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I-O, meet Scrum: Agile engineering process for teams and change management

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ABSTRACT
Study explores Scrum, a comprehensive team performance process based on Agile engineering principles, through an I/O lens. Study focuses on impact of Scrum implementation on team performance, organizational culture, and change management. Role of I/O in implementing engineering process improvement programs is discussed, as well as need for greater I/O involvement in engineering process management.

PRESS PARAGRAPH
Scrum is a form of Agile engineering process management; one that uses a highly specialized team structure, language, and framework to maximize team performance. Little work, though, has been done on understanding how Scrum relies on fundamental I/O principles, or how implementation of Scrum changes the organization and its culture. This research introduces Scrum to an I/O audience and presents preliminary findings on how engineering processes relate to organizational culture, team performance, and the change management process. Implications for both academic and industry settings are discussed.

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This SIOP submission qualifies for the category of multi-disciplinary content for the following reasons:

I/O implications of Engineering process management; change management and culture in Engineering organizations; the 2nd-5th authors work in an Electrical Engineering & Computer Science department.

The body of literature on team performance and member satisfaction is vast, complex, and seemingly inexhaustible; and yet, organizations continue to struggle with constructing and maintaining high performing teams over time. The research presented here brings together an interdisciplinary group of engineers and I/O psychologists to implement a team-based process management framework designed by engineers for implementation in software engineering activities, with the goal of both improving the performance of those teams as well as aligning the department's culture with its larger system environment.

Team performance scholars have continued to propose any number of solutions to improve the performance of both face-to-face and virtual teams. Research suggests that "process losses" occur when individuals join together in teams, and these losses outweigh gains that occur when utilizing team work (Dennis & Valacich, 1993). Process losses include social loafing/free riding (Diehl & Stroebe, 1987), social conformity pressure/evaluation apprehension, and limited communication skills/abilities. These losses impair teams in both closed and open-ended decision tasks and creative endeavors.

Some scholars (Diaz, Day, & Espejo, 2004; Valacich & Schwenk, 1995) have suggested specialized group roles designed to reduce conformity pressures, naming one member as a "devil's advocate" for group sessions who would critique and question aspects of the group's decisions. Subsequent research has found only limited success for the tactic of assigning a dissenting role, as authentic dissent appears to be of greater value to teams in reducing conformity as compared to assigned dissenters (Nemeth, Connell, Rogers, & Brown, 2001). Another attempted tactic to enhance team performance has been to train team members in brainstorming and group communication processes as a way to minimize process loss (e.g.,

Kramer et al., 2001; Sutton & Hargadon, 1996). These strategies were all methods for reducing two of the major challenges in teams research – the frequency with which teams are outperformed by the best individual member or even by an aggregate of non-collaborating individuals (often termed a 'nominal group'). However, some researchers even went so far so to suggest that utilizing face-to-face groups on brainstorming-type tasks should be discontinued altogether (Diehl & Stroebe, 1991; Mullen, Johnson, & Salas, 1991; Stroebe & Diehl, 1994).

The challenges in maximizing the efficacy and efficiency of team performance in a busy organizational environment, outside of the laboratory setting, has led to the generation of many process-oriented approaches, designed to provide structure to work teams as they approach novel tasks. "Scrum" is one of these process approaches, designed by and for engineers to create a formal, highly structured process that is still also supposed to be nimble and responsive to changes in their workplace demands. Scrum is considered to be a form of "Agile" process management.

There is no single authority on what Agile is, but Agile approaches, along with Design Thinking and Lean processes, focus on the customer or user, utilize collaboration, and display openness to change (Lemay, 2019). Agile practices employing small teams and rapid iteration have been adopted by enterprises in finance, marketing, and human resources (Lemay, 2019), and include wide-ranging business such as the U.S. military (McChrystal, 2015), Coca-Cola and Clorox (Lemay, 2019), and the World Bank (Denning, 2018).

Denning (2018) has proposed three laws of Agile: The Law of the Small Team ("work should, in principle, be done in small, autonomous, cross-functional teams working in short

cycles on relatively small tasks and getting continuous feedback from the ultimate customer or end-user"); the Law of the Customer (the point of the enterprise is to deliver value to the customer or user); and the Law of the Network (the entire enterprise operates as teams of teams with shared commitment to delivering customer value and trusting each team's competence to deliver such. Lemay (2019) similarly frames Agile as starting with customers, employing frequent collaboration, and planning for uncertainty.

Scrum is an Agile approach that manages software development in iterations called sprints (Matharu, et al, 2015). Each sprint involves a product backlog, a sprint backlog, and daily scrum meetings, with a focus on daily progress and process improvement (Ruparelia, 2010). The main idea in Scrum is to regularly deliver working product at the end of each sprint that is of highest value to the customer. At the end of each sprint, in the Sprint Review, the development team and the customer review the product that was generated, and identify any improvements (corrections, modifications, or expansions) that are needed and that can potentially be delivered in the future sprints. After the Sprint Review, the team engages in a Sprint Retrospective, looking to make process improvements, increased the efficiencies, and improved product quality in future sprints.

These process approaches arising from technical disciplines (such as software engineering) mimic or duplicate best practices from the I/O literature, often without their realization. Denning's "Law of the Small Team", for example, is a restatement of the Ringelmann effect (Forsyth, 2014) - that teams become less productive/efficient as their size increases; and his "Law of the Network" is a method of describing systems-based approaches

and the value of organizational alignment in performance efficacy. As such, the current research program is a preliminary attempt to look at Scrum, an engineering process management system, through the lenses of team performance and organizational culture research. The research team was awarded a grant from the National Science Foundation's "Revolutionizing Engineering Departments (RED)" program to implement Scrum in both the academic curriculum (i.e., teach Scrum processes and tools to engineering students) and as a new, comprehensive strategy for managing the functions of the academic unit (i.e., use Scrum processes and tools, and Scrum teams, to handle the day-to-day management and project goals of the department). The researchers have been charged with the implementation process itself, but also with designing and evaluating the change management process throughout the Scrum rollout, the role of perceived culture in the Scrum implementation, and the efficiency and satisfaction with team performance in the department as a result of using the Scrum methodology. The researchers have two foci: one, training students, faculty, and staff in team performance processes; specifically, the Scrum agile methodology; and two, shifting the unit's culture itself using Scrum, such that the unit demonstrates an agile culture in its approach to problem-solving, unit management and planning, and overall function.

Having completed the first year of the five-year research program, we present here preliminary findings on baseline organizational culture in the selected academic unit, unit member observations of performance efficacy and processes, and discuss the change management process in the implementation of Scrum as a comprehensive approach for improving team performance. Planned next steps are also presented for discussion.

Design

Participants in the Scrum implementation's first stage consisted of all full-time faculty members in an Electrical Engineering and Computer Science academic unit at a private U.S. university. In order to capture baseline data on perceived organizational culture in the unit, these participants were asked to complete an electronic version (due to covid-19 restrictions in Spring 2020) of Cameron & Quinn's (2006) Organizational Culture Assessment Instrument (OCAI), which uses a competing values framework to ask the respondent to assign percentage weights to descriptive statements regarding the organization (in this case, focusing only on the academic unit, not the institution as a whole) in 6 different areas. Under each of the 6 areas (dominant characteristics, organizational leadership, management of employees, organization glue, strategic emphases, and criteria of success) there are 4 statements, each of which is indicative of one of four cultural typologies: collaborative or "clan" culture, create or "adhocracy" culture, control or "hierarchy" culture, and compete or "market" culture.

In addition to the OCAI, faculty participated in semi-structured interviews that addressed their perceptions of the departmental culture and operations. The interviews were conducted in a virtual video session, recorded, and transcribed. They were analyzed using open and axial coding techniques. During the open coding phase, interviews were coded to identify themes addressed by the participants. A code book was developed to provide detailed definitions of the themes. All interviews were analyzed by two coders separately. Periodically through the process, the coders compared their analysis. Any discrepancies in their coding were discussed and resolved. During this process, several codes were condensed and revised. The OCAI and interview data were

analyzed separately by different members of the research team in order to reduce bias, with results compared after data analysis was complete.

Preliminary Results & Predicted Findings

With an 81% response rate for the OCAI data, analysis of responses indicated a high degree of alignment between current and preferred (or desired) organizational culture in the department. At an aggregate level, full-time faculty observed and preferred to work in what Cameron & Quinn called a "Clan" culture, defined as one that focuses on internal maintenance and emphasizes flexibility, concern for people, and sensitivity to customers (Fig 1).

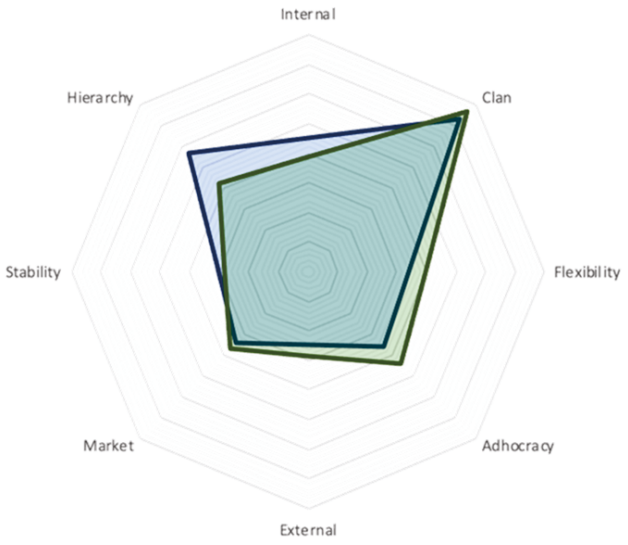

Figure 1: Dept-level culture perceptions (blue indicates perception of current culture, green indicates desired department culture)

The Clan culture was also identified as a theme in the individual participant interviews. Throughout multiple interviews, faculty reported or described the academic department as collegial and friendly. One of the key characteristics of this culture was an openness for everyone to speak their opinion when discussing departmental plans or issues – which aligns with the OCAI description of a concern for people within the organization. Participants indicated that

throughout the decision-making process in the department there was regularly an emphasis on ensuring consensus among the department, and that in the current culture, decisions are made by committee and not just one person.

In looking at individual OCAI responses rather than an aggregate view of the department, a few key patterns and potential challenge areas for the upcoming Scrum implementation were identified – leading the researchers to begin a deeper evaluation of the change management process. A comparatively large minority (37.5%) of respondents identified a current emphasis in the department on a "Hierarchy" or control-focused culture. Hierarchy cultures, like Clan cultures, focus on internal maintenance and considerations rather than external stakeholders. However, in a hierarchical environment, the emphasis is on a need for stability or control over flexibility and concern for people.

The introduction of Scrum as a team process tool in an internally-focused culture is likely to be smoother, given the level of focus within the unit on interpersonal interactions and the maintenance of internal relationships. However, the degree to which individuals identified a distinct hierarchical structure and need for stability and control suggests that the Scrum introduction, and the fundamental changes to the nature of work processes for department members, means there exists a substantial likelihood for a boomerang effect (Lines, 2005) to occur and a resistance to change that may undermine the success of the initiative.

The implementation of engineering team process approaches, conducted by engineers, rarely takes into explicit account the role of culture in the implementation process. This often leads to resistance to change, decreased implementation efficacy, or even the failure of the change process. The inclusion of I/O theory and practice into the Scrum implementation has created new opportunities to improve what is expected to be a comprehensive re-orientation of

the organization under investigation around Scrum process principles. Analysis of additional data collected is currently underway and final results will be available well in advance of presentation at SIOP, and will be these will be included in the conference presentation and subsequent paper made available to attendees.

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