

INTERFACE OF ORGANISATIONAL AGEING AND ORGANISATIONAL ECOLOGY THEORY

STARZENIE ORGANIZACJI A TEORIA EKOLOGII ORGANIZACYJNEJ

José G. Vargas-Hernández¹, Joanna Rakowska^{2,*}, M. C. Omar C. Vargas-González³

¹Tec MM Campus Zapopan, Instituto Tecnológico José Mario Molina Pasquel y Henríquez, Camino Arenero 1101 C.P. 45019, El Bajío, Zapopan, Jalisco 49000, México

²Institute of Economics and Finance, Warsaw University of Life Sciences, ul. Nowoursynowska 166, 02-787 Warszawa, Poland

³Instituto Tecnológico de México, Campus Cd. Guzmán, Cd. Guzmán, Jalisco 49000, México

*E-mail: joanna_rakowska@sggw.edu.pl

José G. Vargas-Hernández; ORCID: 0000-0003-0938-4197

Joanna Rakowska; ORCID: 0000-0001-5135-6996

M. C. Omar C. Vargas-González; ORCID: 0000-0002-6089-956X

DOI: 10.2478/minib-2022-0016

ABSTRACT

The study aimed to conclude on the up-to-date state of the organisational ecology theory concerning relations between organisational ageing and organisational ecology, enhanced by social and ecological systems and ecological management. The applied method included analytical and reflective concluding, based on the synthesis of findings from a critical literature review. It was concluded that: (i) organisational ageing generates some of the most important consequences in organisational ecology; however, there is still no consensus on what kind of consequences prevail; (ii) at population level, the adaptation of organisational structures occurs with the replacement of old organisations that fail to adapt by the new ones; (iii) under the prevalent backdrop of radical structural and strategic changes, individual organisations are subject to inertial forces and thus are confronted with limitations to their success; (iv) ageing has positive consequences for innovative activities of older companies; and (v) the higher the density and concentration of industry, the higher the rates of founding firms and the lower the rates of mortality.

Key words: organisational ecology, organisational aging, organisation change, organisation theory

ABSTRAKT

Celem pracy było podsumowanie aktualnego stanu rozważań teoretycznych dotyczących relacji między starzeniem się organizacji oraz zarządzaniem i systemem społeczno-ekologicznym a ekologią organizacji. Zastosowana metoda badawcza obejmowała wnioski analityczne i refleksyjne, przeprowadzone na podstawie wyników krytycznego przeglądu literatury. Stwierdzono, że: (i) starzenie się organizacji powoduje jedno z najważniejszych konsekwencji dla ekologii organizacji, jednak nadal nie ma zgody co do tego, jakie konsekwencje przeważają; (ii) na poziomie populacji adaptacja struktur organizacyjnych następuje wraz z zastępowaniem starych organizacji, które nie dostosowują się, przez nowe; (iii) poszczególne organizacje podlegają siłom bezwładności i mają ograniczenia, aby odnieść sukces w warunkach radykalnych zmian strukturalnych i strategicznych; (iv) starzenie się ma pozytywne konsekwencje dla działalności innowacyjnej starszych firm, (v) im wyższa gęstość i koncentracja przemysłu, tym wyższe wskaźniki zakładania firm i niższe wskaźniki ich śmiertelności.

Słowa kluczowe: ekologia organizacji, starzenie organizacji, zmiany organizacji, teoria organizacji

JEL: O1; O20; O49

Introduction

The debate on organisational ecology began in the 1970s with a seminal work by Hannan and Freeman (1984). Organisational ecology has been focussing on the impact of social, economic and political environment on the population and diversity of organisations, on how they emerge, grow, transform, decline and die. That new approach explained organisational change by environmental selection process (Baum, 2014; Carrol & Negro, 2018), rather than the earlier supported theory of adaptive change in organisations, incorporated in organisational economic approaches. The fundamental differences with the organisational ecological view and the

economic approach is the empirical account for organisational survival. Other critical differences between organisational ecological theory and organisational economic approaches are the identification of the relevance of competition and mutualism within and between environmental niches.

The debate on organisational ecology evolved over time (Amburgey & Hayagreeva, 2014). Although it has been emphasising the environmental reasons for the founding and failure of organisations, the effect of organisational ageing on the life mechanism and the failure of organisations has become one of the main streams in organisational ecology investigations (Wholey & Brittain, 1986; Barron, West, & Hannan, 1994; Hannan, 1998). That is why organisational ecology is identified by some researchers as organisational demography or population ecology of organisations, based on various methods and theories (Carroll & Hannan, 2002).

The organisational ecology ageing theories distinguish the competitive perspectives by the liability of newness (Stinchcombe, 1965; Hannan & Freeman, 1984) and the perspective of liability of senescence (Barron et al., 1994). Although organisational ecology attends to the aspect of the consequences of ageing for organisational functioning outcomes, there is no consensus on whether the effects of ageing on the organisational functioning are positive or negative (Hannan, 1998).

This fact motivates the rationale for taking up this study, whose aim is to review, synthesise and conclude on the conceptual and theoretical elements of the organisational ecology concerning the relations between organisational ageing and organisational ecology, enhanced by social and ecological systems and ecological management.

Method

The applied method included analytical and reflective concluding, based on the synthesis of findings from a critical literature review. To select the adequate literature from scientific journals, we used search tools, applying key words such as organisational ecology, organisational ageing, organisation change, organisation theory and social and ecological systems. To carry out the text analysis, we applied the standard qualitative data analysis tools.

Findings and Discussion

The concept of organisational ecology refers to an organisational field whose interrelations among the organisations compose a system, becoming the object of inquiry. The emergence of organisational ecology is traced from empirical studies in organisation theory based on the institution-building tasks, in a complex and interdependent environment (Trist, 1977). In organisational ecology, firms compete in standards (David, 1985).

Organisational ecology studies planning, design and management of physical settings that affect and are affected by expectations, organisational values and work practices (Becker, 1988). The consistent performance of leadership styles tends to stimulate the ecological innovativeness of the project supported by the inputs of ecological knowledge, information and competence. Without the injection of knowledge, information and competence, the performance of the leadership style does not stimulate the ecological innovativeness (Bossink, 2004). Socio-ecological knowledge communication and insights contribute to changing values and attitudes as well as trust-building, and facilitate conflict resolution in ecosystem management.

Organisational ecology combines the influences of inertia, imprinting and environmental changes to render obsolete the core technologies of old ageing organisations (Aldrich & Auster, 1986; Barron et al., 1994; Ranger-Moore, 1997). Time passage in organisations leads to accumulation of knowledge and the increasing of organisational competence, paralleling the theoretical perspectives of ageing in organisational ecology: liability of newness (Stinchcombe, 1965; Hannan & Freeman, 1984) and the liability of senescence (Barron et al., 1994). Organisational ecology infers the effects of organisational age in models failing to control the organisational size with a correlation between age and size (Barron et al., 1994).

Organisational ecology theories sustain an equilibrium model based on continuous change and strategic adaptation. The analyses of evolution in organisational ecology approaches are considered the organisational taxonomies, that-at the organisational level-are using the development approaches, at the population level are using the selection approaches and at the community level are using the macroevolutionary approach (Carroll, 1984). The innovation community is a proposed framework based on

organisational ecology to be used in research developing an institutional theory of technology commercialisation (Lynn, Reddy, & Aram, 1996). The legal framework, including institutional arrangements and property rights, is exogenous to the local voluntary collaboration socio-ecological systems (Hahn, 2000).

Organisational ecology theories sustain that at population level, the adaptation of organisational structures occurs with the replacement of old organisations that fail to adapt alongside the new ones. Socio-ecological research has firm-level variations in shaping external environments (Baum & Mezias, 1992; Lubatkin, Schulze, Mainka, & Cotterill, 2001). A conceptual model of the socio-ecological dynamics is linked to socio-ecological system consisting of an ecosystem management by actors and organisations, underlined by the formal rules and informal social norms and conventions as institutions underlying this management.

Organisational growth and survival are outcomes of organisational ecology used to evaluate different mechanisms (Ranger-Moore, 1997). Organisational ageing has consequences and implications in organisational ecology, with evolutionary and learning theories leading to obsolescence processes in organisational innovation. The organisational obsolescence has a specific innovation trajectory (Dosi, 1982). Organisational innovation is enhanced by organisational learning as the source of competitive advantages in industrial ecology. The strategy of learning organisation achieves a corporate competitive advantage in industrial ecology (Chen, Wang, Lin, & Chang, 2018).

Organisational ecology has inferences drawn on the effects of organisational ageing in models failing to control the size in a manner that is meaningfully correlated with the age and size of the organisation. (Barron et al., 1994). Organisational ecology takes into consideration the ageing consequences for organisational outcomes, failing to reach a consensus in the determination of the negative and positive ageing effects on organisational functioning (Hannan, 1998). The decline of organisational responsiveness leads to reduction in the levels of organisational innovation (Aldrich & Auster, 1986).

Ecological change in organisations can be incorporated into the organisational adaptation framed by the organisational ecological theory (Barnett, 1990). The implementation of organisational ecology among the

strategic research groups of firms leads to the performance differences of the organisational forms. Implementing the use of an organisational ecological model of resource has led to the findings supporting the use of an organisational ecological model of form-specific density and resource-partitioning (Carroll & Waminathan, 1992). It was found that the founding rates of firms increase with density and then tend to decline, while mortality rates decline with density and industry concentration.

Organisational ageing is a ubiquitous process that has multifaceted influence on organisational innovation, although the relationship between organisational behaviour and ageing has not been resolved (Hannan, 1998). Organisational ecology processes are an essential element that may influence the changes of organisational populations over time. Ageing has positive consequences for innovative activities on accumulated experience as in the case of older firms that tend to innovate more frequently, and these innovations are more significant.

Organisational ecology maintains that the combination of imprinting, environmental changes and inertia leads to organisational and technological innovation obsolescence of old organisations (Aldrich & Auster, 1986; Barron et al., 1994; Ranger-Moore, 1997).

Organisational population ecology maintains that individual organisations are subject to inertial forces and have limitations that impede their success in achieving radical structural and strategic changes. Organisational ecology has implications in strategic choice as perspectives on organisational strategy constrained by environmental conditions and industry change over time. Organisational ecology and evolutionary theories do not tend to consider the contextual factors of organisational change. It is considered that central organisational populations play a more significant role by way of exercise of ecological dominance, coordination and control over the flows of resources through and into the community (Hawley, 1963; Lincoln, 1976).

In the case of commercially owned technological firms that become organisationally ecologically dominant, this result is an outcome of the technological interdependence and centrality of the network, and the salient feature of the technological systems involved in ensuring the network's functionality is that positive consumption externalities are displayed rather than those arising from ownership (Katz & Shapiro, 1985, p. 424).

Organisational ecology gives support for the theoretical framework and operational methodology for the interdependence analysis of competition and mutualism using the model density-dependent mortality (Barnett & Carroll, 1987; Tucker, Singh, Meinhard, & House, 1988; Carroll & Hannan, 1989; Delacroix, Swaminathan, & Solt, 1989). In the ecological framework, mutualism is considered to favour some populations more than others and results from supplementary similarities and complementary differences.

The ecological principles give the perspective for the analysis from the ecological view of technological interdependence. Analysis of theory and research in organisation and population levels of organisational ecology, as well as the processes of change involved in funding and mortality, is reviewed by Singh and Lumsden (1990). Organisational mortality, in which firms proliferated and failed under conditions of organisational technological change drawing on the community ecology theory, predicts when technologies are systemic and, accordingly, when the conditions would not be favourable for organisational technological change. The organisational ecological theory of adaptation incorporates technological change.

Organisational ecology develops an interdisciplinary and transdisciplinary framework of sustainable development (Carayannis & Campbell, 2010). Organisations possess information-processing routines and technological trajectories that are used to facilitate incremental innovation (Tushman & Anderson, 1986; Henderson, 1993). Organisations are generating, developing and communicating socio-ecological knowledge, norms, sentiments and innovation sensitive for the entrepreneurs and the stakeholders in the scientific and technological inventories and socio-ecological projects that create a macro-effect in social and ecological dimensions.

The dynamics of social responses can be assessed at different organisational levels to enhance the process of adaptive co-management and change the socio-ecosystem with the support of local self-organised steward associations and other authorities at various levels, to learn and experiment with management practices, generate socio-ecological knowledge, and collaborate (Olsson, Folke, & Hahn, 2004).

Socio-ecological systems determine resilience by the ecological dynamics and the social capacity to respond and shape ecosystem changes that

sustain, develop and enhance the ecological conditions for human societies and the socio-ecological change trajectory under conditions of uncertainty (Carpenter, Walker, Anderies, & Abel, 2001; Folke, Hahn, Olsson, & Norberg, 2005). A socio-ecological system challenges the acceptance of uncertainty by enhancing the capacity to deal with disturbance (Berkes, Folke, & Colding, 2003).

A resilient socio-ecological system makes use of disturbances to transform into desired states (Walker, Holling, Carpenter, & Kinzig, 2004), while a non-resilient socio-ecological system is vulnerable to external changes. Community transformation must adopt the socio-ecosystem approach to create a trajectory of building resilience of the social ecological system (Olsson et al., 2004) supported by the interactions of a social network to generate socio-ecological knowledge and provide memory for a management socio-ecosystem (Berkes & Folke, 1992; McIntosh, Tainter, & McIntosh, 2000). Building resilience in socio-ecological systems is a relevant tool to influence physical planning for land-use in communities.

Socio-ecological systems are related to the ecosystems' adaptive governance (Dietz, Ostrom, & Stern, 2003; Eckerberg & Joas, 2004; Folke et al., 2005; Ostrom, 2005). Adaptive governance is supported by social memory of responses to ecological crises requiring social incentives and enabling legislation for collaboration (Pretty, 2003; Malayang, Hahn, & Kumar, 2005). The adaptive governance of socio-ecological systems tends to reduce organisational transaction costs of collaboration and value formation, providing social incentives that have lasting effects on behaviours for implementing socio-ecological projects (Pretty, 2003).

Any governance system must count on social processes, policies and strategies to promote and sustain socio-ecosystem management, as well as for the generation, development and communication of ecological knowledge. The socio-ecological knowledge and the levels of dynamic governance that bridge local actors are relevant dimensions of the socio-ecosystem management whose function it is to generate legal, financial and political support.

Ecological knowledge can be fed into adaptive management practices characterised by continuous monitoring of adaptive responses with management plans adapted to the inherent uncertainty in complex systems (Berkes et al., 2003). The socio-ecosystem management system is based on collaboration and landscape management concerned with adaptive

governance, adaptive management, ecomanagement and resilience, with social response resulting from self-organisation at local level and involving interaction between organisations. Collaborations resulting from an open dialogue arising from stakeholders at local inventories are more concerned with conservation ecology, ecotourism and cultural heritage issues.

Vertical links enable knowledge to be incorporated from other socio-ecosystems into the local socio-ecological knowledge and into management planning (Olsson et al., 2004). Between the social and ecological systems, there should be a mechanism for the prompt generation and forwarding of feedback and responses thereto, thus avoiding the creation of systemic friction, particularly in the case of involvement of actors and agents with higher access to financial resources and assets that are intended for channelisation into various organisational ventures, and those who are vulnerable to replacement by less interested people in the socio-ecosystem management system. Adaptive approaches for socio-ecosystem management under conditions of uncertainty involve building knowledge, linking people and organisations with knowledge systems and mobilisation of resources and socio-ecosystem dynamics to reduce ecological illiteracy; and detection of environmental feedback and responding to enhanced resilience of socio-ecosystem processes and functions (Gadgil, Berkes, & Folke, 1993; Olsson, & Folke, 2001; Folke et al., 2005).

Conclusions

Although the theory of organisational ecology evolved over time, it has invariably been focussing on the impact of social, economic and political environment on the population and diversity of organisations. Applying demographic and economic tools, together with environmental and sociological ones, it attempts to explain how organisations emerge, grow, transform, decline and die, depending on different environmental factors.

Organisational ageing has been long considered one of the most important factors, having consequences and implications in organisational ecology. Despite the long-lasting debate, due to different research approaches and findings, there is still no consensus on what kind of consequences prevail.

Organisational ecology theories maintain that: (i) at population level, the adaptation of organisational structures occurs with the replacement of old organisations that fail to adapt by the new ones; (ii) individual organisations are subject to inertial forces and have limitations that impede them from achieving success when confronted with radical structural and strategic changes; (iii) ageing has positive consequences for innovative activities of older companies; and (iv) the higher the density and concentration of industry, the higher the rates of founding firms and the lower the rates of mortality.

It is important to explore the organisational ageing processes under the new conditions of uncertainty and the new challenges, such as COVID-19 and increasing climate change pressures. Future institutional and ecological research should address such issues as the effects of institutional variables on vital rates, legitimacy role in population dynamics, and criticisms.

References

1. Aldrich, H., & Auster, E. R. (1986). Even dwarfs started small: Liabilities of age and size and their strategic implications. *Research in Organizational Behavior*, 8, 165–198.
2. Amburgey, T. L., & Hayagreeva, R. (2014). Organizational ecology: Past, present, and future directions. *The Academy of Management Journal*, 39(5), 1265–1286.
3. Barnett, W. P. (1990). The organizational ecology of a technological system. *Administrative Science Quarterly*, 35(1), 31–60. doi:10.2307/2393550.
4. Barnett, W. P., & Carroll, G. R. (1987). Competition and mutualism among early telephone companies. *Administrative Science Quarterly*, 32, 400–421.
5. Barron, D. N., West, E., & Hannan, M. T. (1994). A time to grow and a time to die: Growth and mortality of credit unions in New York City, 1914–1990. *American Journal of Sociology*, 100, 381–421.
6. Baum, J. A. C. (2014). Organisational ecology. In S. Clegg., C. Hardy, & W. Nord (Eds.), *Handbook of organization studies*. SAGE, 86–107 .
7. Baum, J. A. C., & Mezias, S. J. (1992). Localized competition and organizational failure in the Manhattan hotel industry, 1898–1990. *Administrative Science Quarterly*, 37(4), 580604.
8. Becker, F. D. (1988). Chapter 52 — Technological innovation and organizational ecology. In M. Helander (Ed.), *Handbook of human-computer interaction* (pp. 1107–1117). North-Holland, Netherlands. doi:10.1016/B978-0-444-70536-5.50057-9. Retrieved from <https://www.sciencedirect.com/science/article/pii/B9780444705365500579>

9. Berkes, F., & Folke, C. (1992). A systems perspective on the interrelations between natural, human-made and cultural capital. *Ecological Economics*, 5, 1–8.
10. Berkes, F., Folke, C., & Colding, J. (Eds.). (2003). *Navigating social-ecological systems: Building resilience for complexity and change*. Cambridge University Press . New York.
11. Bossink, B. A. G. (2004). Effectiveness of innovation leadership styles: A manager's influence on ecological innovation in construction projects. *Construction Innovation*, 4(4), 211–228. doi:10.1108/14714170410815105.
12. Carayannis, E. G., & Campbell, D. F. (2010). Triple helix, quadruple helix and quintuple helix and how do knowledge, innovation and the environment relate to each other? A proposed framework for a trans-disciplinary analysis of sustainable development and social ecology. *International Journal of Social Ecology and Sustainable Development*, 1(1), 41–69.
13. Carpenter, S. R., Walker, B., Anderies, J. M., & Abel, N. (2001). From metaphor to measurement: Resilience of what to what? *Ecosystems* 4, 765–781.
14. Carroll, G. R. (1984). Organizational ecology. *Annual Review of Sociology*, 10, 71–93. doi:10.1146/annurev.so.10.080184.000443.
15. Carroll, G.R., & Hannan, M.T. (2002). *The demography of corporations and industries*. Princeton, NJ: Princeton University Press.
16. Carroll, G. R., & Hannan, M. T. (1989). Density dependence in the evolution of populations of newspaper organizations. *American Sociological Review*, 54, 524–541.
17. Carroll, G. R., & Negro, G. (2018). Organizational ecology. In M. Augier., & D. J. Teece (Eds.), *The Palgrave encyclopedia of strategic management*. London, England: Palgrave Macmillan, 1208–1211, doi:10.1057/978-1-137-00772-8_612 .
18. Carroll, G. R., & Waminathan, S. (1992). The organizational ecology of strategic groups in the American brewing industry from 1975 to 1990. *Industrial and Corporate Change*, 1(1), 65–97. doi:10.1093/icc/1.1.65.
19. Chen, K. H., Wang, J. S., Lin, M. H., & Chang, W. Y. (2018). The influence of learning organization on organizational innovation and organizational performance relationship: The case of ecology industry. *Ekoloji*, 2018(106), 329–335, Article No: e106080.
20. David, P. A. (1985) Clio and the economics of OWERTY. *American Economic Review*, 75: 332–337.
21. Delacroix, J., Swaminathan, A., & Solt, M. E. (1989). Density dependence versus population dynamics: An ecological study of failings in the California wine industry. *American Sociological Review*, 54, 245–262.
22. Dietz, T., Ostrom, E., & Stern, P. L. (2003). The struggle to govern the commons. *Science*, 302, 1907–1912.
23. Dosi, G. (1982). Technological paradigms and technological trajectories. *Research Policy*, 11, 147–162.
24. Eckerberg, K., & Joas, M. (2004). Multi-level environmental governance: A concept under stress? *Local Environment*, 9(5), 405–412.
25. Folke, C., Hahn, T., Olsson, P., & Norberg, J. (2005). Adaptive governance of social-ecological systems. *Annual Review of Environment and Resources*, 30, 441–473.
26. Gadgil, M., Berkes, F., & Folke, C. (1993). Indigenous knowledge for biodiversity conservation. *Ambio*, 22, 151–156.

27. Hahn, T. (2000). *Property rights, ethics, and conflict resolution: Foundations of the sami economy in Sweden* (Doctoral dissertation). Agraria 258, SLU. Department of Economics, Uppsala, Sweden.
28. Hannan, M. T. (1998). Rethinking age dependence in organizational mortality: Logical formalizations. *American Journal of Sociology*, 104, 126–164.
29. Hannan, M. T., & Freeman, J. (1984). Structural inertia and organizational change. *American Journal of Sociology*, 49, 149–164.
30. Hawley, A. H. (1963). Community power and urban renewal success. *American Journal of Sociology*, 68, 422–431.
31. Henderson, R. M. (1993). Underinvestment and incompetence as responses to radical innovation: Evidence from the photo lithographic alignment equipment industry. *RAND Journal of Economics*, 24, 248–270.
32. Katz, M. L., & Shapiro, C. (1985). Network externalities, competition, and compatibility. *American Economic Review*, 75, 424–440.
33. Lincoln, J. R. (1976). Power and mobilization in the urban community: Reconsidering the ecological approach. *American Sociological Review*, 41, 1–15.
34. Lubatkin, M., Schulze, W. S., Mainkar, A., & Cotterill, R. W. (2001). Ecological investigation of firm effects in horizontal mergers. *Strategic Management Journal*, 22(4), 335–357.
35. Lynn, L. H., Reddy, N. M., & Aram, J. D. (1996). Linking technology and institutions: The innovation community framework. *Research Policy*, 25(1), 91–106. doi:10.1016/0048-7333(94)00817-5. Retrieved from <https://www.sciencedirect.com/science/article/pii/0048733394008175>
36. Malayang, B. S. III, Hahn, T., & Kumar, P. (2005). Responses to ecosystem change and to their impacts on human well-being. In *Millennium Ecosystem Assessment, Findings of the Sub-global Assessments Working Group*, Chapter 9. Island. Retrieved from <http://www.maweb.org>
37. McIntosh, R., Tainter, J., & McIntosh, S. (2000). *The way the wind blows: Climate, history, and human action*. New York, NY: Columbia University Press.
38. Olsson, P., & Folke, C. (2001). Local ecological knowledge and institutional dynamics for ecosystem management: A study of Lake Racken watershed, Sweden. *Ecosystems*, 4, 85–104.
39. Olsson, P., Folke, C., & Hahn, T. (2004). Social-ecological transformation for ecosystem management: The development of adaptive co-management of a wetland landscape in southern Sweden. *Ecology and Society* 9(4), 2. Retrieved from <http://www.ecologyandsociety.org/vol9/iss4/art2/print.pdf>
40. Ostrom, E. (2005). *Understanding institutional diversity*. Princeton, NJ: Princeton University Press.
41. Pretty, J. (2003). Social capital and the collective management of resources. *Science*, 302, 1912–1914.
42. Ranger-Moore, J. (1997). Bigger may be better, but is older wiser? Organizational age and size in the New York life insurance industry. *American Sociological Review*, 62, 903–921.

43. Singh, J. V., & Lumsden, C. J. (1990). Theory and research in organizational. *Ecology Annual Review of Sociology*, 16, 161–195 (Volume publication date August 1990). doi:10.1146/annurev.so.16.080190.001113.
44. Stinchcombe, A. L. (1965). Social structure and organizations. In J. G. March (Ed.), *Handbook of organizations*. (pp 142–193) Chicago, IL: Rand McNally.
45. Trist, E. A. (1977). Concept of organizational ecology. *Australian Journal of Management*, 2(2), 161–175. doi:10.1177/031289627700200205.
46. Tucker, D. J., Singh, J., Meinhard, A. G., & House, R. J. (1988). Ecological and institutional sources of change in organizational populations. In G. R. Carroll (Ed.), *Ecological models of organizations* (pp. 7–31). Ballinger, Texas.
47. Tushman, M. L., & Anderson, P. (1986). Technological discontinuities and organizational environments. *Administrative Science Quarterly*, 31, 439–465.
48. Walker, B., Holling, C. S., Carpenter, S. R., & Kinzig, A. (2004). Resilience, adaptability and transformability in social-ecological systems. *Ecology and Society*, 9(2), 5. Retrieved from <http://www.ecologyandsociety.org/vol9/iss2/art5/>
49. Wholey, D. R., & Brittain, J. W. (1986). Organizational ecology: Findings and implications. *Academy of Management Review*, 11(3). doi:10.5465/amr.1986.57140723.

José G. Vargas-Hernández — Research professor at Instituto Tecnológico Mario Molina Unidad Zapopan, earlier at University Center for Economic and Managerial Sciences, University of Guadalajara. Member of the National System of Researchers of Mexico. Professor Vargas-Hernández has a Ph.D. in Public Administration and a Ph.D. in Organisational Economics. He has been a visiting scholar at Carleton University, Canada, University of California, Berkeley and Laurentian University, Canada. He holds a Ph.D. in Economics, Keele University; a Ph.D. in Public Administration, Columbia University; has to his credit studies in Organisational Behaviour at Lancaster University; and holds a Master of Business Administration degree; he has published nine books and more than 300 papers in international journals and reviews (some translated to English, French, German, Portuguese, Farsi, Chinese, etc.) and more than 300 essays in national journals and reviews. He has obtained several international awards and recognitions. He has also experience in consultancy. His main research is in organisational economics and strategic management. He teaches for several doctoral programmes.

Joanna Rakowska, dr hab. — received her PhD and habilitation in economics from the Warsaw University of Life Sciences, Poland. She is the head of the European and Regional Studies Division at the Institute of Economics and Finance at WULS. Her research focuses on different factors of local and regional sustainable development, including entrepreneurship, demography, labour market, renewable energy, public funds, self-government, etc., and their interconnectedness. She has published three books and more than 100 papers in international journals, conference proceedings and reviews. She has served as a visiting scholar at the Scotland's Rural College, the United Kingdom; the University of East London, the United Kingdom; and Agroscope, the Federal Office for Agriculture, Switzerland.

M. C. Omar C. Vargas-González — Professor and Head of the Department of Systems and Computing at the Technological National of Mexico Campus Ciudad Guzmán, Professor of Telematics Engineering at the University Center of the South of the University of Guadalajara; holds a master's degree in Computer Systems. He has received training in Entrepreneurship and Multidisciplinary Innovation at Arizona State University (2018) as well as a diploma in Ecosystems of Innovation and Entrepreneurship from the Harvard University School of Business. He currently conducts research in diverse areas such as Entrepreneurship, Economics, Statistics, Mathematics and Information and Computer Sciences, has collaborated in the publication of more than 15 articles in magazines and directs innovation and technological development projects.