CHAPTER

3

PACS STRATEGIC PLAN AND NEEDS ASSESSMENT

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WHY DO YOU NEED A PACS STRATEGIC PLAN?

For more than 100 years, the efficiency of radiology practices has been limited by film and film-handling activities. Picture archiving and communication systems (PACS) completely reengineer radiology practices by enabling images to be electronically viewed virtually anywhere on a clinical workstation or an ordinary PC. Film is printed on demand instead of after each and every exam by the technologists. Prior examination films do not need to be retrieved, matched to current films, distributed to radiologists, and retrieved again for refiling and storage. Radiologists' reports are not delayed due to missing films or because of inadequate hanging space for film on an alternator or view box.

PACS enables ubiquitous availability of images, resulting in improved clinical care and productivity throughout the healthcare enterprise. Patient

care is improved due to image availability and faster report turnaround and because the image dataset can be manipulated to yield more clinical information (e.g., three-dimensional [3-D] reconstruction and computer-aided diagnosis [CAD]).

Because a PACS is expensive technology that impacts the entire healthcare enterprise, a strategic business plan is essential to define the costs, benefits, technical changes, and operational changes that will need to occur to make the PACS a success. In many cases, a principal goal of the PACS strategic business plan is to help secure funding for the PACS and to provide a roadmap for its implementation. Building a strategic plan often provides the first opportunity in the process to educate end users about how the PACS will impact their operations. The issues and functional requirements identified in the strategic planning process will become input to the request for proposal (RFP). PACS vendors will be required to respond in detail to the RFP about how they will meet the unique needs of your institution.

WHAT IS IN THE PACS STRATEGIC PLAN?

A PACS strategic business plan is typically comprised of operational, technical, and financial sections. The following documentation is required to develop the plan:

- A list of all sites where images are acquired, clinically reviewed, or interpreted, which will help to define the scope of the project.
- A modality list for each site, which will identify any upgrades and associated costs that will be required to successfully integrate the imaging equipment with the PACS.
- An organizational chart, which will reveal the contacts responsible for each area that may be affected by the PACS. These stakeholders will need to be educated about how a PACS can affect their operations. In turn, they may become some of the key decision makers that will help define how the PACS should be implemented in their areas.
- Mission and vision statements to illustrate how a PACS is aligned with the organization's other strategic goals.
- Technical staffing data, throughput statistics, and hours of operation by modality, which will project productivity and capacity improvements that may result from a PACS implementation.

- Professional staffing data, including reading room locations and the degree of subspecialty interpretation, which will help estimate the number and type of primary interpretation workstations that will be needed.
- Exam volume and commensurate film expenses, which will help project film savings and estimate digital image archive needs.
- Network diagrams, including wide area networks to offsite imaging sites, to determine the adequacy of imaging dataset transmission.
- Number and type of different radiology information systems (RIS) and hospital information systems (HIS) deployed across the enterprise and whether patients have a unique medical record number across the various sites in the enterprise. Vendors should be able to explain how their PACS solution will seamlessly and effectively facilitate the flow of images across disparate HIS and RIS systems.

PACS STRATEGIC PLANNING: OPERATIONS

There are six recommended components to the operational section of the plan: (1) alignment with other strategic initiatives, (2) a PACS readiness assessment, (3) a basic phased implementation plan, (4) a PACS operational impact analysis, (5) a market assessment, and (6) a concluding section that illustrates how PACS can leverage existing human and capital resources to meet future demand for radiological services. Each component is discussed below.

ALIGNMENT TO STRATEGIC GOALS AND OBJECTIVES

The first phase of the strategic planning process is to outline the strategic goals and objectives for the project. Strategic goals may be logistical in nature, for example, moving into a new "digitally ready" department. There may also be strategic business objectives for the PACS, for example, aligning the PACS plans for a private radiologist's practice with the PACS plans for the hospital served. Other objectives may include protection or expansion of market share and professional recruitment. Information systems (IS) initiatives will need to be integrated with the PACS; for example, deployment of an electronic medical record or a new RIS will need to be aligned with the PACS strategy.

PACS READINESS ASSESSMENT

A PACS readiness assessment consists of an assessment of the organizational behavior, technical infrastructure, and existing operations. Assessment of organizational readiness includes a candid evaluation of whether the current leadership, departmental culture, and available support personnel are ready to implement and manage the change processes associated with a PACS implementation. A leader with prior PACS experience and project management skills is recommended in order to develop the institutional "vision" for a PACS. Operational and technical aspects of the organization's readiness to implement PACS may be gleaned from interviews with key stakeholders and decision makers.

Since a strategic business plan is often the vehicle that is used to secure funding for a PACS, interviews conducted during the strategic planning process represent an opportunity to both educate and build support for a PACS throughout all levels of the institution. Consultants with direct PACS experience can provide the education that is necessary for building support for the strategic business plan. The results of the interviews will drive the development of the PACS implementation plan. The specific objectives of each interview are discussed below.

Radiology administration, including the administrative director and the chief of radiology, can identify the drivers for PACS from a radiology perspective, including service and productivity issues. Radiology administrators can assist with computed radiography (CR) or digital radiography (DR) deployment strategies. With PACS, on demand printing often replaces printing each study after acquisition. Ironically, this may result in the need for more printing capacity at certain locations (e.g., the film library). Radiology administrators can assist with the deployment strategy for Digital Imaging and Communications in Medicine (DICOM) compliant printers.

Hospital executives, including the chief executive officer, chief operating officer, chief information officer, chief financial officer, and vice presidents, can identify PACS drivers from an institutional perspective. The chief financial officer should discuss competing capital-intensive initiatives and describe the requirements for the capital decision-making process. These executives can also assist in setting the financial goals for reducing film printing. PACS does not completely eliminate the need to print film, and it is important to plan for the ability both to print on demand and to print film as a backup strategy in the event the PACS is down.

Referring physicians can define their service level expectations from radiology and provide insight into how a PACS can be optimized throughout the enterprise to improve patient throughput and care. Referring

physician support is critical to the success of a PACS project. High-volume clinical areas, such as the intensive care unit (ICU) and emergency room, may have special requirements for electronic viewing of images. These areas are accustomed to having direct access to film and may require workstations comparable to those deployed in radiology, including dual monitors for side-by-side comparison of current and prior exams, with high-brightness, high-resolution, and grayscale monitors. The plan should include estimates of the associated costs of these workstations.

Radiologists should describe how the current analog environment negatively affects their ability to provide optimal service and how the PACS will mitigate or remedy the situation. A privately owned radiology practice may have PACS goals that are inconsistent with the hospital's. Outside consultants may be able to offer solutions that are more closely aligned with both the hospital's and the radiologists' goals. Professional staffing and interpretation practices will help to determine the location and type of diagnostic workstations and monitors that should be deployed.

The role of film librarians will be significantly different in a PACS environment. Film librarians will be managing electronic images, printing on demand, and managing the unread case list. They will need to be PC proficient and able to understand complex decision rules, particularly during the transition period from analog to digital images, to ensure that all relevant prior images, regardless of medium, are available at the time of interpretation. Therefore, the skill sets of this group need to be assessed. The film librarians can also provide estimates of the impact of lost film on patient care and throughput.

Technical managers and technologists should describe workflow, particularly as it relates to film-handling activities. The interviews of technical managers and technologists along with observations should be used to quantify the expected positive impact of a PACS on technologists' productivity and equipment utilization.

The interviews conducted during the PACS readiness assessment should be synthesized to highlight common themes about the PACS strategic goals and objectives.

IMPLEMENTATION PLAN

The third component of the operational strategic plan is a high-level implementation plan based on a phased approach to the PACS deployment. The phases of the implementation plan are typically based on strategic financial and operational PACS drivers that were identified in the interview process.

The plan should include potential schedules for CR or DR deployment, digital archive building, transitioning radiology operations to PACS, and enterprise-wide PACS deployment of electronic images as well as plans to reduce film expenses.

The implementation plan should include a description of each major phase of the project, including its primary objectives and benefits, estimated time frame, dependencies, and costs (Table 3.1). The implementation plan sets the parameters on when PACS-related expenses will be incurred and when film and film-related savings will be realized. Therefore, the implementation plan is a prerequisite to developing the PACS return on investment (ROI).

PACS IMPACT ANALYSIS

The fourth component of the operations section is the PACS impact analysis. The impact analysis includes estimates of the expected PACS benefits that may be realized through improved workflow and clinical care at each phase of the PACS deployment. Much of the emphasis will be on the workflow and productivity improvements that occur within radiology. Enterprise-wide PACS benefits should be discussed, although they are generally more difficult to quantify.

PACS IMPACT ON FILM AND FILM-RELATED EXPENSE

Film savings are usually the most quantifiable cost savings used to justify investments in PACS. Film savings include not only the cost of the actual film used but also all film-related costs, such as chemistry, film handling, storage, transportation, reprints and retakes, and film processor maintenance.

Film cost avoidance projections should include estimates of additional film that would otherwise be used to meet expected exam volume growth. Estimates should also include projected film increases that would otherwise occur with the use of newly deployed multislice computed tomography (CT) scanners and other image-intensive modalities.

Cost savings can also include an anticipated reduction in the film library workforce, but many plans attempt to estimate this more aggressively than is reasonable. It is important to remember that the need to manage and retrieve prior films may persist for several years after the deployment of PACS, and the need to print some films on demand may persist indefinitely.

TABLE 3.1
PACS Implementation Plan

Phase	Key Objectives	Primary Benefits	Time Frame	Dependencies	Estimated Cost
1	Develop and communicate PACS strategic plan Install telecommunications links Upgrade CT, MRI, US, and NM modalities to DICOM, worklist-enabled Prepare sites for viewing locations Install networking (wiring and switches) Prepare computer room Install PACS core system, including Web server Implement RIS interface Install speech recognition server and RIS interface Train radiologists	Set stage for remaining phases	3–6 months	Vendor selected Contract signed Funding approved RIS stable	$1,600,000 (PACS) $220,000 (SR)
2	Bring CT, MRI, US, and NM modalities online Integrate modalities with PACS Train technologists Acquire images QA image quality	Improve radiologist productivity Reduce lost film	6–12 months	Phase 1 completed	$600,000 (PACS)

(Continued)

TABLE 3.1
PACS Implementation Plan *(Continued)*

Phase	Key Objectives	Primary Benefits	Time Frame	Dependencies	Estimated Cost
	Implement softcopy interpretation of CT and MRI modalities Install diagnostic workstations Train radiologists Implement limited filming/print on demand Integrate laser printers with PACS Develop and implement limited filming program	Improve report turnaround Improve access to digital modality images in radiology			
3	Install CR Install CR equipment Integrate CR with PACS Train technologists Acquire images Perform QA on image quality	Reduce lost film Improve access to plain film images in radiology	3–9 months	Phase 1 completed CR funding approved PACS support plan	$230,000 (PACS) $1,000,000 (CR)

	Implement softcopy interpretation of CR Install clinical review workstations (ICUs and EDs) Train clinicians Limited filming/print on demand Develop and implement limited filming program	Improve radiologist productivity Improve report turnaround Improve access to plain film images in ICU and ED			
4	Integrate imaging Web user interface with electronic medical record Image distribution to clinicians Market capability Inform clinicians of availability and hardware requirements Assist with installation Train users Implement limited filming/print on demand Expand limited filming program	Provide access to images to referring clinicians Improve service Reduce film cost	6–12 months	Phases 1, 2, and 3 completed	$250,000

CR indicates computed radiography; CT, computed tomography; DICOM, Digital Imaging and Communications in Medicine; ED, emergency department; ICU, intensive care unit; MRI, magnetic resonance imaging; NM, nuclear medicine; PACS, picture archiving and communication systems; QA, quality assurance; SR, speech recognition; US, ultrasound.

In addition, films from modalities that cannot easily be converted to digital format (e.g., mammography) must continue to be managed by the film librarians.

Film-related cost savings must be related to the implementation plan. For example, if deployment of enterprise-wide electronic distribution of images is delayed until the latter phases of the project, you will not be able to stop printing film until after this phase of the project is complete. If you are phasing in PACS one modality at a time, film savings will be realized only for the modalities implemented and only if electronic distribution is available for those modalities.

Some areas are particularly challenging for electronic distribution and may need to continue to print film until the operational issues unique to these areas are addressed. For example, orthopedists may need to be able to perform measurements on the images for comparison with prosthetic devices. If the PACS does not provide this capability, the orthopedists will need to continue to receive film. Deploying workstations in operating rooms (ORs) may be a challenge due to space constraints, the bright lighting conditions, and requirement for a sterile operating field, resulting in continued film printing for this area. Digital mammography places some extraordinary demands on PACS due to the large image sizes and requirement for high-resolution workstations. As a result, digital mammography is not widely deployed at the current time.

PACS OPERATIONAL IMPACT ANALYSIS

The PACS impact analysis should include an analysis of technologist workflow in order to quantify the productivity and capacity opportunities that may result from a PACS implementation within radiology. Productivity and capacity improvements are commensurate with the amount of film-handling activities that are eliminated through a PACS implementation. The total time required for these activities can be estimated based on a percentage of total work time spent on performing them or on a per-exam basis. The time required for film-handling activities can then be annualized to hours based on the number of studies performed. The film-handling time estimates may be obtained through any combination of interviews, heuristics, or observations. Examples of film-handling activities include but are not limited to sneaker-nets, film printing, matching priors, refilming, searching for lost films, and slow teleradiology systems. Increases in equipment capacity due to faster throughput through elimination of film-handling activities should also be estimated.

The recouped equipment capacity may not be commensurate with the technologist productivity gains, since adjustments for multi-technologist staffing and other factors may be required. For example, if two technologists are staffing a CT scanner, patient throughput may be reduced if one technologist is processing film while the second technologist is focusing on patient throughput.

Capacity opportunities and productivity improvements during the off shifts should be excluded if the demand is exceptionally low during those periods. Always include benefits and shift differentials when translating the hours saved to salary avoidance.

PACS IMPACT ON MARKET SHARE ANALYSIS

The competitor analysis includes a definition of the immediate radiology market, a description of competitors, and the status of their PACS implementations. The strategic plan should note any PACS advertising done by local competitors in order to highlight any potential threat to market share. Complete the threat assessment with a description of the market share at risk if PACS is not implemented at your institution. Typically, estimates for the at-risk market share are provided by senior hospital executives and the hospital's marketing department. The goal of projecting the market-share-at-risk assessment is to estimate the amount of additional revenue that may be shifted to or from a competitor that has respectively superior or inferior radiology services.

The market share analysis is important because enhanced revenue from PACS has a far greater impact on ROI analysis than do film and film-handling savings alone. However, revenue assessments are difficult to make and are based on soft assumptions about current and future market share. Therefore, it is imperative to include the most senior levels of institutional and radiology administration in generating the assumptions that lead to expected PACS-related revenue changes. It is ultimately up to this same team to decide whether projected revenue enhancements should be included directly in the ROI. Projected revenue enhancements can often turn a negative PACS ROI positive. Even if potential revenues are not included in the ROI, they should be discussed in the strategic plan to illustrate the point that without a PACS, current revenue sources may be at risk to PACS-enabled competitors who may be capable of delivering electronic images to the clinicians' desktop computers.

The example in Table 3.2 illustrates the point. Community Hospital knows its current annual volume and estimates that it currently captures 60%

TABLE 3.2
Potential Shift in Market Share Exam Volume

Modality	Community Hospital Volume (est. 60% market share)	Estimated Total Outpatient Market Volume	Outstanding Market Share (40%)	5% Potential Market Shift in Volume to Community Hospital
CT	13,470	22,450	8,980	449
Diagnostic	51,174	85,290	34,116	1,706
MRI	4,718	7,863	3,145	157
US	5,964	9,940	3,976	199
Total	75,326	125,543	50,217	2,511

CT indicated computed tomography; MRI, magnetic resonance imaging; US, ultrasound.

of the outpatient radiology business in its target market area. Based on its known volume and its estimate of current market share, Community Hospital estimates the total market volume and outstanding market share. Senior administrators then discuss the referring physician community, competition, and advantages of being the first hospital in the area to deliver images to the referring physicians' desktop computers. They agree that it is reasonable to assume a potential 5% shift in the outstanding market share to Community Hospital if digital image service is available and effectively marketed to the referring physician base. Even with a current outpatient volume of only 75,326, a 5% shift of the outstanding market share to Community Hospital would result in an additional 2,511 exams annually.

To estimate potential revenue, Community Hospital multiplies the potential outpatient exam volume by its charge per exam and then by its average collection rate. The result is the potential revenue opportunity that might be available by effectively marketing a PACS in a competitive market. Table 3.3 illustrates the calculation for potential revenue. Table 3.3 indicates that a 5% shift in market share could potentially lead to over a half a million dollars in additional revenue. The model assumes that the mix of exams will remain the same.

The next question typically asked is, "What additional resources would be required to accommodate the potential additional business?" The answer lies in the equipment and technologist productivity gains that may accrue from a PACS.

MEETING FUTURE DEMAND NEEDS THROUGH PACS OPPORTUNITIES

Increasing the radiology equipment base is expensive, and there is a national shortage of technologists. As discussed in the technologist's workflow sections above, hospitals and imaging centers that use technologists to process, label, package, and move and hang film will achieve the greatest increases in productivity and capacity gains as a result of a PACS implementation.

A potent argument for PACS in the strategic plan is to compare capacity and productivity gains that can be expected to accrue from a PACS implementation to the future increases in demand for radiological services due to normal growth and increased market share. Often, the additional capacity recouped by eliminating film handling by technologists will be more than adequate to accommodate the additional market share. This is a potent argument; not only because there is a potential for an increase in market share

TABLE 3.3
Estimated Additional Revenue Based on a 5% Shift in Outstanding Market Share

Modality	Added Volume	Estimated Average Change per Exam ($)	Average Collection Rate	Total Additional Outpatient Net Revenue ($)
CT	449	679	60	182,922.60
Diagnostic	1,706	167	60	170,921.16
MRI	157	1,200	60	113,232.00
US	199	350	60	41,748.00
				508,823.76

CT indicates computed tomography; MRI, magnetic resonance imaging; US, ultrasound.

and additional revenue generation, but because most, and sometimes all, of the revenue can be realized with little or no additional costs.

In the example in Table 3.4, the marginal or additional demand for new exams by year 5 is shown in line A. This is a combination of the demand from new market share due to improved service from the PACS and a 5% estimated annual growth rate. Line B is the total capacity that is expected to become available when film-handling activities are eliminated and when data

TABLE 3.4
Ability to Meet Growth and Market Demand Through Reduced Film Handling and Worklist Management

	Demand Projections				
	Plain Film	**Ultrasound**	**CT**	**MRI**	**Nuclear Medicine**
Estimated annual growth	1,189	354	603	147	82
Additional market share potential (outpatients)	156	49	56	132	23
Total additional exams (A)	1,345	403	659	279	105
	Recoverable Capacity				
	Plain Film	**Ultrasound**	**CT**	**MRI**	**Nuclear Medicine**
Recovered exam capacity from film handling	0	1,349	1,678	261	261
Recovered exam capacity from worklist management	12,509	590	804	109	136
Total annual potential recovered exams (B)	12,509	1,939	2,483	370	397
	Ability to Meet Demand				
B/A	930%	481%	377%	132%	380%

CT indicates computed tomography; MRI, magnetic resonance imaging.

entry is reduced through worklist management. The last line, B/A, shows the percentage of the new demand by year 5 that can be met using existing human and physical resources. The result can be translated to cost avoidance and may be included in the PACS ROI.

Many other benefits to the enterprise that can be attributed to PACS may be difficult to quantify. Clinicians will experience improved productivity since they will no longer need to spend time looking for film or visiting the film library. Images and reports will be available in a more timely fashion, providing improved support for clinical decisions. Improved turnaround for radiological reports can reduce inpatient length of stay. Deployment of CR or DR and electronic viewing in the OR can reduce the amount of time required for film processing and therefore the amount of time required for the operation, reducing the risk to the patient and potential costly downtime of the OR.

Some PACS-related costs may also be difficult to quantify. Training and support are extraordinarily important to the success of PACS, and the resources required for effective delivery are consistently underestimated by potential PACS buyers. A marketing campaign informing referring physicians about the availability and benefits of electronic image distribution is crucial to the realization of film cost savings and maximizing the competitive advantage this can provide.

PACS STRATEGIC PLANNING: TECHNICAL

The technical strategic plan includes an assessment of IS readiness to implement a PACs and an assessment of the network infrastructure and PC base with respect to supporting a PACS and electronic image distribution. The section should conclude with a discussion of PACS management issues.

TECHNICAL READINESS

The chief information officer and the network engineering department can describe their existing networks, their PC support, and their general readiness to support a PACS as well as other information technology (IT) initiatives. In some cases, interviews with IT professionals can be a potent opportunity to allay any apprehensions about the impact of a PACS on their existing operations.

The interviews with the IT staff should include an evaluation of the current local area and wide area network infrastructure and its ability to

support the networking traffic that PACS is expected to introduce, with recommendations for any upgrades that may be required. In addition, it should be determined whether the existing modalities are currently networked via a private network or connected to the networking infrastructure that will be used for PACS (i.e., the hospital network), as this migration may need to be performed prior to implementation.

The installed PC base should be evaluated as to its suitability for enterprise electronic distribution. A minimum of Pentium II processor, 500 MHz with 128 MB RAM, with a 17-in monitor is generally recommended. Newer machines may be required by some PACS vendors.

Finally, suitable space for the PACS core components (e.g., a data center) must be available in order to deploy PACS. Estimates of space requirements should be included, and any needs that are not easily accommodated should be identified. Anticipated deficiencies in the reading areas should be described, and anticipated construction costs and workstation furniture should be included.

The goals of the interviews with the RIS manager are to understand the RIS-related workflow and any expected equipment upgrade paths. Workflow with regard to entry of patient demographics, scheduling, order entry, and the systems utilized for each of these steps should be reviewed to determine whether any changes will be required to support PACS workflow and functionality.

The ability of both the PACS vendor and the RIS vendor to provide the necessary integration or interfaces between systems should be evaluated and any costs associated with this task should be determined. If there are multiple (different) HIS-RIS deployed across the enterprise, then this should be documented for the vendor in the request for proposal (RFP). It is important to specify the exact version of the RIS(s) when making this determination. It is helpful to identify another site with a similar combination of RIS-PACS and contact that site as a reference.

PACS MANAGEMENT

The strategic plan should include a discussion of the human resources required to successfully deploy and support the PACS. Consider the skill sets required and the duties that will be expected of each individual involved in the project and in support for the project. Services that are expected to be outsourced from the PACS or other vendor should be described and eventually included in the RFP. Services that will be needed on an ongoing basis

(e.g., an on-site service representative) will need to be included in the system maintenance agreement negotiated with the PACS vendor.

A downtime contingency plan is crucial to a successful implementation. Although a detailed operational plan does not need to be developed until the system implementation is in progress, it is important to include an estimate of any capital investments that will be required to support the contingency plan (e.g., backup CRs and laser printers).

FINANCIAL ANALYSIS

The financial analysis should include an ROI analysis. All quantifiable cost savings, cost avoidance, revenue opportunities, and revenue protection estimates should be included in the analysis. The cash flows should be based on the implementation plan. For example, if CR is not expected to replace conventional radiography until year 2, then any film savings from conventional radiography should not be included until year 2.

As discussed in the operational plan, cost savings may include film savings, film library, technologist productivity, and off-site storage, including transportation. Revenue opportunities are based on estimates of increased exam volume due to competitive marketing of improved service related to PACS.

Capital expenses include the estimated costs of the PACS equipment, computed radiography, required networking upgrades, and services (e.g., project management, implementation support, and training) required to support the implementation. Capital expense estimates should also include cost estimates for system upgrades, such as additional storage purchased as required.

Operating expenses include the annual cost of the system maintenance agreement with the PACS vendor and the additional human resources (full-time equivalents) required to support the PACS.

The financial analysis should be projected for at least 5 or 6 years and can be extended further as necessary to show an eventual payback.

A Web server, typically included in most PACS implementations for the electronic distribution of images to clinicians, can also provide images to radiologists, providing remote night-call via home teleradiology. If this is a requirement, an assessment of the availability of cable modem or digital subscriber line service at the radiologists' homes should be conducted to determine the feasibility of this approach. In addition, a preliminary assessment of the infrastructure necessary to support secure access from outside

the firewall to an imaging Web server via, for example, a virtual private network server, should be included.

CONCLUSION

In conclusion, an effective PACS strategic plan serves as a marketing tool to communicate the benefits of PACS to senior administration and all stakeholders and educates key decision makers regarding the scope of the issues necessary to make informed decisions. The plan must make a serious attempt to quantify expected benefits in a way that is convincing to the key decision makers in order to provide a basis for allocating the necessary funding. The plan should also identify all costs associated with converting to a PACS, including training and PACS administration. Last, a formal strategic plan establishes the basis to move forward with a comprehensive RFP document, typically the next step in the PACS acquisition process.