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Resilience of Training Processes: Model and Case Study

Abstract: *It is noteworthy that the political considerations or features of the policy process in local, state or regional politics rarely feature in analyses of resilience . Yet, the nature and function of politics is as important to community resilience as any other social process. Politics is an activity that helps societies decide "who gets what, when, and how" (Lasswell, 1958). Disasters and the policies that deal with disasters are clearly political in the sense that they imply the distribution of resources through a system of government. Thus, we may offer the hypothesis that most if not all aspects of resilience are influenced by public policy, either by design or by accident.*

Researchers and practitioners have recently begun to be more interested in resilience and vulnerability.

A community needs to be able to bear stresses without losing all functionality if it is to be able to recover from a natural disaster.unit, which would significantly improve the business.

Keywords: *Resilience, quality of education, training, risk, vulnerability, training process, production, new technology, technological advancement, efficiency and effectiveness of training, development of training quality, training management.*

1. INTRODUCTION

The role of engineering in the public policy process sometimes is misunderstood by engineers and non-technical policy makers. Engineers are motivated by many goals, including the physical strength and resilience of systems, their operational efficiency, efficiency in their construction, their safety (a paramount concern) and, of course, the elegance of the system a component of a system, ranging from the technical excellent of a telecommunications system to the beauty of bridges and similar public works. Ultimately, engineering is both a creator and servant of society, and, as such, is

embedded in all the other social aspects of communities that promote or inhibit resilience (Petroski, 1992). Engineers, however, are uniquely positioned to understand the nature of infrastructure, the interrelatedness or infrastructures, the degree to which infrastructure systems can absorb strain or shocks, and the extent to which the system has designed or serendipitous resilience. And from engineering comes the important metaphors that define communities: robustness and resilience. Engineers play a crucial role in promoting community resilience; they must also consider the social and political environment of engineering, as well as the limits of engineering in protecting communities

from the worst outcomes of disasters. The subtle balancing of social, political, economic, environmental, and engineering aspects of communities is particularly difficult to achieve, but is a worthy goal in a world of increased hazard vulnerability. This chapter will help outline some of the features of the environment in which engineers and all decision-makers must operate.

2. RESILIENCE CAPACITY AND STRATEGIC AGILITY: Prerequisites for Thriving in a Dynamic Environment

Concept of resilience includes:

Robustness - strength, or the ability of elements, systems, and other units of analysis to withstand a given level of stress or demand without suffering degradation or loss of function; Redundancy - the extent to which elements, systems, or other units of analysis exist that are substitutable, i.e., capable of satisfying functional requirements in the event of disruption, degradation, or loss of function;

Resourcefulness - the capacity to identify problems, establish priorities, and mobilize resources when conditions exist that threaten to disrupt some element, system, or other unit of analysis (resourcefulness can be further conceptualized as consisting of the ability to supply material - i.e., monetary, physical, technological, and informational - and human resources to meet established priorities and achieve goals); An organization's resilience capacity captures its ability to take situation-specific, robust, and transformative actions when confronted with unexpected and powerful events that have the potential to jeopardize an organization's long-term survival Strategic agility is a complex, varied construct that can take multiple forms but captures an organization's ability to

develop and quickly apply flexible, nimble, and dynamic capabilities. These organizational attributes share common roots and are built from complementary resources, skills, and competencies. Together, strategic agility and resilience capacity enable firms to prepare for changing conditions, restore their vitality after traumatic jolts, and become even more proficient as a result of the experience. Resilience capacity helps firms navigate among different forms of strategic agility and respond effectively to changing conditions. In this chapter, we explain why organizational resilience capacity can be viewed as an antecedent to strategic agility, and as a moderator of the relationship between a firm's dynamic activities and subsequent performance. For organizations, being prepared means that a firm or agency is equipped to deal with unforeseen adversity and it is ready to capitalize on unexpected opportunities. In turbulent, surprising, continuously evolving marketplace environments only well prepared, flexible, agile, and relentlessly dynamic organizations will thrive. Unstable environments create frequent challenges. Often these events are viewed negatively, but as Sutcliffe and Vogus (2003) explain, resilient organizations are able to maintain positive adjustments under disruptive conditions. Resilience capacity provides the basis for restoration after a severe jolt and can offer an opportunity for an organization to undergo a positive transformation as a result of overcoming an exceptionally challenging experience. Similarly, strategic agility enables a firm to initiate and apply flexible, nimble, and dynamic competitive moves in order to respond positively to changes imposed by others and to initiate shifts in strategy to create new marketplace realities (McCann, 2004). Strategic agility and resilience capacity share common roots and are built, in part, from complementary capabilities and assets. Moreover, both presume change

and surprise can be sources of opportunity. However, they are distinct constructs that are designed to respond to different environmental conditions. Strategic agility is needed to address change that is continuous and relentless while resilience capacity is needed to respond to change that is severely disruptive and surprising (Deevy, 1995; Hamel and Valikangas, 2003; Jamrogetal., 2006; McCann, 2004). Often firms experience both types of change and, thus, resilience capacity and strategic agility are complementary capabilities that enable organizations to deal with the tumultuous environments in which they operate.

Resilience capacity is a multidimensional, organizational attribute that enables a firm to effectively absorb, respond to and potentially capitalize on disruptive surprises (Hamel and Valikangas, 2003; Lengnick-Hall and Beck, 2005; McCann, 2004). It provides a foundation of insight, flexibility, and hardiness that makes it possible for a firm to bounce back and often create new ways to flourish when faced with uncertainty and adversity stemming from a discontinuous jolt within its ecosystem. Resilience capacity is embedded in a set of organizational routines and processes by which a firm conceptually orients itself, acts decisively to move forward, and establishes a setting of diversity and adjustable integration that enables it to overcome the potentially debilitating consequences of a disruptive shock (Lengnick-Hall and Beck, 2005). We define resilience capacity as the organizational ability and confidence to act decisively and effectively in response to conditions that are uncertain, surprising, and sufficiently disruptive that they have the potential to jeopardize long-term survival. Resilience capacity is associated with an ability to solve current problems while preserving flexibility. Resilience capacity offers the *potential* for enhancing the organization's capability set as a direct

consequence of the response activities. Modest levels of resilience capacity enable a firm to recover from disruptions and resume normal operations, and high levels of resilience capacity can enable a firm to undergo a robust transformation and thereby thrive in part as a result of the adverse events. Recovery is defined as bouncing back or rebounding from environmental disruptions and resuming established levels of performance. Robust transformation, in contrast, is defined as capitalizing on environmental disruptions in ways that create new options and capabilities. Thus organizational resilience represents a continuum of response ranging from survival to recovery to beneficial transformation. The higher the level of resilience capacity the more reasonable it is to expect that an organization will achieve a position toward the robust transformation end of the continuum. Strategic agility has been defined as "the ability to quickly recognize and seize opportunities, change direction, and avoid collisions" (McCann, 2004: 47), as the ability to "produce the right products at the right place at the right time at the right price" (Roth, 1996: 30), or as "moving quickly, decisively, and effectively in anticipating, initiating and taking advantage of change" (Jamrogetal., 2006). It captures an organization's ability to manage and adjust to continuous change and so is tied to the frequency and tempo of environmental shifts and indicates a firm's nimbleness and quickness. Strategic agility prepares organizations to embrace relentless change by generating a range of resource and capability alternatives; developing skills at aligning, realigning and mobilizing resources; taking resolute action; and removing barriers to change (Brown and Eisenhardt, 1997; D'Aveni, 1994). Since both resilience capacity and strategic agility underscore a firm's need for deliberate and positive activities in the face of changing conditions, there is a strong connection between these two

organizational characteristics. However, there are also important distinctions between the two. Table 3.1 highlights some of the important differences between resilience capacity and strategic agility. One goal of this chapter is to offer a more in-depth understanding of these two constructs and of the interactions between them that enable organizations to thrive in dynamic environments.

Cognitive resilience

The first dimension of resilience capacity - *cognitive resilience* - is an organizational capability that enables a firm to notice shifts, interpret unfamiliar situations, analyze options, and figure out how to respond to conditions that are disruptive, uncertain, surprising and have the potential to jeopardize the organization's long-term survival (Lengnick-Hall and Beck, 2005). Multiple factors contribute to the creation of cognitive resilience but two of the most important elements are:

1. **Organizational identity.** Firms can foster positive, constructive conceptual orientation through a strong sense of purpose, authentic values.
2. **Sensemaking.** Cognitively resilient are adept at sensemaking in order to interpret and provide meaning to core unprecedented, situation - specific events and conditions (Thomas et al., 1993; Weick, 1995).

Behavioral Resilience

Behavioral resilience comprises the established behaviors and routines that enable a firm to learn more about a situation, implement new routines, and fully use its resources under conditions that are disruptive, uncertain, surprising, and have the potential to jeopardize the organization's long-term survival. These actions and activities allow organization members to respond collaboratively to

environmental threats and challenges in ways that facilitate a stronger and more competent firm (Lengnick-Hall and Beck, 2003). Routines and activities that comprise behavioral resilience are developed through a combination of practiced resourcefulness and counterintuitive action juxtaposed with useful habits and behavioral preparedness. In this way, behavioral resilience results from a dynamic tension between behaviors that foster creativity and unconventional actions, and familiar and well-rehearsed routines that keep an organization grounded and to provide the platform for inventiveness.

Resourcefulness

Learned resourcefulness is the accumulation of established practiced behaviors for innovative problem-solving that rest in heightened levels of ingenuity. As organizations develop and reinforce routines try proliferate ideas, manage conflict to cope with several new ii at the same time, facilitate change, and initiate novel activity (Kirton, 1976), individuals and organizations become adept engaging in disciplined creativity leading to unconventional robust, responses to unprecedented challenges (Lengnick-I Lill and Lengnick-Hall, 2003; Mallak, 1998a; Weick, 1993). Resource! "i" behaviors typically combine innovation and decisiveness capitalize on an immediate situation. Organizations that devch and rehearse behavioral routines that promote resourcefulness and creativity are able to take whatever resources inl opportunities are at hand to move the firm forward. Coutu (200i described these behaviors as "ritualized ingenuity." This i al lead to timing advantages including the ability to capitals rapid response opportunities, to do more with less, and to use a of a firm's assets to full advantage.

Useful Habits

Third, in direct contrast to learned resourcefulness and counterintuitive action, behavioral resilience also depends on useful, practical habits especially repetitive, well-rehearsed routines that provide the first response to any unexpected threat. Useful habits emerge from genuine organizational values. A cohesive sense of what a company believes (the core values that contribute to cognitive resilience) is the foundation for developing day-to-day behaviors that translate intended strategies into actions. If an organization develops values that lead to habits of investigation rather than assumption, routines of collaboration rather than antagonism, and traditions of flexibility rather than rigidity, it is more likely to intuitively behave in ways that open the system and generate resilient responses.

Preparedness

Fourth, behavioral preparedness helps bridge the gap between the divergent forces of learned resourcefulness and counterintuitive action and the convergent forces of useful habits. Behavioral preparedness is taking actions and making investments before they are needed to ensure that an organization is able to benefit from situations that emerge. Behavioral preparedness is the activity-based foundation for informed opportunism (Waterman, 1987). Behavioral preparedness also means that an organization deliberately unlearns obsolete information or dysfunctional heuristics (Crossan et al., 1999; Hammonds, 2002). It is just as important for organizations to quickly discard behaviors that result in inappropriate constraints as it is for them to develop new competencies. Behavioral preparedness enables an organization to act in response to opportunities that other firms without their competencies might forego. Firms that have not developed the necessary

behaviors before they are needed jeopardize behavioral resilience because they are unable to capitalize on unanticipated changes in technology, ideas, or market conditions.

Outcomes from Behavioral Resilience

Behavioral resilience translates the thoughts and perceptions identified through cognitive resilience into tangible actions and responses. This leads to two important outcomes. First, a combination of learned resourcefulness and counterintuitive actions generates a complex and varied inventory of potential strategic actions that can be drawn upon in emerging situations. Resourcefulness and mobile resources combine to create a reservoir of options that expand the range of possible future behaviors (Ferrier et al., 1999). Second, a combination of useful habits and behavioral preparedness creates a foundation of rehearsed and habitual expert routines that ensure an organization's initial and intuitive action response to any situation will create options rather than constraints.

In summary, cognitive resilience, behavioral resilience, and contextual resilience work together to create an organizational capability that has important implications for the development of strategic agility. Before discussing these implications, however, it is important to examine key aspects of strategic agility.

3. PERSPECTIVES ON STRATEGIC AGILITY

Strategic agility means that an organization can take quick, decisive, and effective actions and that it can trigger, anticipate, and take advantage of change (Doz and Kosonen, 2007; Jamrog et al., 2006). Firms demonstrating strong agility are able to maintain their strategic

supremacy despite market fluctuations (D'Aveni, 1999; Thomas, 1996). A high level of strategic agility means that a firm is able to demonstrate a consistent capacity for concentrating resources on key strategic issues, accumulating new resources efficiently and effectively, complementing and combining resources in new ways, and redeploying resources for new uses (Hamel and Prahalad, 1993). In many ways, strategic agility captures a firm's prowess for developing and learning complex problem-defining and problem-solving heuristics (Lei et al., 1996). The competitive dynamics literature argues that agility is correlated with a number of factors such as response speed, fast directional changes, number of strategic moves taken in a time period, variety in strategic moves undertaken, a firm's ability to initiate new action sequences, and similar indicators of a broad action repertoire coupled with decisiveness (Ferrier, 2001; Ferrier et al., 1999; Grimm et al., 2006). Much of what we know about how to achieve strategic agility is drawn from our understanding of organizational change (Brown and Eisenhardt, 1997; Goldman et al., 1995; Rindova and Kotha, 2001), exploration and exploitation (Benner and Tushman, 2003; March, 1991; O'Reilly and Tushman, 2004), and dynamic capabilities (Eisenhardt and Martin, 2000; Teece et al., 1997; Winter, 2003).

However, strategic agility can be realized through different component routines, resources, and competencies depending on the conditions and outcomes that a firm is striving to achieve. In other words, the elements of strategic agility that appear crucial in an extremely turbulent and unpredictable market appear to be different than the components of agility that are essential in a more moderately

dynamic marketplace characterized by punctuated equilibrium. Moreover, agility that is designed to augment and capitalize on existing sources of competitive advantage is quite different than agility that is designed to result in discontinuous and radically different sources of advantage. A firm with a rich and varied agility repertoire is able to develop resources and competencies that allow effective responses to a range of market and strategic conditions. We discuss the origins of these differences next.

Strategic Agility and Market Turbulence

The level of market turbulence determines the pattern of routines, capabilities, and resource deployments that is likely to be most effective. In environments that are only moderately unsettled, and characterized by punctuated equilibrium, agility is best achieved by patterns that are "complicated, detailed, analytic processes that rely extensively on existing knowledge and linear execution to produce predictable outcomes" (Eisenhardt and Martin, 2000: 1106). Because a firm has a baseline understanding of external conditions, it is able to emphasize *complexity reduction* and focus its analysis on anticipating and understanding the nature, direction, and consequences of the changes that are taking place.

Resilience Capacity, Strategic Agility and Organization

As indicated previously, resilience capacity and strategic agility reflect a number of common roots including change and emergent behavior; creativity; intentional purposeful decision-making and action; and requirements to despite uncertainty.

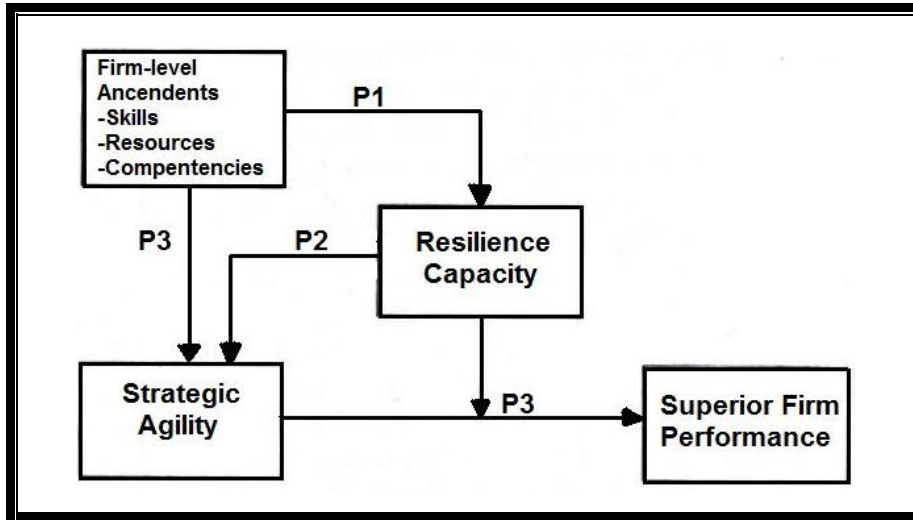


Fig.1 Interaction among resilience capacity, strategic agility, and organizational performance

4. AN INITIAL COMPARISON OF SELECTED MODELS OF SYSTEM RESILIENCE

The label “resilience” has come to be used by many researchers in biology, psychology, organizational dynamics, safety, and complexity theory to describe one or another aspect of the adaptive capacity of organisms, species, groups, and organizations. As a result, there are many potential definitions of and representations for resilience, each of which suggest different ways to parameterize a system’s adaptive capacity. This chapter compares several proposed models for resilience of human systems in order to determine how they are similar and where there are substantive differences.

The models compared are models in the sense they represent a representational system that captures key concepts and relationships about how systems can be more or less resilient. The representations tend to use state space diagrams, a capture general empirical relationships as parameters in the state space. The models were selected for comparison because the parameters associated with each representation facilitated comparisons. As

the practical interest for resilience engineering continues to grow, so does the need for a clear definition and for practical methods. The purpose of this chapter is to propose a working definition of resilience and analyze it in some detail. The working definition is as follows:

A resilient system is able effectively to adjust its functioning prior to, during, or following changes and disturbances, so that it can continue to perform as required after a disruption or a major mishap, and in the presence of continuous stresses.

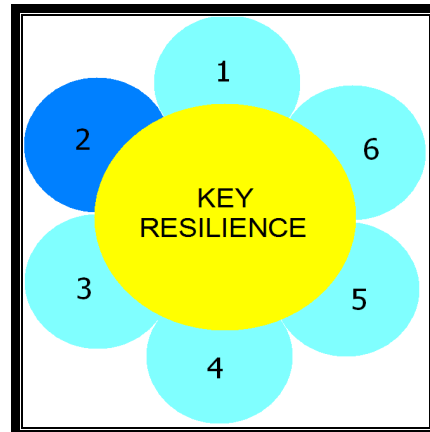


Fig. 2 Business model of resilience of training

Interactions among	
Number	Key
1. Risk management	-Training: yes/no - Number of candidate -Training level - Literature level -Place to take course - Resources to use -Choice of teacher - Time to take course
2. Unexpected disaster	-Natural disasters -Political/social unrest
3. Regular resource-CNC resource	-Quality level -Reserve equipment
4. Risk of selection resource	-Reserve equipment -Manufacturers warranty -Efficiency of maintenance
5. Training with/without CNC equipment	-Case study
6. Perception of candidates	-Knowledge level -Certificate -Teacher level -Financial contributions

Tab.1 Interaction among

The key term of this definition is the ability of a system to *adjust* its functioning. (The terms system and organization are used interchangeably in this chapter.) This makes clear that resilience is more than the ability to *continue* functioning in the presence of stress and disturbances. While the ability of a system or an organization to preserve and sustain its primary functions is important, this can be achieved by other and more traditional means. Continued functioning can, for instance, be achieved by isolating the system from the environment, or by making it impervious to exogenous disturbances. An example of that is the *defence-in-depth* principle,

which means that there are multiple layers of barriers between the system and the environment in which it exists. The defence-in-depth solution can, of course, serve.

The Critical

A resilient system must be able to flexibly monitor what is going on, including its own performance. The ability to monitor enables the system to cope with that which could become critical in the in sir term. The flexibility means that the monitoring basis must be assessed from time to time, so that the monitoring does not begin constrained by routine and habits.

As argued above, it is in practice only possible for a system to be ready to respond to the regular threats, or even just to some of I he nr. It is nevertheless a potential risk if the readiness to respond is limited to a small number of events or conditions. The solution is to monitor what may become critical, and use that to change a state of normal operation to a state of readiness when solution is to monitor things that can become critical, and to use it for changing state of normal work, to state of readiness, when conditions indicate that a crisis, disturbances, or failure is Imminent. Such a two-step approach will be more cost-effective.

If a system can make itself ready when something is going to happen, rather than remain in a state of readiness more or less permanently, then resources may be freed for more productive pin poses. The difficulty is, of course, in deciding that something may go wrong early enough so that there is sufficient time to change a state of readiness. It is also necessary that the identification of the impending event is so reliable that preparations are not made in vain.

Monitoring normally looks for certain conditions or relies on certain indicators. These are by

definition called leading indicators, because they indicate what may happen *before* it happens.

5. TRAINING WITH/WITHOUT CNC EQUIPMENT

As the beginning of this century managers of some companies noticed the regularities among of surplus values which appeared as the result of short or long-term training. Trainings were supported by workers and their associations because they were aware of the importance of these training for their positions and progress. Trainings are mostly used for advancing of

craftsmanship skills. However deficit of these skills as the consequence of technological progress made us conclude that taking into account their efficiency training should be directed towards the foundation of an effective organization. The orientation was accepted by trade unions as well as by managements of companies for the purpose of mutual positive result. *What we can do is to estimate the effect the training has had on the person who attended it: if he /she has increased his/her knowledge related to the job he/she is performing; if he/she is doing his job more effectively, how the efficiency of performed training is graded.*

<i>Aspect</i>	<i>Questionnaire results</i>
a) evaluate visual presentation	excellent-----100%
b) evaluate the lecturer	excellent-----98.36%
c) evaluate complete quality of training	very well----- 63%, Well---37%
d) do you consider in necessary to attend the training course again	unsatisfactory-----82%
e) remarks	96% of the present candidats said that there was deficiency of practical training and making of at least one piece on CNC machines.

Table 1 – Questionnaire results without CNC

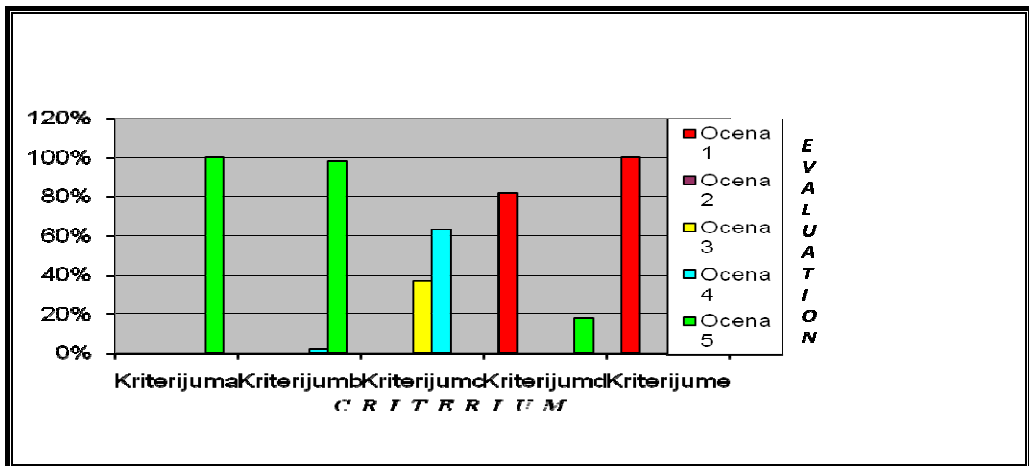


Fig 2- Results of evaluation without use CNC

No	Aspect	Evaluation				
		1	2	3	4	5
1.	Evaluate complete quality of seminar					
2.	Evaluate visual presentation of the material					
3.	Evaluate the practical part of lecture and work on CNC equipment					
4.	Taking into account your initial knowledge how would you evaluate yourself in learning the information about the material					
5.	Evaluate the lecturer's displaying					
6.	Is it necessary to have a higher level training – advanced training		Yes		No	

Table 2 – Aspects of evaluation with CNC

The results of evaluation					
Criterium	Evaluation				
	1	2	3	4	5
1	0	0	0	0	15/100%
2	0	0	0	0	13/100%
3	0	0	0	1/7.69%	12/92.3%
4	0	0	2/15.38%	8/61.5%	3/23%
5	0	0	0	1/7.69%	12/92.3%
6/yes	0	0	0	0	13/100%

Tab 2 - The results of evaluation

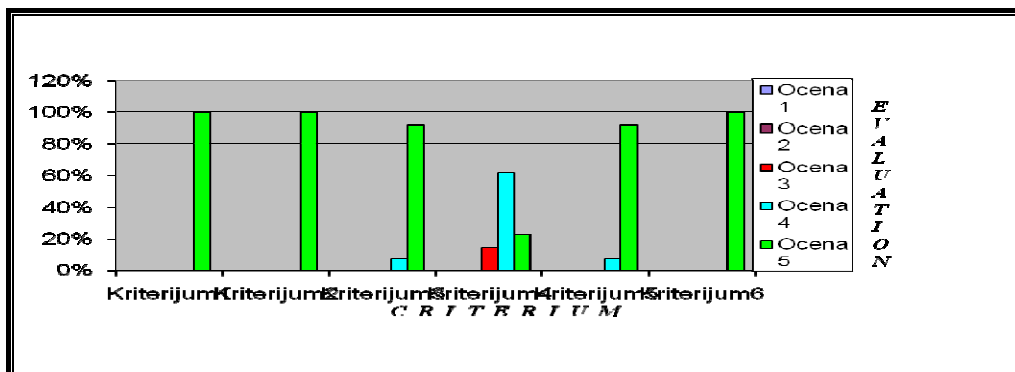


Fig 3- Results of evaluation with the use CNC

Case study results of taken course with/without CNC technologies-resources, informing autors to summary that:

Increasing of RESILIENCE essentially obligate and expand opinions of Risk.

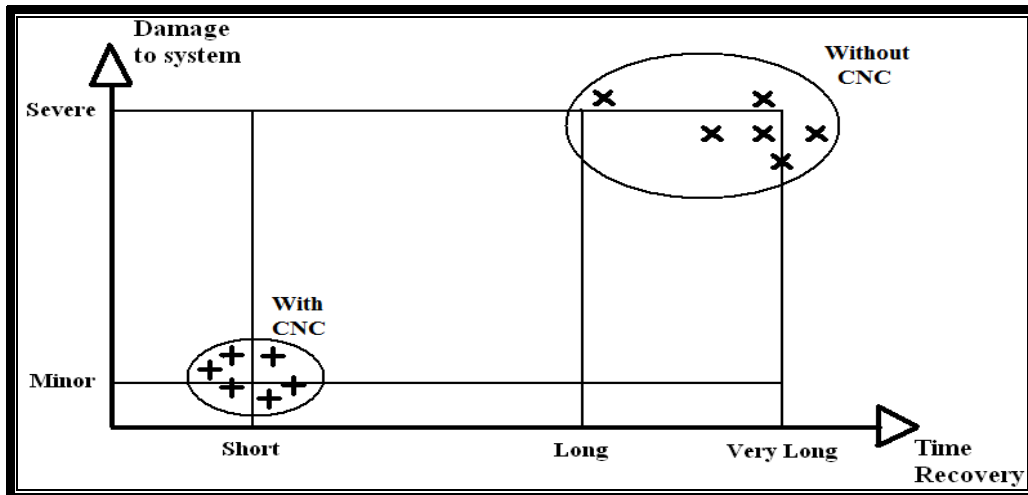


Fig. 4 – Resilience of business

6 SUMMARY

Numerous details related to the needs of resilience of training process, especially when we talking about new technologies-CNC technology, must be analysed to be able to make a conclusion about the priorities and needs of training. This is the primary source of planning the training which is usually done a year in advance. It is also the basis for modifying of already existing training programmes, specifications for new programmes, in the needed scope, level and thematic.

When this procedure is not followed, there isn't usually any other reliable source of information about the training needs. Only impressions with no arguments aren't often valid.

The complexity of the process of projecting the needs for training can be expressed through differences between spontaneous discovering the needs and systematic projecting of training needs. Although we often insist on training of employees as systematic and continuous process it must satisfy immediate needs. For example, if for certain political reasons, a new market is opened, a fast reaction is expected and quick preparation of people for that area or employing those

who are able to adapt to the existing situation. It means in instantaneous response, otherwise those more skilled and qualified will establish themselves on the new markets. It's irrational to miss the need because, for example, learning of the certain foreign language can be included in a yearly training plan.

Basic phases in projecting the training needs are:

- stating the needs for training
- discovering the source of information of the needed training
- choosing the criteria for evaluating and ranking the needs
- researching momentary needs of training
- selecting the needs and their articulation
- including the needs into curriculum
- monitoring, analysing and evaluating the efficiency and effectiveness of the performed training.

Final evaluation:

Resilience rating of the training process is very complex. It is necessary to establish the correlation of resilience, risk and vulnerability process course. On based approach to this process (one of the possible is given in Fig.1, and fig.2 as well as on table 1, 2 and 3.), execute quality

improvement training services and continually learning organizations and users.

The goal is continuously improving the resilience, and permanent process of

training and professional development. Finally it can be said that increased resilience of business system mean and expanding opinions on Risk.

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