A Strategic PACS Maturity Approach

Theoretical principles and practical implications

Seminar Medical Informatics

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Utrecht, June 10, 2011
PACS reduce reliance on film-based radiology departments and an approach that supports the process of maturing PACS is valuable.

MRQ: ‘How can hospitals mature their PACS?’
Key conclusion: alignment is positively related to PACS performance

**Main research question:** How can hospitals mature their PACS?

**Answer:** Hospitals should align organizational dimensions related to PACS, done simultaneously and hence by an integrated management perspective.

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**Part I: balanced evaluation**

Holistic approach enables rich understanding of PACS impacts

- PACS-BSC model is suited to evaluate PACS implementations from different angles

**Part II: maturity planning**

PACS maturity model helps hospitals with strategic objectives for growth

- Business/IT-alignment helps understand why key elements in clinical practice have not been realized
- Towards higher maturity levels, operational efficiencies, IT-integration, & effective care expand

**Part III: align PACS**

PACS investments should be balanced out to obtain synergizing benefits

- The PACS maturity model contributes to an integral alignment model
- Alignment is positively related to PACS performance
- Alignment framework appears useful to identify PACS improvements

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Towards higher maturity levels, operational efficiencies, IT-integration, & effective care expand

- The PACS maturity model contributes to an integral alignment model

Alignment is positively related to PACS performance

- Alignment framework appears useful to identify PACS improvements
PACS maturity concepts
PACS maturity: an evolutionary plateau of process improvement including a checklist to evolve on to the next level

A PACS maturity model: A systematic meta-analytic review on maturation and evolvability of PACS in the hospital enterprise

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A R T I C L E   I N F O
Article history:
Received 4 January 2008
Received in revised form 18 June 2008
Accepted 24 June 2008

Keywords:
PACS
Maturity
Evolvability
Alignment
Meta-analysis
Hospital enterprise

A B S T R A C T

Introduction: With PACS and medical imaging technology maturing, the importance of organizational maturity and effective deployment of PACS in the hospital enterprise are becoming significant.

Objective: The objective of this paper is twofold. Firstly, PACS literature on maturity and evolvability in the hospital enterprise is analyzed, resulting in an overview of the relevant developments concerning maturity of PACS. Secondly, this paper looks at the development of a maturity model for PACS technology.

Methods and results: Using structured search queries, we identified 54 papers reporting relevant aspects of maturity and evolvability of PACS. From the results of a meta-analytic review on PACS maturity and evolvability, we propose a model – the PACS maturity model (PMM) – that describes five levels of PACS maturity and the corresponding process focus.

Conclusion: We argue that this model can help hospitals to gain insights into their (strategic) objectives for growth and maturity with regard to PACS, the electronic patient record (EPR) and other health information systems. Moreover, the proposed model can be applied as a valuable tool for organizational assessments, monitoring and benchmarking purposes. Hence, the PMM contributes to an integral alignment model for PACS technology.
The PMM describes five levels of PACS maturity and towards higher levels of maturity, operational efficiencies, IT-integration and effective care expand.

References:
Development of an alignment framework
“... we see the computer age everywhere but in the productivity statistics.”

A framework that allows hospitals to systematically mature PACS and further enhance PACS performance is valuable to any hospital

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<th>IT-alignment</th>
<th>PACS performance</th>
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<tr>
<td>• PMM does not explicitly define mechanisms on how to move through maturity levels</td>
<td>• PACS performance defined based on systematic meta-analytic review of 980 key publications</td>
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<td>• ‘Alignment’: applying IS/IT in an appropriate and timely way, in harmony with business strategies, goals, and needs</td>
<td>• Four performance constructs are defined (see also PACS-BSC, Van de Wetering et al., 2006)</td>
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<td>• Combining PACS maturity with alignment is the key to obtain synergizing PACS performance benefits</td>
<td>• PACS performance: “multifactorial impacts and benefits produced by the application of PACS. This is expressed in terms of hospital efficiency and clinical effectiveness with respect to PACS workflow and the patients’ clinical journey.”</td>
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<td>• Understand the multifactorial nature of PACS performance and how this can be evaluated from an integral perspective</td>
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A conceptual model was developed combining (1) PACS maturity, (2) PACS alignment and (3) PACS performance.

Reference:
PACS Maturity results from Dutch hospitals
Dutch hospitals matured PACS towards the beginning of level four and have the ambition to mature PACS much further.

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<th>Level 5: Optimize PACS CI</th>
<th>Level 4: Integrated Managed Innovation</th>
<th>Level 3: Clinical Process Capability</th>
<th>Level 2: PACS process</th>
<th>Level 1: PACS infrastructure</th>
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**Lowest scores:**
a: All departments of the hospital can request and plan radiology exams using an electronic order-entry system
b: All diagnostic images from other departments are stored into one central PACS archive

**Highest scores:**
a: PACS is compatible with current international standards and classifications
b: PACS exchanges information with the radiology information systems (RIS) and hospital information system (HIS) without any complications

**a: (HIGHEST) Primary interpretation by radiologists using uncompressed (highest resolution) images from all modalities**

**b: (LOWEST) Strategic and operational (multiyear) plans contain impact and opportunities for chain partners with respect to PACS**
Dutch hospitals matured PACS towards the beginning of level four and have the ambition to mature PACS much further.

**Level 5:** Optimized Enterprise PACS Chain

**Level 4:** Integrated N Innovation

**Level 3:** Clinical Process Capability

**Level 2:** PACS process

**Level 1:** PACS infrastructure

**Lowest scores:**

a: PACS generates comprehensive management information that is always on time

b: The hospital has an accurate overview of the contribution of PACS to overall cost prices per radiology exam

**As is Maturity level**

**To be Maturity level**

a: (HIGHEST) Radiologist are aware of the fact that PACS has the potential to influence the competitive position of the hospital

b: (LOWEST) Innovative solutions (e.g. integration of new tools and applications) with PACS are discussed during clinico-radiological meetings
Dutch hospitals have the ambition to mature their PACS towards the Enterprise PACS Chain while simultaneously improving their alignment.
Hospitals can formulate strategies and maturity roadmaps to further improve the performance of the adopted PACS system.
Conclusions
Hospitals can use the PACS maturity concepts to achieve higher productivity levels and operational efficiency gains

- The PACS Maturity Model is a sense-making tool that supports a strategic and systematic deployment of PACS

- Alignment has a significant positive impact on the multifactorial performance of PACS in terms of efficiency and effectiveness

- PACS investments should be balanced out in the organization in order to obtain synergizing benefits

- Hospitals that follow the general strategic PACS maturity principles for practice are more likely to achieve alignment of PACS in clinical practice

- PACS can be exploited much further, to achieve higher productivity levels and operational efficiency gains in hospitals

- Developments and disruptive innovations are continuing to emerge. Therefore, research and development are now vital!
Q&A
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**Introduction**

Rogier van de Wetering is a researcher and lecturer in medical informatics at the Centre for Organization and Information, Department of Information and Computer Sciences, Utrecht University, The Netherlands. His main research focuses on the maturity and alignment of Picture Archiving and Communication Systems (PACS) – digital radiology – in hospital enterprises, a topic on the cutting edge of information sciences and medical informatics.

PACS is a technology that acquires medical images digitally from several modalities in the radiology department (e.g., CT, Ultrasound, MRI, plain X-ray, etc.), stores them into central data repositories and makes them available upon request by for instance referring clinicians. According to Huang [1] PACS can be defined as “workflow-integrated imaging systems that are designed to streamline operations throughout the entire patient care delivery process”. Achieving this type of seamless environment with PACS is also a high-cost venture, however [2].

A successful method for implementing and aligning PACS in the hospital enterprise would therefore be a prerequisite, and might have a current and desired level of maturity of PACS valuable to any type of hospital. As the importance of imaging technology and the radiology practice grows and evolves, the importance of strategic direction and preparation for the future are becoming more significant [3]. In practice, we see that a strategic planning approach towards PACS and PACS (re)deployment is lacking, both in hospital board rooms as well as in the scientific sources.
References


