Operationalising resilience

Title: Operationalising Resilience: A simulation-based study of team resilience

Authors

Melike Senturk, Doctoral Researcher at the University of Edinburgh Business School
Nick Oliver, Professor of Management at the University of Edinburgh Business School

Contact Details:

Melike Senturk (corresponding author)
The University of Edinburgh Business School
29 Buccleuch Place
Edinburgh, UK
EH8 9JS
Email: melike.senturk@ed.ac.uk
Tel: +44 7541 492 966

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Summary

This study aims to identify the precursors of team resilience during challenging and disruptive operating conditions. In order to provide a complete picture of team resilience, a comprehensive framework was established comprising a range of antecedent and outcome variables of resilience. A total of 164 participants, divided into 21 teams of 7-9 members each, took part in a simulation that replicated challenging operational conditions and tested team resilience. Data included teams' objective performance measures and self-assessments of their performance and collective behaviour. Initial findings suggested high levels of correlations between the objective performance measures and team resilience. Preliminary analysis reveals strong correlations between the precursor variables and team resilience. Mixed methods analysis will be used for the further analysis and interpretation of the data.

Track: Organization Studies

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Introduction

Resilience, which is defined most broadly as the ability of an entity to overcome the challenging conditions and to continue functioning, is a complex and "multifaceted" concept (Cumming, Barnes, Perz, *et al.*, 2005, p.975) that has been investigated by various disciplines and at multiple levels, including organization studies, starting from 1980s and the number of investigations has escalated since then. The majority of these investigations are explorative and based on analyses of case studies (for e.g. Weick, 1993; Freeman, Hirschhorn & Triad, 2003; Christianson, Farkas, Sutcliffe, *et al.*, 2009).

However, due to a scarcity of explanatory empirical investigation, the literature lacks a comprehensive framework that explains organizational resilience. Empirical investigation at the team level is particularly limited (Alliger, Cerasoli, Tannenbaum, *et al.*, 2015, p.177). To address this gap, this study employs a simulation-based methodology that is rarely seen in organizational resilience research in order to address the limitations mentioned above. Specifically, we seek to answer the question "what characteristics differentiate resilient teams and organizations from those that are less resilient?"

Literature Review

Resilience research became crucial for the organizational researchers and practitioners especially after the 1980s with the increases in number and intensity of adverse conditions that organizations face (Shrivastava, Mitroff, Miller, *et al.*, 1988). While only some of this adversity poses significant challenges to organizational survival, most creates a disruptive and challenging environment for teams and individuals working for those organizations. Operating under these disruptive environments negatively affects the overall performance of teams and individuals. Thus, organizational resilience at the individual and team level should be perceived as an inextricable facilitator of routine performance.

Organizational resilience as a concept has its roots in several literatures, namely those on general resilience (Holling, 1973; Horne, 1997), the crisis management literature (Quarantelli, 1988; Mitroff, Shrivastava & Udwadia, 1987), positive psychology (Sutcliffe & Vogus, 2003; Weick, 2003) and high-reliability organizations (Weick, Sutcliffe & Obstfeld, 1999). A theme that runs through all of this literature is adversity and the means to overcome it; the literature identifies several characteristics of resilient organizations. These characteristics include: effectiveness of communication (Weick, 1993); tight coordination (Weick, Sutcliffe & Obstfeld, 1999, p.117); high situational awareness (Burnard & Bhamra, 2011, p.5587) and well-developed, rapid problem solving ability (Stewart & O'Donnell, 2007, p.248). However, the question of "what characteristics differentiate resilient teams and organizations from those that are less resilient?" lacks a satisfying answer. Providing that answer requires organizational resilience researchers to move on from the conventional methods such as case studies or after-the- event interviews and to attempt new methods such as direct observations and experiments (van der Vegt, Essens, Wahlstrom, *et al.*, 2015, p.977). Conventional methods typically rely on after-the-event narratives of actors and/or researchers, which may be susceptible to a variety of biases.

Methods

This study employed a simulation-based methodology in order to test a conceptual framework, derived from the existing literature, of the factors that may explain resilience.

Teams of 7-9 individuals took part in a simulation in which they were required to identify profitable orders of greetings cards, produce cards according to demanding, predefined specifications and, within tight time deadlines, deliver their orders to the controllers for inspection. The exercise simulates a competitive and dynamic market environment, in which teams compete for orders and in which team performance is directly comparable. The exercise can be quite stressful, as teams have to process a great deal of information whilst working quickly and accurately. Teams operate in the same physical space during the simulation itself; the atmosphere is typically busy, noisy and excitable. It is not unusual for arguments to break out within teams due to the pressure. Team members often report mental and sometimes physical exhaustion due to intensive card-writing. By the end of the exercise some participants have headaches from the combination of the pressure and levels of concentration required.

Four weeks before the game, participants were allocated to teams on a random basis and provided with a comprehensive briefing pack to enable them to develop their strategy and organization and to practice production. After four weeks of preparation, two simulations (or trading periods) were conducted, each of which lasted for two hours and fifteen minutes. One included six teams (44 participants), formed from MBA students; the second comprised 15 teams (120 participants), formed from MSc students. A total of 164 individuals participated in the research.

Data were collected in a number of ways. First, team performance (profits, number of cards produced, value of sales, unfulfilled orders, etc.) was objectively assessed using data collected by the controllers during the game. These measures are shown in Table 1.

Table 1 about here

Secondly, questionnaires were administered to participants before and after the game. A tentative framework of the precursors of resilience was established based on the literature on organisational resilience. Multiple measures were built into questionnaires administered to participants before and after the simulation. These are summarized in Table 2.

Table 2 about here

Third, interviews were conducted with the six MBA teams 3-5 days before the game. Finally, after the game each team was required to make a presentation about its performance and the reasons behind it, which the researchers attended and took notes.

Data gathered from these sources was analysed employing both quantitative and qualitative analysis methods in order to establish a comprehensive picture of team resilience. Quantitative data (performance data, questionnaire data) were entered into SPSS. These quantitative analysis results were supported by qualitative analysis of the interviews and presentations.

The unit of analysis was “the team”, for two reasons. Firstly, team resilience provides a link between organizational and individual resilience and comprises elements from both levels of resilience. Nevertheless, the scarcity of empirical investigation is greatest in team level

resilience which is perceived as an important gap to be addressed. Secondly, it is very impractical to employ hands-on simulations on organization level and if individual level was preferred, then it would not be possible to collect data on concepts concerning collective action (such as coordination, interaction, collective sensemaking, etc.). Thus, practical considerations also advise for the preference of "teams" as the analysis unit.

Initial Findings

Table 3 shows descriptive statistics of the objective indicators of teams' performance:

Table 3 about here

As seen from Table 3, objective team performance shows a wide range. Across both simulations, only four teams made a profit which signals the challenging nature of the exercise. Only a few teams successfully undertook high value orders, which were inherently harder to complete within the time allowed. Most teams remained below an average value of £350 per order, which meant it was difficult for them to make a profit. In general, teams were successful in delivering the orders they have taken in a timely manner as seen from the low mean percentage of unfulfilled orders. However, some teams were unable to complete the orders to the standards demanded by the specifications which caused many of their orders to be rejected by the controllers.

Table 4 displays the descriptive statistics associated with the questionnaire measures described above. Measures include a prefix (of either pre- or post-) that indicates whether participants completed them before or after the simulation (or both).

Table 4 about here

The Cronbach's alpha values, except for the individual resilience scale, show a high level of internal consistency. The measure of individual resilience also shows strong internal consistency, albeit at a moderate level. With regard to the three measures that were administered both before and after the simulations, namely "team resilience", "mindfulness" and "innovative behaviour", responses vary before and after the simulations which suggests that events during the game shifted participants' perceptions of these factors.

Lastly, Table 5 and Table 6 display the results of initial correlation analyses.

Table 5 about here

Team resilience is positively and meaningfully correlated with profits, sales and number of good cards produced and negatively and strongly correlated with percentage of rejected orders. These initial results confirm the proposed relationships between team resilience and

the performance measures. Thus, these results appear to demonstrate the importance of resilience for performance in disruptive and challenging working conditions.

Table 6 about here

Moreover, correlation analyses also indicated positive and meaningful correlations between team resilience and mindfulness, team potency, individual resilience, affective well-being and team transactive memory systems, as proposed. Contrary to expectations, no meaningful correlations were detected between team resilience and trait anxiety. Lastly, innovative behaviour appears to have more complex relations with team resilience when considering both pre and post-game levels of these constructs. Further quantitative and qualitative analysis is required to identify the reasons behind all the findings.

Discussion

The analysis of the collected data is envisaged as a mixed methods design. Quantitative findings will consist of correlations among the precursor and outcome variables possibly with the inclusion of moderator variables. These correlations will be supported with the qualitative findings obtained from the team presentations and individual self-assessment papers. These presentations and papers include participants' narratives of the team collective behaviour before and during the simulations. These narratives will enlighten the causes behind the particular relationships demonstrated in the quantitative analysis and combined findings will provide for the visualisation of overall structure of resilience.

Conclusion

In summary, full length version of this paper will aim to explain how highly resilient teams differ from less resilient teams with respect to the characteristics they demonstrate during challenging conditions. In order to complete the paper, there is a need of a more developed resilience literature analysis and a more detailed analysis of the simulation data by combining the inferences of data gathered from different sources. Lastly, this detailed analysis should be interpreted in a more elaborative manner in the discussion section of the full paper.

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Table 1: Objective Measures of Resilience

Measure	**Explanation**
Profit/Loss	Cash value of the profit (or loss) made by the team.
Sales per employee	Cash value of total sales made by the team divided by the number of team members.
Good cards per employee	Number of cards produced by the team and accepted by the controller divided by the number of team members.
Average value per order	Total cash value of the orders taken by the team divided by the number of orders taken.
Rejected orders	Orders rejected by the controllers as a percentage of orders delivered by the team.
Unfulfilled orders	Orders unfulfilled by the team as a percentage of orders taken by the team.

Table 2: Questionnaire-Based Measures of Resilience and its Precursors

Measure	Explanation
Team Resilience:	Stephen et al.'s (2013) three item scale, which assesses "a team's capacity to bounce back from a setback". This measure was taken both and after the game.
Mindfulness:	Vogus' (2004) constructed this scale to measure "the process of mindful organizing; i.e. a capability for error detection and correction". The scale constructed from nine items and has been administered both in the before and after game questionnaires.
Innovative Behaviour:	Scott and Bruce's (1994) constructed this scale to assess "individual innovative behaviour". Three items refer to idea generation, three items refer to idea promotion and three items refer to idea realization. This scale has also been employed both in the before and after game questionnaires in order to capture the innovative behaviour both during the preparation phase and the simulation phase.
Team Transactive Memory Systems (TMS):	As a possible precursor of resilient team behaviour Lewis' (2003) fifteen item "transactive memory systems" scale has been used in the after game questionnaire. Transactive memory systems are defined as "the cooperative division of labour for learning, remembering, and communicating relevant team knowledge" by Wegner (1987). Five items measure specialization, five items measure credibility and five items measure coordination.
Control measures:	To control for the possible effects of certain constructs outside the model of the study, additional scales has been administered in the questionnaires. Firstly, Guzzo et al.'s (1993) nine item "team potency" scale is used in the pre-game questionnaire in order to measure teams' members' "collective belief about their group's likely effectiveness". Secondly, Smith et al.'s (2008) "the brief resilience scale" is used also in the pre-game questionnaire to assess team members' individual "ability to bounce back or recover from stress". Thirdly, four items have been derived from the "Big Five Inventory" in order to assess the emotional stability dimension of the personality of team members. Lastly, in order to assess the after game subjective well-being of teams' members, twelve items have been derived from Warr's (1990) "affective well-being" scale and included in the after game questionnaire.

Table 3: Descriptive statistics of objective performance measures, n=21 (at the team level)

Measures	Profit/Loss (£)	Sales per employee (£)	Good cards per employee	Average value per order (£)	Rejected orders (as % of successful orders)	Unfulfilled orders (as % of orders taken)
Mean	-1305.67	562.94	10.65	360.48	17.89	8.33
Std. Deviation	1704.82	260.31	3.59	141.06	13.86	11.49
Minimum	-4545.00	38.57	1.14	208.89	0	0
Maximum	1550.00	1104.29	16.57	801.11	60	44.44

Table 4: Descriptive Statistics of self-reported questionnaire measures, n=163 (at the individual level)

Measures	**Pre-Team Resilience**	**Post-Team Resilience**	**Pre-Mindfulness**	**Post-Mindfulness**	**Pre-Innovative Behaviour**	**Post-Innovative Behaviour**	**Pre-Team Potency**	**Pre-Individual Resilience**	**Pre-Trait Anxiety**	**Post-Affective Well-being**	**Post-Team TMS**
Mean	3.96	4.15	4.01	3.84	3.69	3.03	3.91	3.54	3.41	3.71	3.99
Std. Deviation	0.41	0.59	0.35	0.37	0.21	0.42	0.31	0.24	0.19	0.34	0.35
Minimum	3.00	2.67	3.13	3.16	3.24	1.96	3.22	3.05	3.04	2.71	3.30
Maximum	4.67	4.83	4.58	4.75	4.02	3.60	4.55	3.98	3.79	4.13	4.83
Reliability score (Cronbach's Alpha)	0.913	0.937	0.862	0.862	0.860	0.913	0.848	0.656	0.706	0.833	0.795
Number of items in the scale	3	3	9	9	9	9	8	6	4	12	15

Table 5: Correlations between team resilience and objective performance measures, n=21 (at the team level)

	Team Resilience	Profit/Loss (£)	Sales per employee	Good cards per employee	Average value per order	N of orders rejected	N of unfulfilled orders
Team Resilience	1						
Profit/Loss	0.629**	1					
Sales per employee	0.522*	0.689**	1				
Good cards per employee	0.453*	0.534*	0.931**	1			
Av. value per order	0.326	0.546*	0.818**	0.641**	1		
N of orders rejected	-0.683**	-0.608**	-0.475*	-0.413	-0.301	1	
N of unfulfilled orders	-0.379	-0.465*	-0.304	-0.315	-0.021	0.060	1

*Correlation is significant at the 0.05 level (2-tailed).
**Correlation is significant at the 0.01 level (2-tailed).

Table 6: Correlations between team resilience and its precursors, n=163 (at the individual level)

Measures	Pre-Team Resilience	Post-Team Resilience	Pre-Mindfulness	Post-Mindfulness	Pre-Innovation	Post-Innovation	Pre-Team Potency	Pre-Individual Resilience	Pre-Trait Anxiety	Post-Affective Well-being	Post-Team TMS
Pre-Team Resilience	1										
Post-Team Resilience	0.456**	1									
Pre-Mindfulness	0.461**	0.447**	1								
Post-Mindfulness	0.345**	0.656**	0.502**	1							
Pre-Innovation	0.226*	0.115	0.415**	0.282*	1						
Post-Innovation	0.100	0.163	0.216	0.318*	0.315**	1					
Pre-Team Potency	0.623**	0.259**	0.566**	0.322**	0.402**	0.195*	1				
Pre-Individual Resilience	0.067	0.180*	0.216*	0.202*	0.228**	0.050	0.208**	1			
Pre-Trait Anxiety	0.092	0.084	0.171*	0.145	0.110	0.019	0.131	0.583**	1		
Post-Affective Well-being	0.168*	0.393*	0.205*	0.423**	0.062	0.096	0.155	0.234**	0.191*	1	
Post-Team TMS	0.327**	0.648**	0.273**	0.572**	0.160	0.119	0.200*	0.240**	0.039	0.444**	1

*Correlation is significant at the 0.05 level (2-tailed).
**Correlation is significant at the 0.01 level (2-tailed).