GRANT journal
ISSN 1805-062X, 1805-0638 (online), ETTN 072-11-00002-09-4
Vol. 8, Issue 2
EUROPEAN GRANT PROJECTS | RESULTS | RESEARCH & DEVELOPMENT | SCIENCE

Resilience-Phase-Model (RPM): A Conceptual Model Approach To Resilience

Manuela Varsani[1]

[1] University of Latvia, Aspazijas boulv. 5, Riga, Latvia, email: mvarsani1234@gmail.com

Grant: M15 HS Fulda, Fulda University, Faculty of Business: Quantitative Methods of Business and Economics Research
Name of the Grant: Empirical Investigation of Decision Making Behaviour in a Public and Professional Context
Subject: AH - Economics

Abstract How to survive in turbulent and unpredictable environments is increasingly recognized as a fundamental challenge. In general theories about resilience exist a lot. And it becomes also more common to use the scientific knowledge from interdisciplinary science. Despite this, or perhaps because of it, adequate explanation or definition remains elusive. In recent years, interest in identifying and developing resilience characteristics has increased to foster viability. But the high variety of science perspective offer a different basis for understanding resilience. The need for a more general work on this topic has been identified. That resulted in the development of Resilience-Phase-Model (RPM), a conceptual model approach to Resilience.

Keywords Resilience, model

1. INTRODUCTION

Over the last few years there has been considerable interest in the idea of resilience across all areas of scientific world.[1] It appears that resilience is replacing sustainability in everyday discourses although it is not quite clear what resilience means, beyond the simple assumption that it is good to be resilient.[2] The term resilience lends itself to a number of interpretations that have generated interest in a wide variety of research fields, ranging from ecology to metallurgy, individual and organizational psychology to safety engineering and economics.[3] The need for a more general work on this topic has been identified. The paper will, firstly outline the origin of resilience and the development of this research field; secondly, present a number of different meanings of resilience and structure them into two phases as basis for the development of a Resilience-Phase-Model (RPM), thirdly raise some critical issues to be considered when transferring the (interpretative) meaning of resilience into a model and finally, outline some concluding remarks.

2. RESILIENCE

Originate from the Latin root *resilire*, meaning to spring back, resilience was first used by physical scientists to describe the characteristics of a spring and to specify the stability of materials and their resistance to external shocks.[4] Then taken over in psychology and education and also found its way into other fields of research like economics and management.[5]

Especially the work of the Canadian ecologist Crawford S. Holling represented a quantum leap in resilience research. His article "Resilience and Stability of Ecological Systems", published in 1973 in the Annual Review of Ecology and Systematics[6] , not only expanded the field of application of the resilience concept of developmental psychology towards ecology. Holling also initiated a paradigm shift at the same time. For the first time, the term resilience no longer referred to a specific ability of individuals but to entire ecosystems. The hitherto prevailing idea of ecosystems as a stable, equilibrium structure was radically questioned by Holling. In the end, Holling was concerned with the survivability of the system in the face of adverse incidents.[7] This idea - in particular regarding the concrete design, consideration, improvement and extension of survivability - became a crucial point for the further development of the concept of resilience.[8] Overall, research has evolved into different strands and waves. There are four main areas that cannot be sharply distinguished but are overlapping and partly parallel and whose discourse lasts until today.[9]

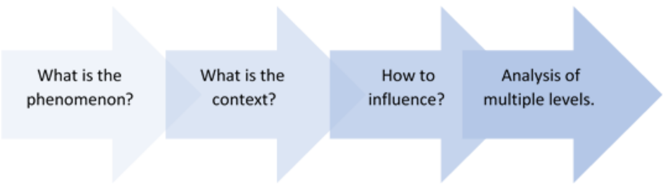

Figure 1: Research-fields of the phenomenon resilience (own illustration)

All in all, there is an almost unmanageable variety of definitions that describe resilience[10]. In addition, it is noticeable that resilience is often discussed either in the sense of a static or rather a dynamic guiding concept. The definitions proposed below show the evolution of the concept of resilience through time, starting from Holling's

[1] Gibson and Tarrant 2010, 6
[2] Davoudi et al. 2012, 299
[3] Annarelli and Nonino 2016, 5
[4] Davoudi et al. 2012, 300
[5] Mohr 2016, 411; Hoffmann 2017, 48; Geramanis and Hermann 2016, 21
[6] Holling 1973
[7] Holling 1973, 13
[8] Wink 2016, 126
[9] Hoffmann 2017, 50
[10] Fathi 2014, 2

definition given in 1973 and spanning a variety of research fields and moreover also entering evolutionary economic.

Author	Field	Phase 1	Phase 2
Holling[11]	Ecosystem	ability to absorb change and still exist…	…ability to return to *equilibrium* after temporary disturbance.
Cumming[12]	Ecosystem	ability of the system to maintain its identity in the face of internal change and external shocks and disturbances	-
Dinh[13]	Engineering	ability to bounce back when hit with unexpected events	-
Fathi[14]	Social	ability to focus in preventive measures to reduce risk factors and remain stable and occupational	being able to recover quickly from a crisis and being able to learn from past events
Mohr[15]	Social	the ability to deal with adverse and very difficult situations in such a way…	…that one returns to a form of psychic stability. This can be the old balance, but it can also be a condition that did not exist before, a new equilibrium, even growth is possible ("posttraumatic growth").
Rolfe[16]	Social-economic	a dynamic organizational adaptability that evolves and grows over time. It is the ability to deal with unforeseen crises that have occurred …	…learn to get back in the origin condition
Walker[17]	Social-ecologic	the capacity of a system to absorb disturbance and reorganize while undergoing change…	…still retain essentially the same function, structure, identity, and feedbacks…
Rose[18]	Economics	static resilience: the ability of a system or organization to maintain its core functions when shocked	dynamic component of resilience: the speed at which it is possible to return to ideal functioning conditions
Philipsen[19]	Economics	after deflection…	…to reach a stable state, again
Weick[20]	Economics	The intrinsic ability of an organization (system) to maintain…	…or regain a dynamically stable state
Di Bella[21]	Economics	is the capacity of a single entity, despite multiple risk factors or massive inbalances	…to make a positive development

[11] Holling 1973
[12] Cumming et al. 2005
[13] Dinh et al. 2012
[14] Fathi 2014, 2
[15] Mohr 2016, 413
[16] Rolfe 2019, 26
[17] Walker et al. 2004, 5
[18] Rose 2007, 383–95
[19] Philipsen and Ziemer 2014, 68
[20] Weick and Sutcliffe 2015, 12

Analyzing these definitions, understandings or concepts mentioned above one can see that in most cases, resilience is the ability of a system to face adverse incidents (crisis) over two stages, as categorized from the author over two phases. As there is a difference between operations before, in the presence or after a major mishap. Phase 1 (stable → fragile) is about the ability of a system to do preventive activities to reduce risk factors, to absorb changes and disturbances (adaptability) or to maintain in its core-function (static resilience). Operations in Phase 2 (fragile → stable) have the focus on the ability of the system to reach - fast, dynamically - the same stable state again or a new stable state.

Combining the different definitions of resilience outlined above shows that resilience is understood as a latent process with two phases, although it is not explained in the same way.

3. RESILIENCE-PHASE-MODEL (RPM)

Based on the definitions of resilience, an overall model will be outlined that helps to classify the definition diversity in the resilience discourse. This RPM is developed on following basic statements.

The following statements are based on the resilience model:

- The system's meaning model is survivability in the face of adverse events.[22]
- The considerations are based on statements of system theory[23]. In order to understand how systems are preserved and changed, systems research deals with the internal structure of systems, the interdependencies between system elements and their relation to the environment.[24]
- System elements (Units), can be both material and non-material nature, and stand in any kind of mutual network of relationships and influencing process.[25] These constantly occurring interactions between the elements can again lead to a new quality, a new status or a new state of the overall system.[26]
- The state of a system element should be maintained in a certain stability in an equilibrium or lead to an alternative state of equilibrium.[27] (Folke et al. 2010)

[21] Di Bella and Woywode 2014, 6
[22] Holling 1973, 1, 14; Landes and Steiner 2013, 801
[23] Further details on system theory can be found in Luhmann (Luhmann 2003).
[24] Di Bella and Woywode 2014, 140
[25] Vogt 2015, 9
[26] Ant 2018, 48
[27] Theoretical elaboration of the resilience concept occurred above all within the framework of the models of complex adaptive systems, be it evolutionary biology or more technically cybernetic. In cybernetics, the crucial term for the question of resilience is "feedback": systems with negative feedback can compensate for disturbances and return to their stable state; they commute around an equilibrium point. Systems with positive feedback amplify interference and can thus easily change to another system state. If they exceed a certain threshold, the transition to another attractor, that is, a different pattern of order, cannot be stopped. (Vogt 2015, 9) (Malik 2016, 7–39)

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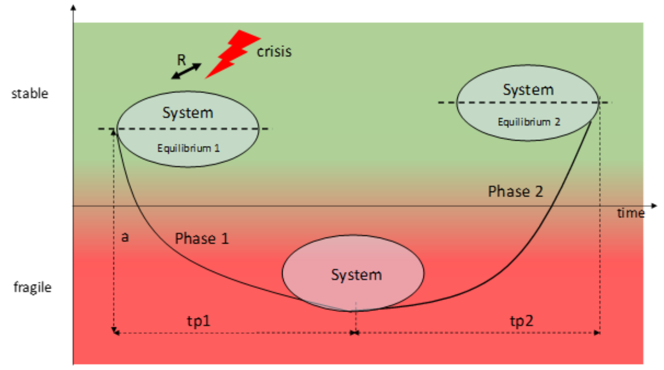

Figure 2: Resilience-Phase-Model (RPM) – (own illustration)

To determine the Resilience-Phase-Model more closely, the following attributes can be used:

Phase 1: stable - fragile
Equilibrium (Eq1): The system / unit is in an equilibrium state (equilibrium). The expressiveness and the relationship of central building blocks to each other within the system determine the stability, one could say, the equilibrium.[28] But new equilibrium states (Eq2) can also be the result of a resilient reaction of the system.[29]

Crisis (C): There is a disturbance of stability due to an event affecting the system (Crisis). This can be a disruptive change, which can be perceived as a threat, crisis or disaster, as a risk factor for healthy development.[30]

Resistance (R): Means the ease or difficulty of changing the system. It is an indicator about the system stability in relevance to the power of disturbance. In this meaning, greater forces or perturbations are required to change the current state of the system.[31] Resistance shows the capacity of a system to be robust and to protect itself from change.[32]

Altitude (a): What is the maximum amount the system can be changed before losing its ability to recover.[33]. An additional explanation would be the degree to which a system can be changed without losing the ability to recover from the shock. It can also be said that it is the leeway that exists until the equilibrium state tilts.[34] Of greater importance here is not, how long it takes for the system to become fragile (tp1), but how much disturbance it can take and remain within critical thresholds. Measures to reduce the altitude may have reactive (persistent), preventive (risk analysis) or adaptive character (developement of competences).[35] Folke describes this as "the magnitude of shock that the system absorbs and remains within a given state; the degree to which the system is capable of self-organization; and the degree to which the system can build capacity for learning and adaptation".[36]

Phase 2 fragile – stable (recovery)
Holling defined the phase 2 as engineering resilience. This is the ability of a system to return to an equilibrium on the previous state (Eq1) or to a new state (Eq2) after a disturbance[37]. This phase can be also called transformation. In this phase, the speed by which the system returns to equilibrium is the measure. The faster the system bounces back, the more resilient it is. The emphasis is on return time.[38]

As consequence of mentioned above attributes of Resilience, the measure of resilience is resistance to disturbance and its degree and the speed by which the system returns to equilibrium.

4. CLOSING COMMENTS

The application of systems theory is now also taking place in many other disciplines, so that it can be described as a suitable "basis for the unification of science". However, it is important in such an analogy formation that a transfer of processes of natural systems to social systems is not one-to-one possible, but requires a kind of cognitive integration, ie a contextual transfer of knowledge.

There is thus a critical time element in the social system response to change in terms of people and institutions. These are important temporal dimensions of change that are theorized about in the resilience literature, yet the empirical body of work on this dimension is limited.[39]

The RPM is an interpretive approach for discussing resilience attributes. Main information for the development of this model origins form research work in the socio-ecologic field. So there are some critical issues to be considered when translating resilience from the natural to the social world. There is no "one size fits all" approach to the future.

The investigation of dynamics of positive adaptation or transformation is characterized by a high degree of complexity. This is due, on the one hand, to the complex, interrelated relationships between the system components and, on the other, to uncertainty about the outcome of the processes. System researchers try to master complexity in different ways. A popular empirical basis for resilience research is case studies. In doing so, "small", local cases are used as well as global case studies in which aggregated data is used. System dynamic approaches often attempt to reflect feedback effects between the personal, social, economic and ecological components of a system. Partly it remains with theoretical modeling, partly with quantitative and qualitative investigations, participative designs or action research. In many cases, hybrid research strategies are also used to ensure that the complex causal relationships are adequately captured. A classic approach is the combination of quantitative interviews and qualitative elements such as interviews or the use of focus groups. One of the more innovative pluralistic approaches is agent-based modeling, a technique in which historical and development-related narratives of different actors are simulated from different perspectives.

Nevertheless, the common approach until today mainly consisted in planning and building resilience in a defensive and reactive way. But the real managerial stake behind the topic of resilience is its profound comprehension at all phases, together with the need to build it in a proactive manner, and not only to use it as a defensive response to extreme events. Therefore, the managerial challenge is transforming resilience from a set of redundant preventive actions into a proactive strategy.

[28] Mohr 2016, 421
[29] Folke et al. 2002, 437
[30] Hoffmann 2017, 66; Demmer et al. 2011, 5397
[31] Walker et al. 2004, 4–5
[32] Di Bella and Woywode 2014, 143
[33] Walker et al. 2004, 4–5
[34] Di Bella and Woywode 2014, 143
[35] Gibson and Tarrant 2010, 7
[36] Folke et al.; Folke et al. 2002, 436
[37] Holling 1973, 4
[38] Davoudi et al. 2012, 300
[39] Downes et al. 2013, 6

Sources

1. Annarelli, A., And F. Nonino. 2016. “Strategic and operational management of organizational resilience. Current state of research and future directions.” Omega 62:1–18.
2. Ant, M. 2018. Effizientes strategisches Management. Wiesbaden: Springer Fachmedien Wiesbaden.
3. Cumming, G., G. Barnes, And S. Perz. 2005. “An Exploratory Framework for the Empirical Measurement of Resilience.” Ecosystems 8(8):975–87.
4. Davoudi, S., K. Shaw, L.J. Haider, A.E. Quinlan, G.D. Peterson, C. Wilkinson, H. Fünfgeld, D. Mcevoy, And L. Porter. 2012. “Resilience. A Bridging Concept or a Dead End? “Reframing” Resilience: Challenges for Planning Theory and Practice Interacting Traps: Resilience Assessment of a Pasture Management System in Northern Afghanistan Urban Resilience: What Does it Mean in Planning Practice? Resilience as a Useful Concept for Climate Change Adaptation? The Politics of Resilience for Planning: A Cautionary Note.” Planning Theory & Practice 13(2):299–333 (9 December, 2019).
5. Demmer, W.A., S.K. Vickery, And R. Calantone. 2011. “Engendering resilience in small- and medium-sized enterprises (SMEs). A case study of Demmer Corporation.” International Journal of Production Research 49(18):5395–413.
6. Di Bella, J., And M.J. Woywode. 2014. Unternehmerische Resilienz. Protektive Faktoren für unternehmerischen Erfolg in risikoreichen Kontexten. Mannheim, Universität Mannheim, Diss., 2014. Mannheim: Universitätsbibliothek Mannheim.
7. Dinh, L., H. Pasman, X. Gao, And M. Mannan. 2012. “Resilience engineering of industrial processes: principles and contributing factors.” Journal of Loss Prevention in the Process Industries 25(2):233–41.
8. Downes, B.J., F. Miller, J. Barnett, A. Glaister, And H. Ellemor 2013. How do we know about resilience? An analysis of empirical research on resilience, and implications for interdisciplinary praxis (7th december 2019).
9. Fathi, K. 2014. “Resilienz – taugt dieser Begriff als „Ein---Wort---Antwort“ auf die Häufung von Krisen?” Forschungsjournal Soziale Bewegungen – PLUS 27(4). http://www.forschungsjournal.de/fjsb-plus (21 October, 2019).
10. Folke, C., S. Carpenter, And T. Elmqvist. Resilience and sustainable development: building adaptive capacity in a world of transformations.
11. Folke, C., S. Carpenter, T. Elmqvist, L. Gunderson, C.S. Holling, And B. Walker. 2002. “Resilience and sustainable development. Building adaptive capacity in a world of transformations.” Ambio 31(5):437–40.
12. Geramanis, O., And K. Hermann, eds. 2016. Führen in ungewissen Zeiten. Impulse, Konzepte und Praxisbeispiele. Wiesbaden: Springer Fachmedien Wiesbaden.
13. Gibson, C.A., And M. Tarrant. 2010. “A 'Conceptual Models' Approach to Organisational Resilience.” The Australian Journal of Emergency Management 25(2):6–12.
14. Hoffmann, G.P. 2017. Organisationale Resilienz. Kernressource Moderner Organisationen. Berlin, Heidelberg: Springer Berlin Heidelberg.
15. Holling, C.S. 1973. “Resilience and Stability of Ecological Systems.” Annu. Rev. Ecol. Syst. 4(1):1–23.
16. Landes, M., And E. Steiner, eds. 2013. Psychologie der Wirtschaft. Psychologie für die berufliche Praxis. Wiesbaden: Springer VS.
17. Luhmann, N., ed. 2003. Beobachter. Konvergenz der Erkenntnistheorien? Materialität der Zeichen / A 3. 3rd ed. München: Fink.
18. Malik, F. 2016. Strategy for managing complex systems. A contribution to management cybernetics for evolutionary systems. Frankfurt, New York: Campus Verlag.
19. Mohr, G.J. 2016. “Systemische Resilienz – Die Perspektiven und das Resilienz-Quadarat.” Organisationsberat Superv Coach 23(4):411–26.
20. Philipsen, G., And F. Ziemer. 2014. “Mit Resilienz zu nachhaltigem Unternehmenserfolg.” Wirtsch Inform Manag 6(2):68–76.
21. Rolfe, M. 2019. Positive Psychologie und organisationale Resilienz. Stürmische Zeiten besser meistern. Positive Psychologie kompakt. Berlin, Heidelberg: Springer Berlin Heidelberg.
22. Rose, A. 2007. “An economic framework for the development of a resilience index for business.” Environmental Hazards 7(4):73–83.
23. Vogt, M. 2015. Zauberwort Resilienz. Einführung zur Tagung „Zauberwort Resilienz. Was stärkt in Zeiten des radikalen Wandel?“. Tutzing.
24. Walker, B., C.S. Holling, S.R. Carpenter, And A.P. Kinzig. 2004. “Resilience, Adaptability and Transformability in Social-ecological Systems.” E&S 9(2) (7th december 2019).
25. Weick, K.E., And K.M. Sutcliffe. 2015. Managing the unexpected. Sustained performance in a complex world. 3rd ed. Hoboken NJ u.a.: Wiley.
26. Wink, R. 2016. Multidisziplinäre Perspektiven der Resilienzforschung. Wiesbaden: Springer.