

Technology Innovation Dynamics

Innovation Governance

Complex adaptive system (CAS) cognations typically reflect bounded individual agents interacting and adapting to each other and the associated environment.¹ These evolutionary patterns for industries imply that there exists a supportable requirement to monitor how competitors are attempting to evolve and that evolution necessitates planning—considering both the industry and stakeholder actions.² However, reactive development needs to occur in response to the evolutionary efforts of nonindustry business agents as well.³

As a metaphorical actor in society, technology can reflect dynamic system behavior. CAS theory application allows employee analysis of technology innovation as a living organism, creating chaotic dynamics in system behaviors. Under this abstraction, technology innovation interacts with organizational formations within society as an ecosystem that produces change.⁴ The organizational transformations may occur:

- Resisted or encouraged
- Rapidly or slowly
- Linearly or nonlinearly
- Frequently or sporadically
- Profoundly or ineffectively
- With meager or ample resources⁵

Through influencing change, depending on perceived value creation and value appropriation,^{6,7} a technological innovation affects organizational system performance features that can result in a trajectory that is stable, periodic, chaotic and random.⁸

Technology inspires innovation. Enterprises are commonly involved in cultivating technological innovations. How organizational representatives communicate about technological innovation is often a significant factor in the success or failure of innovation management. The purpose of this

article is to furnish readers with practical knowledge on how to help technological innovation efforts succeed. To this end, the following discussion addresses how to manage technical innovation-related risk and obtain support for technological innovation projects.

Technological Innovation and Organizational Learning

Organizational learning affects technological innovation.⁹ Conversely, technological innovation affects organizational learning.¹⁰ Further facilitation of organizational learning can occur if manager-leaders pay attention to such characteristics as absorptive capacity.^{11,12} Absorptive capacity provides the capability to



Robert E. Davis, DBA, CISA, CICA

Is a freelance information systems (IS) audit senior manager/consultant, author and university-level instructor. He has provided data security consulting and IS auditing services to the US Securities and Exchange Commission, the US Enrichment Corporation, Raytheon Company, the US Interstate Commerce Commission, Capital One, Dow Jones & Company, Fidelity/First Fidelity (Wells Fargo) and other organizations. His workbook credits include *Assuring IT Governance*, *Assuring IT Legal Compliance*, *IT Auditing: An Adaptive Process* and *IT Auditing: Assuring Information Assets Protection*. He has also authored articles and presented material addressing IS issues.

recognize, assimilate and apply external new knowledge into the organizational knowledge base and innovation capability.¹³ With absorptive capacity, organizational technology research and development efforts contribute to new knowledge generation and enhance absorptive capacity,¹⁴ by which the higher the organizational learning ability of an enterprise, the higher the level of technological innovativeness.¹⁵

Technology innovation is self-organizing and learning that reflect CAS attributes. Technological innovation induces change. Technological transformation can stimulate generative organizational learning.¹⁶ For instance, charting a successful course for an information systems innovation implementation requires continued vigilance in maintaining and updating the conceptual framework partially through reflection on practical experience.¹⁷ As another instance, while working for 3M Company, William McKnight developed management practices addressing responsibility delegation and employee initiative encouragement based on organizational learning generated by Dick Drew's successful masking and cellophane tape technological innovation as a lab technician.¹⁸

Innovative Business Focus and Key Pitfalls

Technology innovations may manifest in different forms that require managerial attention. Manager-leaders should continuously scan the business environment for technological innovation.¹⁹ Technological innovation potentially presents a plethora of organizational opportunities.²⁰ Contextually, in complex organizational evolution, the root of creativity is in diversity, yet efficiency uncertainty is inevitable.²¹ In other words, there are potential critical pitfalls for organizations that focus on, then respond to, technological innovation as defenders.²² Explicitly, if the organization abandons the current technology for a rival technology, the firm may be committing financial suicide because of the required new internal competencies and manufacturing facilities.²³ On the other hand, if the organization holds on to the current technology while investing in the novel technology, the cultural change may be unwelcome.²⁴ Furthermore, the firm may lack the competencies to develop the new technology, or existing customers may pressure the firm to stay with the old technology.²⁵

Industrial systems reside within social systems that reside within environmental systems.²⁶ Thus, given organizations are CAS operating within a broader CAS,²⁷ interpretation problems concerning what is sustainable may place extraordinary demands on manager-leaders regarding technological innovation.²⁸ Change management processes should facilitate adaptive responses to current or future circumstances, allowing value delivery when the product or service mix modification occurs due to technological innovation.²⁹ Nevertheless, there are instances of too much focus on technological innovation.³⁰ Organizations should avoid continuously adding technology features even though few customers want them and rely solely on incremental innovation.³¹

“ INNOVATION REQUIRES
GOOD GOVERNANCE
USING APPROPRIATE
RISK MANAGEMENT
PRACTICES. ”

Moreover, as technological innovations extend social impact, corresponding ethical issues expand for enterprise employees.³² In response, a managerial moral assessment concerning what is sound and unsound about new devices (or methods that may emerge)³³ and appropriate use of IT options becomes imperative.³⁴ Specifically, technological innovation adoption can raise security threats³⁵ and presents challenges to manager-leaders that demand a shift in mind-set, culture or operational procedures.³⁶ For example, when complexity, bureaucracy and centralization are excessively confining, the adhocracy (matrix) organizational structure supports the need to innovate and operate situationally to overcome environmental circumstances³⁷ that may increase the potential for a security breach. Consequently, innovation requires good governance using appropriate risk management practices.

Communicating Technological Innovation With Internal Stakeholders

Considering CAS theory interaction constructs, manager-leaders can:^{38, 39, 40}

- Improve current activities
- Change activities
- Continue the project
- Discontinue the project

Experientially, the most effective ways to communicate to internal stakeholders about technological innovation is through PowerPoint presentations, organizational newsletters and interoffice emails. Regarding the PowerPoint communication option, the presenter's organization strategy should encompass describing the innovation plan, then the benefits, and, once the audience appears hooked, an anecdote to make the technological innovation benefits realizable in stakeholders' minds. Furthermore, the presenter should include practiced hand gestures, polished verbal delivery and participant interaction using a survey response collection technique. Limiting the slide count to 10 aids in generating a higher retention rate for participants when attempting to gain the buy-in of stakeholders. The assumption is that the internal stakeholder audience demands a short and to-the-point presentation.

An organization's change management processes should allow it to adapt and continue delivering value when an innovation changes its products or services.⁴¹ How well an enterprise manages changes under a CAS is proportional to triumphant delivery on adopted strategic objectives.^{42, 43} Effective program marketing to impacted audiences ensures innovation expectations transparency.^{44, 45} Crucial to successful structures is communication among all parties based on constructive relationships, common language utilization and a commitment to resolving innovation-related issues.^{46, 47} Communication about planned innovations should focus on results identified as critical outcomes.^{48, 49} Thus, when establishing an innovation program, a formal, inclusive communications network—with purpose clarity and policy distinctiveness—is recommended.^{50, 51}

Conclusion

Regardless of whether manager-leaders deem competitiveness or innovation outcomes most important for the organization, there is little empirical evidence in the reviewed academic literature that demonstrates how the characteristics of learning organizations affect organizational results.⁵² However, scholars have found that the learning organization factors that have a higher association with organizational performance are those that pertain to:

- Structures
- Information systems
- Organizational culture⁵³

Consequently, the researchers have concluded that organizational mediations focusing on the three listed factors appear more likely to produce higher change adaptation and innovation levels than those strictly converging on education and applications.⁵⁴ Nonetheless, despite learning organization designs facilitating change adaptation and innovation, they are unequally effective in improving organizational performance.⁵⁵

“ TO ACHIEVE
EFFECTIVE TECHNICAL
INNOVATION
MANAGER-LEADERS
SHOULD GOVERN
TECHNOLOGICAL
INNOVATION
CONSIDERING CAS
THEORY. ”

To achieve effective technical innovation manager-leaders should govern technological innovation considering CAS theory. A sufficient organizational control environment assessment can enhance coordination effectiveness and efficiency for technological innovation. Manager-leaders should actively participate in ensuring their organization has

an adequate control environment for governance-related exchange, since this domain represents an essential governance structure management component for supporting technological innovation coordination.

Governance-related exchange behaviors encompass:

- Structural issue negotiation and planning
- Performance monitoring
- Mutual investment⁵⁶

Consequently, organizational manager-leaders should deploy a comprehensive coordination risk assessment framework that assists in the design of appropriate employee policies, procedures, standards and rules.^{57, 58}

Thus, proper management regulates participating parties in a coordination-based relationship⁵⁹ through governance mechanisms linked to technology innovation dynamics.

Endnotes

- 1 Stacey, R. D.; *Strategic Management and Organisational Dynamics: The Challenge of Complexity*, Custom Edition, England, 2011
- 2 *Ibid.*
- 3 *Ibid.*
- 4 Estrin, J.; *Closing the Innovation Gap*, McGraw-Hill Education, USA, 2009
- 5 Luecke, R.; R. Katz; *Harvard Business Essentials: Managing Creativity and Innovation*, Harvard Business Review Press, USA, 2003
- 6 Christensen, C. M.; *The Innovator's Dilemma: The Revolutionary Book That Will Change the Way You Do Business*, HarperBusiness, USA, 2011
- 7 *Op cit* Estrin
- 8 Dooley, K. J.; "A Complex Adaptive Systems Model of Organization Change," *Nonlinear Dynamics, Psychology, and Life Sciences*, vol. 1, iss. 1, 1997, p. 69-97
- 9 Dasgupta, M.; R. K. Gupta; A. Sahay; "Linking Technological Innovation, Technology Strategy and Organizational Factors: A Review," *Global Business Review*, vol. 12, iss. 2011, p. 257-277, <http://journals.sagepub.com/doi/abs/10.1177/097215091101200206>
- 10 *Ibid.*
- 11 *Ibid.*
- 12 Azadegan, A.; K. J. Dooley; P. L. Carter; J. R. Carter; "Supplier Innovativeness and the Role of Interorganizational Learning in Enhancing Manufacturer Capabilities," *Journal of Supply Chain Management*, vol. 44, iss. 4, 2008, p. 14-35, <https://onlinelibrary.wiley.com/doi/full/10.1111/j.1745-493X.2008.00070.x>
- 13 Martin-de Castro, G.; "Knowledge Management and Innovation in Knowledge-Based and High-Tech Industrial Markets: The Role of Openness and Absorptive Capacity," *Industrial Marketing Management*, vol. 47, May 2015, p. 143-146, <https://www.sciencedirect.com/science/article/abs/pii/S001985011500067X>
- 14 *Op cit* Dasgupta, Gupta and Sahay
- 15 *Ibid.*
- 16 *Ibid.*
- 17 Swanson, E. B.; N. Ramiller; "The Organizing Vision in Information Systems Innovation," *Organization Science*, vol. 8, iss. 5, 1997, p. 458-474, <https://pubsonline.informs.org/doi/abs/10.1287/orsc.8.5.458>
- 18 *Op cit* Luecke and Katz
- 19 Nambisan, S.; M. Sawhney; "A Buyer's Guide to the Innovation Bazaar," *Harvard Business Review*, vol. 85, iss. 6, 2007, p. 109-118, <https://hbr.org/2007/06/a-buyers-guide-to-the-innovation-bazaar>
- 20 Căţinean, I.; D. Căndea; "Characteristics of the Cloud Computing Model as a Disruptive Innovation," *Review of International Comparative Management*, vol. 14, iss. 5, 2013, p. 783-803, www.rmci.ase.ro
- 21 *Op cit* Stacey
- 22 *Op cit* Luecke and Katz
- 23 *Ibid.*
- 24 *Ibid.*
- 25 *Ibid.*
- 26 Senge, P. M., et al.; *The Necessary Revolution: Working Together to Create a Sustainable World*, Doubleday, USA, 2010
- 27 Metcalf, L.; S. Benn; "Leadership for Sustainability: An Evolution of Leadership Ability," *Journal of Business Ethics*, vol. 112, iss. 3, 2013, p. 369-384, <https://link.springer.com/article/10.1007/s10551-012-1278-6>
- 28 *Op cit* Swanson and Ramiller

- 29 Davis, R. E.; *IT Auditing: Assuring Information Assets Protection*, Pleier Corp., USA, 2008
- 30 *Op cit* Luecke and Katz
- 31 *Ibid.*
- 32 Stahl, B. C.; G. Eden; M. Jirotko; M. Coeckelbergh; "From Computer Ethics to Responsible Research and Innovation in ICT: The Transition of Reference Discourses Informing Ethics-related Research in Information Systems," *Information & Management*, vol. 51, iss. 6, 2014, p. 810-818, <https://www.sciencedirect.com/science/article/pii/S037872061400007X>
- 33 *Ibid.*
- 34 Stahl, B. C.; J. Timmermans; C. Flick; "Ethics of Emerging Information and Communication Technologies: On the Implementation of Responsible Research and Innovation," *Science and Public Policy*, vol. 44, iss. 3, 2017, p. 369-381, <https://academic.oup.com/spp/article/44/3/369/2525576>
- 35 Chou, D. C.; "Cloud Computing: A Value Creation Model," *Computer Standards & Interfaces*, vol. 38, 2015, p. 72-77, <https://www.sciencedirect.com/science/article/abs/pii/S0920548914000981>
- 36 *Op cit* Căţinean and Căndea
- 37 Steiger, J. S.; K. A. Hammou; M. H. Galib; "An Examination of the Influence of Organizational Structure Types and Management Levels on Knowledge Management Practices in Organizations," *International Journal of Business and Management*, vol. 9, iss. 6, 2014, p. 43-57, www.ccsenet.org/journal/index.php/ijbm/article/view/34988
- 38 *Op cit* Dasgupta, Gupta and Sahay
- 39 *Op cit* Dooley
- 40 *Op cit* Luecke and Katz
- 41 *Op cit* Davis
- 42 *Ibid.*
- 43 Kontoghiorghes, C.; S. M. Awbre; P. L. Feurig; "Examining the Relationship between Learning Organization Characteristics and Change Adaptation, Innovation, and Organizational Performance," *Human Resource Development Quarterly*, vol. 16, iss. 2, 2005, p. 185-212, <https://onlinelibrary.wiley.com/doi/full/10.1002/hrdq.1133>
- 44 *Op cit* Davis
- 45 Mentzer, J. T.; M. B. Myers; T. P. Stank (Eds.); *Handbook of Global Supply Chain Management*, Sage Publications, USA, 2007
- 46 *Op cit* Davis
- 47 *Op cit* Mentzer, Myers and Stank
- 48 *Op cit* Davis
- 49 *Op cit* Stacey
- 50 *Op cit* Davis
- 51 *Op cit* Mentzer, Myers and Stank
- 52 *Op cit* Kontoghiorghes, Awbre and Feurig
- 53 *Ibid.*
- 54 *Ibid.*
- 55 *Ibid.*
- 56 *Op cit* Mentzer, Myers and Stank
- 57 *Op cit* Davis
- 58 Gosain, S.; Z. Lee; Y. Kim; "The Management of Cross-Functional Inter-Dependencies in ERP Implementations: Emergent Coordination Patterns," *European Journal of Information Systems*, vol. 14, iss. 4, 2005, p. 371-387, <https://link.springer.com/article/10.1057/palgrave.ejis.3000549>
- 59 *Op cit* Mentzer, Myers and Stank