



Automation Systems Project Management – Part 2

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Abstract

This paper tries to investigate project management knowledge expansion to a vertical industry – automation systems. First the literature carefully limits the scope of automation systems. It then gathers themes from literature review, map themes between vertical automation systems, PMI common themes and other technical / managerial disciplinary themes. The managerial and technical specific requirements are gathered, understood, and solution themes are proposed for each requirement.

At the end, the literature concludes an integrated management framework is preferable to support automation systems project management. PMO, program and operation management should also get involved so that the whole automation systems project management movement can get enough support within the enterprise.

This is the second part of the article.

Step 4 - What do systematically identified articles tell us about project management in the non-traditional areas identified?

Requirement theme; (reference)	Solution theme; (reference)	Analysis / Description	PMI specific ? (N/Y/N A); Autom ation System specific ? (N/Y/N A)	Project Manager Initiatives / Role(s) PM can play.	Theme Categoriz ation: Character istics; Attributes ; traits;
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<p>Technical Limitation; (Wikipedia, 2011)</p>	<p>Impossible to automate all tasks. Partial Automation; Analyse Alternatives; Combine business process; Operation process (Bredillet 2008); Document limitations; introduce new technology once technology is available</p>	<p>This happens all the time; Perhaps happen more in automation systems since the disciplines involved are broad and multi-disciplinary; Try to build your system that is flexible to update, modified & integrate with industrial standards and technology</p>	<p>N;Y</p>	<p>Make sure Review / Record / limitations, alternatives, decision analysis document, and lessons learned into highly effective knowledge management systems. Make sure manual operation processes are documented, implemented, and will be enforced.</p>	<p>Contingency ; process & practices; risk management; technologies; standards; tools; model & evaluations;</p>
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<p>Security Threats/ Vulnerability; (Wikipedia , 2011)</p>	<p>Security Management Integration; Vulnerability Management; Governance and Monitoring; Training operation safety, security threats awareness; Improve Quality Management; Improve responsiveness to disaster events; Risk Management Process Improvement</p>	<p>This can be very serious, depending on what kind of automation systems. Beware this can cause disasters events to society; Public Safety & Health; Availability; Robustness are most importance.</p>	<p>N;N</p>	<p>Set up process to regularly examine systems threats / vulnerability Set up process to investigate new systems threats / vulnerability Set up risk management / Business Continuity action plan and drive operation execution Facilitate / organize enterprise wise education events to bring safety / security awareness</p>	<p>Security management; CISSP; Education</p>
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<p>Unpredictable development costs; (Wikipedia , 2011)</p>	<p>Scope / Requirement Management; Communication Management; Modelling; Strict estimations; Program and phases management; Strengthen evaluation best practices; Incremental/ Iterative development methodology (industrial practise and standards)</p>	<p>Be cost cautious; Strict Cost & Schedule Tracking</p>	<p>Y:Y</p>	<p>Introduce careful, conservative assessment of technologies, modelling, reviews and appraisals, before implementation. Carefully plan activities, phases. Track Scope / Budget/ Cost and compare them with the estimated values frequently.</p>	<p>Cost management; Earn Value Management; Research Evaluation methodology; modelling; Estimation & Forecasting; Scope Management and Planing; Knowledge Management; (PMI);</p>
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<p>High initial cost; a huge initial investment; cost of automation is spread; (Wikipedia, 2011)</p>	<p>PMO, Mega projects Portfolio & Program Management; Executive support, strategy level integration; cross functional & departmental co-ordination</p>	<p>The multi-disciplinary nature of automation systems involve different experts from different, widely spread functional departmental</p>	<p>Y;Y</p>	<p>PMO get executive support; Convince executive to buy your plan; Highlight this as a long term strategies by using ROI; Come up with a plan dividing it into smaller programs / projects, have clear value-added targets in each of them. Diplomacy between functional areas so as to gather support and funding.</p>	<p>Cost analysis and EV management; PMO diplomacy ; strategies; marketing; project planning; system design</p>
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<p>Great impact on corrosion on assets and processes; (Kane, 2007)</p>	<p>Environmental engineering best practices; Risk Management & Action Plan; Monitoring/Governance/Data Gathering initiatives</p>	<p>Corruption, Corrosion, Pollution can be specific to automation system or large industrial energy plants.</p>	<p>N;Y</p>	<p>Bring awareness to all employees about environment and pollution. Produce risk management register, plans for corrosion on assets and processes. Make sure there are governance processes to keep watching</p>	<p>Environmental engineering; Organization Events; procurement management; vendor selection; project planning; performance, history; refinement; tools; operation management; law & ethics</p>
<p>Proactive Corrosion Management; (Kane, 2007)</p>	<p>Corrosion prevention treatments, minimize corrosion upsets and failures, and; minimize the availability.</p>	<p>Operation process; system and human monitoring; strong risks management;</p>	<p>N;N</p>	<p>Initiate implementation projects for Monitoring, Governance, Data Gathering, Analysing and Recording data</p>	<p>Quality assurance; governance, compliance; operation management; technology implementation project; law & ethics</p>

<p>Improved programming and interfaces: (Le Pree, 2009)</p>	<p>Process control, asset management and diagnostic data; Requirements Feedback/ Gathering. Redesign interfaces, involving ergonomics & usability considerations.</p>	<p>Training / buy or develop better tooling and software products</p>	<p>N;N</p>	<p>Initiate project to improve user interface, by gathering feedback, iterative design and review, expert judgement opinion, better schedule management.</p>	<p>Communication; ergonomics & usability; procurement management; technical evaluation process;</p>
<p>Poor / to be improved Diagnostic Infrastructure (Le Pree, 2009)</p>	<p>Marry process control, asset management and diagnostic data proven methodology and in-depth knowledge; measure performance and identify improvement</p>	<p>It can be more complicated in automation systems since it involves adapters / hooks between monitoring infrastructure and different machinery / automation system components (integration difficulty).</p>	<p>N;Y</p>	<p>Initiate project programs to improve diagnostic infrastructure; Gathering feedback, introduce experts infrastructure review; identify and manage improvement items; execution of items; constant testing and monitoring</p>	<p>Communication; technological infrastructure development project management; operation management; evaluation; business process analysis.</p>

<p>Increasing flexibility, reliability and visibility;</p>	<p>Integration with enterprise resource planning systems; Track-and-trace, documentation and historical analysis.</p>	<p>Involve careful design of the systems, and operation processes; Centralized knowledge repository;</p>	<p>Y;Y</p>	<p>Keep these design principles in mind as early as possible before implementation.</p> <p>Design reviewed carefully, iteratively by multiple experts, gather feedback that against the principles.</p> <p>Initiate integration projects with ERP (Information systems) that may simplify designing one on your own.</p> <p>Carefully manage artefacts in knowledge management units for training</p>	<p>Systems & architecture design; Evaluate design; architecture methodologies. Knowledge management.</p>
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<p>Energy best practices, technologies in energy management (Miller, 2011)</p>	<p>Integrate Engineering best practices to the existing; Gather energy strategies and apply it to the plan</p>	<p>Energy Conservation technologies may be quite specific to nature of system components; Train & bring awareness to employees so the whole company can get involved</p>	<p>N;Y</p>	<p>Projects to evaluate review and introduce different possible energy saving practices. Implement and execute projects that modify the existing automation systems, or integration energy saving components to automation systems.</p> <p>If the practice require behavioural changes of workers, organize events that would change their behaviour(s), and gain top-down involvement</p>	<p>Change management; Education; technology & practices evaluation process; Integration project management; risk management.</p>
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<p>Metering and communication infrastructure (Miller, 2011)</p>	<p>Integrate metering and communication infrastructure technology, standards, devices, best practices into automation systems</p>	<p>Metering specific to automation, industries; May need diagnostic optimisation to the process line (Six Sigma & performance analysis) Communication Infrastructure can be common electronic media; meetings; workshops; automated reporting systems</p>	<p>N;Y</p>	<p>Initiate projects to established (implement) communications infrastructure And/or Metering infrastructure. Make sure the infrastructure are utilized by operations and employees. Make sure there are on going maintenance and administrations of the infrastructures.</p>	<p>Data analysis; technology management; infrastructure management;</p>
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<p>Management programs, multi-disciplined teams; interoperability; (Miller, 2011)</p>	<p>People & HR Management; PMO; knowledge management; Cross functional teams collaboration & communication management; Interoperability management (industrial best practices)</p>	<p>The nature of automation systems are broader and more multi-disciplinary as usual that an enterprise-wide centralized team may be helpful to facilitate communications</p>	<p>Y:Y</p>	<p>Make sure your systems designed to support interoperability;</p> <p>Use PMO to co-ordinate between functional units, vendors.</p> <p>Document all dependencies and contingencies between system components</p> <p>Store information using high effective information management infrastructure</p> <p>Encourage utilization of communication infrastructure</p>	<p>Communications; PMO support & program managements; Organization theory; HR management; operation management; stock management; interoperability management</p>
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<p>Collection and visualization of real-time energy data; (Miller, 2011)</p>	<p>Monitoring / log and trace / data / reporting framework; Hook them with a solution systems meeting industrial standards/ methodologies/ best practices;</p>	<p>Make sure the process is enforced; Different Automation System components may have their own ways of generating data</p>	<p>N;Y</p>	<p>Initiate a project to execute this object. Initiate business process to make sure operations will utilize and manage the infrastructure</p>	<p>Feedback analysis; technology evaluation ; Education & training; Artefacts management; communication infrastructure management</p>
<p>Multiple drivers of change; upgrade & maintenance; availability (Microsoft, 2003)</p>	<p>Stakeholder management; Migration plans; infrastructures documentation models; best practices; track changes; gap analysis and detailed planning;</p>	<p>This is particular true in manufacturing systems since there are too many components that contingency/dependence management can be really complicated. Changes Request needed to be carefully reviewed</p>	<p>Y;Y</p>	<p>Stakeholder analysis; Communication planning; meeting enumerations on contingency pros-cons, technical contingencies and dependencies,</p>	<p>Communication management; architecture migration planning; system design; operation readiness; security & business continuity</p>

<p>No Process visibility benefits. (Microsoft, 2003)</p>	<p>PMO establishment ; Executive Support; Training staff awareness; motivation and rewards initiatives; Increase visibility; Communication planning</p>	<p>Please make sure all these processes are enforced; by closer managing; increase enterprise awareness; and increase process visibility</p>	<p>Y;N</p>	<p>Project manage activities that would increase process visibility, such as results reporting page(s) that can be accessible by executives;</p> <p>Also get help from PMO that will give them enterprise wide support and visibility</p>	<p>Public Relations; Organization theory; communication; PMO management; strategies</p>
<p>Departmental balance; Rolling Up Requirements: Individual needs to collective requirements, prioritising needs. (Microsoft, 2003)</p>	<p>PMO establishment ; Executive Support; Training staff awareness; motivation and rewards initiatives; Increase visibility; Communication planning</p>	<p>The nature of automation systems are broader and more multi-disciplinary as usual that an enterprise-wide centralized team may be helpful to facilitate communications</p>	<p>Y;Y</p>	<p>Demonstration political savvies, communication, strategy to get acceptance or support for pushing through new infrastructure processes</p>	<p>Politics; communication; interpersonal skills; PMO management;</p>

<p>Change Management Issues; Partner perspectives. (Microsoft, 2003)</p>	<p>Technology Vendor locked in; handcrafted manufacturing system</p>	<p>Careful Design of systems that can minimize vendor locked in; Also make sure change management infrastructure and processes can be issued.</p>	<p>Y:N</p>	<p>Manage projects that carefully evaluate design against vendor lock in criteria. Manage Vendor. Improve change management infrastructure</p>	<p>Vendor management; partnership management; procurement management; change management; law & ethics</p>
<p>Training – increase awareness: (Microsoft, 2003)</p>	<p>(Testing, commitment, feedback, micro-topics).</p>	<p>Important for functionality; emergency handling, security, health and safety, awareness. etc</p>	<p>N:Y</p>	<p>Initialise events that can train employees and bring their awareness for changing. Utilization information systems or physical manuals to facilitate self-studied or cross-trained activities. Encourage competencies check and feedback.</p>	<p>Education; knowledge management; Organizational events; procurement management;</p>

<p>Scope management (Microsoft, 2003)</p>	<p>Scope Management (PMI)</p>	<p>Track progress reporting, PM reporting</p>	<p>Y:N</p>	<p>Use PMI ways to clarify scope, monitoring and tracking scope everyday; Ensure scope management process is being enforced.</p>	<p>PMI skills</p>
<p>Test the System; Run and Refine the System (Microsoft, 2003)</p>	<p>Quality Management (PMI) or another quality standards (ISO-xx)</p>	<p>Close monitoring with Quality assurance agents; Frequent feedback, quality tracking & analysis. Certain system components may need technological testing specification</p>	<p>Y:Y</p>	<p>Manage quality assurance specialists, auditors to align with compatibility or compliance, standards of components Make sure the problems reported are evaluated, prioritised, investigate, fixed or managed. Make sure operations aware of problems or changes.</p>	<p>Quality management; system audit;</p>

Documentation;	Content Management Systems; Knowledge Management; Configuration and Change Management; Cross training; etc	Device effective vehicles that would facilitate effective documentation, knowledge sharing; and self-learning.	Y:N	<p>Projects establish effective content management, knowledge infrastructure, so that relevant units can share, reference and collaborate, utilizing this assess.</p> <p>Also make sure information stored are easily searchable and retrievable.</p> <p>Make sure there is access control on the systems.</p>	Communications; knowledge management
Gather and Define System Requirements Structure the Implementation and Prepare for Change; (Microsoft, 2003)	Scope Management; Requirement management; Project Planning and Execution; Change management;	Project management Execution (PMI)	Y:N	PMI relevant skill sets.	PMI

People Management; ;(Microsoft, 2003)	Project Management; People Management;	Project management (PMI), HR, Line management Execution	Y:N	PMI project procurement management, project human resource management	PMI & general management (HR & procurement)
Data Management;(Microsoft, 2003)	Using industrial practices, standards and technology for data storage, migration, cleansing analysis & interpretation and reporting	Introduce standards, experts' framework, and processes. Make Sure the processes are enforced	N:Y	Initiate and manage data management projects; Establish common platform to share knowledge and data in area of data management;	Manage technical projects; optimisation; evaluations; others.

Discussion and Tips

Here are the observations from the mapping. What's make automation systems unique.

- 1) Automation systems are a multi-disciplinary system. It can be a combination of business systems, mechanical, electrical, chemical, manufacturing process, electronic, static infrastructure, material, and supply chain and/or information systems.
- 2) Since it is so broad and diverse, implementing one, maintaining one, or automating one may involve lots of people with different mentality and skill sets. People may be situated in different political circles inside the enterprise, or outside (such as vendors, subject matter experts)
- 3) The scope / cost of developing, modifying or automating systems can be so huge that it may be wise to execute them into multi-projects, multi-phases, multi-programs; At the same time all of them can share common platform of knowledge or other sharable resources.
- 4) At the same time it may be worthwhile to use a centralized unit, such as PMO to co-ordinate resources, facilitate department descriptions, and lobbying for enterprise wide / executive management support.

- 5) Also the system itself is too complex that, it has to be designed carefully to achieve non functional requirements such as public health, safety, availability, security, vulnerability, interoperability, maintainability, scalability, adaptability, cost, performance etc
- 6) On the other hand, outside the automation systems, there are requirements of integrating at least two main separate logical frameworks; One is governance – monitoring – analysis - reporting framework. The other framework that would improve the energy efficiency and environmental friendliness. The third one is a Enterprise Resource Planning systems. The fourth one is a communication and knowledge management infrastructure framework.
- 7) Each framework can consists of information systems, user interface, multi-disciplinary sensors/effectors/drivers/hooks to systems components, administration staff, knowledge / skill sets, business operation process document etc.
- 8) The impact of integration them all at once is unrealistic, costly, some may be even impossible because of technical or environmental limitations. Project manager has to be aware the risks of moving each pieces, get enough support, prioritise, and communicate carefully while moving or integrating those pieces. Some tasks may require behaviour changes of the whole organization that messages delivered are highly visible and political sensitive.
- 9) To decide how, what and why to integrate software or hardware pieces into the systems, lots of careful assessments and evaluations need to be done. Experience project managers may need external resources to support the changes that utilizing procurement management vehicles can be frequent.
- 10) After implementation, communication infrastructure can be used to train workers, and co-ordinate operation management efforts. Walking around everyday seems to be necessary. Artefacts, references & document are needed to be stored properly for effective retrieval. Collaboration tools, knowledge and support sites are beneficial to support operations.
- 11) If you are the project or program manager jump in the first day, how can you manage the whole systems without multi-disciplinary technical knowledge? At least high-level glossaries and logical maps have to be handy. Also visualising and presenting data nicely may be a bonus as well. Decision-making needs to be careful and collaborative between business and technical experts unit. Also composing and de-composing teams are unavoidable.

Conclusion

This document tries to investigate project management knowledge expansion to a vertical industry – automation systems. First the literature carefully limits the scope of automation systems. It then gathers themes from literature review, map themes between vertical automation systems, PMI common themes and other technical / managerial disciplinary themes. The managerial and technical specific requirements are gathered, understood, and solution themes are proposed for each requirement.

At the end, the literature concludes an integrated management framework is preferable to support automation systems project management. Quasi management sub-framework such as energy – environmental friendly, process monitoring ad control, communication and knowledge management infrastructure, enterprise

resource management, organization behavioural management are vital to integrate into the existing automation systems.

Owing to the scope, cost, exposure, political sensitive nature of such integration, it would be much better to have a PMO, to segregate changes into different programs, processes; while providing a common platform to share knowledge and management tooling/information. PMO can also lobby for strategic integration and enterprise-wide support

Reference

Bredillet (2008). Exploring Research in Project Management: Nine Schools of Project Management Research; PMI Journal Sep 2008

Carden, Egan. (2008). Does Our Literature Support Sectors Newer to Project Management? The Search for Quality Publications Relevant to Non-traditional Industries; PMI Journal (Sep 2008); Vol. 39, No. 3, 6-27

Lila Carden, Toby Egan. (2008). Does Our Literature Support Sectors Newer to Project Management? The Search for Quality Publications Relevant to Non-traditional Industries Project Management Journal. Sylva: Sep 2008. Vol.39, Iss. 3; pg. 6, 22 pgs

Crawford, Helm. (2008). Government and Governance: The Value of Project Management in the Public Sector; PMI Journal Sep 2008

Ingason, Helgi Thor, Jónasson, Haukur Ingi. (2008). Contemporary knowledge and skill requirements in project management Project Management Journal, Jun2009, Vol. 40 Issue 2, p59-69, 11p, 2 charts, 7 diagrams; DOI: 10.1002/pmj.20122; (AN41331844); PMI Journal Sep 2008

LePree. (2009). Simplifying Optimization, Chemical Engineering Nov 2009; 116, 12; pg 25.

LePree. (2009). Staying Alive, Chemical Engineering, New York: May 2009; Vol. 116, Iss. 5; pg. 25, 5 pgs

Lydon, Bill. (2011). Pharmaceutical Automation Roundtable (PAR) - Part 1 - MES Benchmarking Survey Results; Automation Portal; Automation.com

Kane. (2007). A New Approach to Corrosion Monitoring; Chemical Engineering; Jun 2007; 114, 6; pg.34

Miller. (2011). Cover Story: Success in energy conservation; Emerging best practices, technologies in energy management; ISA.org Technical News

Wikipedia. (2011). Industrial Engineering

Wikipedia. (2011). Automation Systems

The Author

Eric Tse is an international recognized expert/consultant in Enterprise Access and Identity Management Architecture Design and Implementation. He has been working with international renowned experts in information technology in many prestigious companies. He also pursues research interests in project management, financial models, application/enterprise/solution architectures, compilation technology and philosophy of science.

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