |
| Intradepartmental conflict as to who owns what | | | | √ |
| Ease of transporting patients across departments | | | | √ |
| Patient Tracking | | | | |
| Reducing risk of lost patient | | √ | | |
| Reducing look time for patients during rounds, etc. | | | √ | √ |
| Automatic charge capture | √ | | | |
| Fall/Wander alerts | | √ | | √ |
| Workflow Analysis | | | | |
| Increased patient throughput | √ | √ | √ | √ |
| Improved staff scheduling | | | | √ |
| Improved OR/ED efficiency | √ | | | |
| Faster patient care | | | | √ |
| Other Potential Applications | | | | |
| Staff security (panic button) | | √ | | √ |
| Medication error avoidance | | √ | | √ |
| Finding missing charts | | | √ | √ |
| Automatic workstation log on and off (HIPAA compliance) | | √ | √ | √ |
| Automatic bed free/utilization tools | √ | √ | √ | √ |
| Automatic whiteboards | | | √ | √ |

Table 1. Hard and Soft Return Elements of Various IPS Applications. This table lists some of the return elements that should be considered. It is intended as a representative list. While it is believed to be inclusive, there may be other applications that your institution and IPS vendor are targeting. These applications could be mapped onto Table 1 and analyzed similarly.

Current Issues

Analyzing the Return on Investment for Indoor Positioning Systems

Step 3—Analyze internal costs. Next, the same cross-functional team that identified the problems to be solved can work to analyze any internal costs, which may be either one time or ongoing. These costs may include IT installation or labor costs, nursing labor costs, etc. or ongoing expenses, such as those related to tag preventative maintenance.

Step 4—Project annual savings rate of return. The team should estimate the hard returns expected from the IPS. Table 1 identifies some, but the specifics will vary by hospital. You may assume, for example, that you will improve your loss rate of telemetry transmitters by 10%. If you currently have 100 transmitters, this means that you would be able to locate 10 previously lost transmitters at \$1,500 each for a total savings of \$15,000. A similar analysis can be done for IV pumps, external pacemakers, cables, monitors, or other tracked devices—which are typically portable assets. Then the team can move down Table 1 to “Reducing equipment rentals,” “Reducing look time” and so on. All these figures are added to generate a projected annual savings rate.

Remember the rentals. Additionally, suppose that the team believes they can reduce IV pump rentals by half and the current cost of these is \$100,000. This results in an additional \$50,000 in savings. Ignoring other elements of the hard returns for the sake of simplicity, this means the potential savings is \$96,750 plus \$50,000 or \$146,750.

Step 5—Calculate ROI. At this point, an ROI analysis can be easily calculated. First, the estimated annual-

ized ongoing costs (the amount needed each year to support the system) are subtracted from the projected annual savings rate. This number is divided into the one-time system cost and the resulting number is the system ROI in years.

The final ROI. Assume also that there will be ongoing costs of about \$10,000 for support contracts, batteries, and labor. This reduces the annual savings to \$136,750. Against a cost of \$120,000 to install the IPS, the ROI is determined by dividing the system cost (\$120,000) by the annual savings (\$136,750) to achieve an ROI of 0.88 year or 10.56 months.

Conclusion

With the right technology applied to solving location problems, indoor positioning solutions can have a dramatic impact on savings and a fast return on investment. To analyze this ROI, and present the strongest case to justify an IPS investment, simply quantifying the hard returns can be enough. Across asset tracking, for example, there are many ways to save. When applied to problems such as lost assets, excessive equipment rentals, surgical instrument management, and improved equipment utilization, an IPS can help a hospital avoid significant costs.

Reducing delays in patient care because the right equipment isn't available can actually increase revenue. Hard returns related to workflow analysis also exist, but the ROI may take longer because of changes required to established processes. Whatever the IPS application, there is potential for return. Using the methodology presented in this article will provide the data you need to defend an IPS investment to management. ♦

“Use hard returns to justify an IPS purchase.”
—Michael K. Dempsey

| Tracked Equipment | Quantity | Cost | Improved Loss Rate | Potential Savings |
|---------------------------------|----------|--------|--------------------|-------------------|
| Telemetry Transmitters | 100 | \$1500 | 10% | \$15,000 |
| External Pacers | 50 | \$1650 | 22% | \$18,150 |
| Infusion Pumps | 70 | \$3000 | 20% | \$42,000 |
| 12 Lead Cables | 40 | \$600 | 90% | \$21,600 |
| Total Savings Potential: | | | | \$96,750 |

Table 2. Projected annual savings rate of return.