Software That Supports an Agile Process for Organizational Innovation

Angela Mattia, PhD
Assistant Professor of Decision Sciences and Information Management
Davis College of Business, Jacksonville University
Jacksonville FL 32211, USA

Abstract

The vast amount of creativity and innovation literature offers numerous definitions and diverse perspectives on what creativity is and how an organization can be innovative. This research defines the link between creativity, invention and innovation. Next it offers a vision on how an agile process can enhance viable options for innovative success. It is argued that currently there are many software features that can promote a relationship between creativity and innovation, which is necessary to have a positive outcome. Lastly, software features that currently exist in commonly used business applications are mapped to the agile process. The paper presents an agile process for creativity, invention, and innovation, summarizes it in a typology and illustrates its application.

Keywords: software, creativity, innovation, agile process, invention

1. Introduction

The vast amount of creativity literature offers numerous diverse perspectives (Boden, 2004; Couger, 1996; Gardner, 1993) on what creativity is and how to get it. At its simplest form, creativity occurs anytime a person creates something new that has some kind of value. New products, a solution to a problem, a work of art are just a few ways in which creativity can manifest itself. This research looks at creativity in relationship to innovation and investigates how software tools can support both. The goal of the creative process is to create something new and when linked to an outcome of innovation includes a positive orientation towards making something better. Creativity that has an innovative outcome can lead to increased productivity and to increased wealth for a firm(Hessels, van Gelderen, & Thurik, 2008). The purpose of this paper is to discover software tools and to develop an agile process to support the organizational innovation process. This paper can provide insights for researchers and managers as well.

2. Creativity, Invention and Innovation

Many researchers have investigated the creative process. It is well established that it involves numerous phases. The phases are commonly described as first insight, preparation, saturation, incubation, illumination, implementation and verification (Brennan & Dooley, 2005; Cropley, 2006; Rank & Frese, 2008). Illumination is described as the "Ah-Ha!" experience. Saturation or preparation and implementation or verification is easily understood. Saturation or preparation is where you gather information and investigate a topic. The phase of verification or implementation is when you test an idea. Saturation, preparation, implementation and verification require conscious and more manageable actions. The other phases (first insight, incubation, and illumination) are more subconscious and seem somewhat more mysterious. They are unpredictable and less manageable.
Numerous other authors (Farooq, Carroll, & Ganoe, 2005, 2007; Maiden, Gizikis, & Robertson, 2004; Terry & Mynatt, 2002; Warr & O'Neill, 2005) offer research based on a broader range of creativity literature. Farooq, Carroll et al., 2005 present and justify "three requirements for supporting creativity:

- Divergent thinking is the ability to generate a set of possible responses, ideas, options, or alternatives in response to an open ended question, task, or challenge. Convergent thinking involves narrowing this set to one alternative, and then implementing this alternative by empirically testing and communicating it to the related community.
- Shared objectives imply a group vision of the goals of its work that members wish to achieve.

- Reflexivity is the extent to which members collectively reflect on the group's objectives, strategies, and processes as well as their wider organizations and environments, and adapt them accordingly".

Three perspectives on what creativity is and how to get it are identified by Ben Shneiderman (2002). His work concentrates on mega-creativity, which is a term that describes the idea that software tools could benefit millions of people. It is a useful strategy whether you use software are not. The perspectives are described as inspirationalism, structuralism, and situationalism and offer us a frame of reference to for understanding how this study will view creativity.

3. Software Support for Creativity

"The large amount of literature on creativity, discovery, design, innovation, and composition may be sorted into three intersecting schools" (Ben Shneiderman, 2007) The schools have the same definition as Shneiderman (2002), but the examples of the creativity tools have been updated and the focus shifts to important lessons being offered to designers of creativity support tools. For example, structuralist thinking encourages systematic tools (same) that include progress indicators with reminders of what is still needed (new). The inspirationalist view supports development of image libraries, thesauri, sketching interfaces (new), and concept-mapping tools. Situationalists broaden the designer's view to include email and collaboration tools, as well as the e-science notebooks that guide users and coordinate groups through scientific processes over weeks, months, and years (new).

The mega-creativity framework is used in Shneiderman (2002) to facilitate creative work by building on four activities and eight tasks that are presented. Shneiderman (2007) shifts its focus to changing mindsets and developing design guidelines (principles) and appropriate research methods. More recent works by Shneiderman emphasize the need to study the creative process (Ben Shneiderman, 2007; B. Shneiderman, Gerhard Fischer, Mary Czerwinski, Mitch Resnick, & Myers, 2006) Shniederman (2002) defines three levels of creativity. First, everyday creativity is impromptu or personal. Second, revolutionary creativity is the great breakthroughs and paradigm shifting innovations. Third, evolutionary creativity are contributions that refine and apply existing paradigms or methods of research. Shniederman (2002) does not concentrate on revolutionary or impromptu creativity, but it does concentrate on evolutionary creativity and how to develop the software support tools according to the three perspectives identified in this paper - inspirationalism, structuralism, and situationalism. This research will build on this concept.

4. A framework for mega-creativity

After several years of exploration, the genex framework (Carroll, 2002; B. Shneiderman, 2000; Ben Shneiderman, 2002b) evolved into the framework for mega-creativity which has four activities:

- Collect: Learn from previous works stored in libraries, the Web, and other sources.
- Relate: Consult with peers and mentors at early, middle, and late stages.
- Create: Explore, compose, and evaluate possible solutions.
- Donate: Disseminate the results and contribute to libraries, the Web, and other sources.

It builds primarily on the situationalists' perspective by using the potential offered by the World-Wide Web. The mega-creativity frameworks goal is to suggest improvements for web-based services, personal computer software tools and calls for integrating creativity support tools. Improvements include reducing the distraction caused by poorly-designed user interfaces, users' attention can be devoted to the task. Some creativity tools already exist, but could be enhanced to ensure smooth integration across novel tools or word processors, presentation graphics, email, databases, spreadsheets, and web browsers. In an effective design, available functions would be in agreement with problem-solving strategies, leaving the users to concentrate on creativity (Ben Shneiderman, 2002a). The three perspectives (inspirationalism, structuralism, and situationalism) each generate useful suggestions for tasks. The eight tasks below are primarily related to the four activities, but these tasks could take place during any phase.

The eight tasks described below are supported by integrated creativity support tools.

(1) Searching and browsing digital libraries, the Web, and other resources
(2) Visualizing data and processes to understand and discover relationships

(3) Consulting with peers and mentors for intellectual and emotional support
(4) Thinking by free associations to make new combinations of ideas
(5) Exploring solutions—What-if tools and simulation models
(6) Composing artifacts and performances step-by-step
(7) Reviewing and replaying session histories to support reflection
(8) Disseminating results to gain recognition and add to the searchable resources

5. Conceptual Synthesis

Research frameworks are attempts to capture and explain the complex, interdependent, and dynamic factors and processes that exist in our world. Mackenzie (2000) presents a process approach for the organization sciences that views organizational behavior as fundamentally a physical process, thus it is a sustained phenomenon or one marked by gradual changes through a series of states. This supports Shneiderman (2007) conclusion that creativity is a process. It is important to note that variables are often a form of the outcomes (results) that come from a process and are inherently causal (Mackenzie, 2000). This research proposes that innovation can be the outcome of the creative process(Mattia, 2011, 2012; Ben Shneiderman, 2007). Interestingly enough, factor research models are the most commonly used models in creativity research (Ben Shneiderman, 2007), and although they are useful to researchers, a gap exists in the study of the actual processes that produce the factors.

"The emphasis on close study of domain experts as they make discoveries has led many researchers to adopt case study, observational, and interview methods with small numbers of users over weeks and months. Their goal is to capture the processes that precede breakthrough incidents and to collect evidence that supports hypotheses about how software design features promote creative moments." (Ben Shneiderman, 2007) In business, creativity is not enough. It must be actionable. Inventions are the manifestation of creative actions. It is something new. Innovation differs from invention in that innovation refers to doing and/or using something in a new way. It is directly related to organizational change. In business and economics, innovation is the catalyst to growth and therefore very important to the survival of the organization (Figure 1).

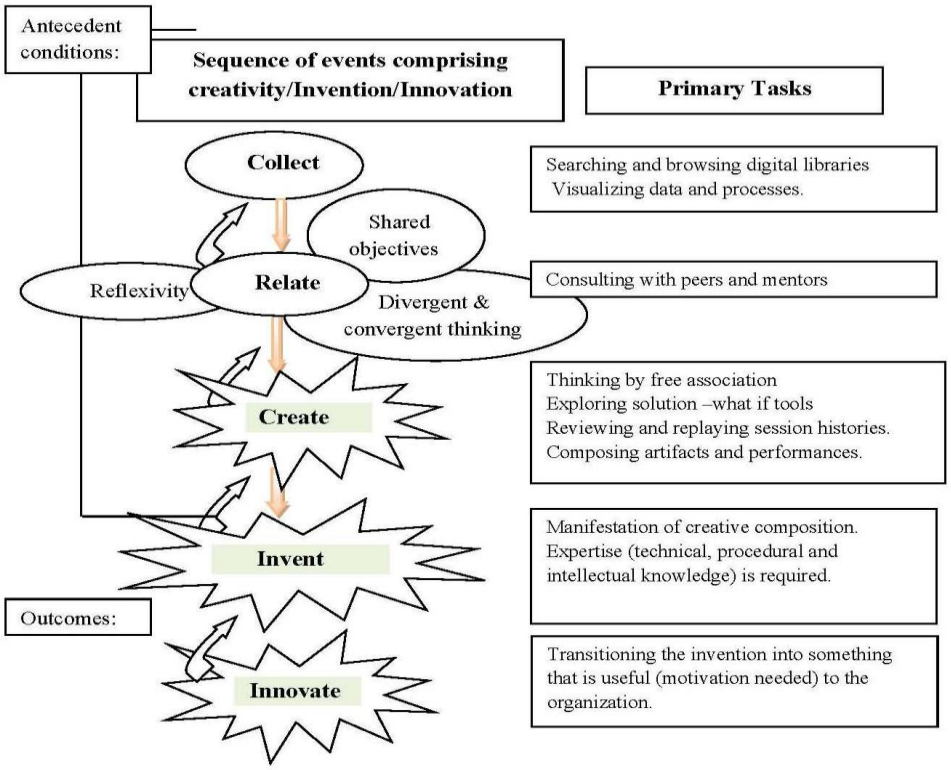

Figure 1. A Visual Synthesis of the Creativity/Innovation Process adapted from (Mattia, 2012; Ben Shneiderman, 2007)

Proposition 1a. Organizations will be most effective at promoting creativity if they treat it as a process that evolves as gradual changes through a series of actionable states.
Proposition 1b. Organizations will be most effective at innovation if they treat it as an outcome that developed because something was used and/or done in a new way.
Proposition 1c. Organizations will be most effective at innovation if they treat it as an outcome to the creative process.

6. *Conceptual Implications: An Agile Process for Innovation*

After several years of exploration, the genex framework (Carroll, 2002; B. Shneiderman, 2000; Ben Shneiderman, 2002b) evolved into the framework for mega-creativity and upon further research this study adapts the framework into the Agile Process for Creativity and Innovation which has five main activities:

- Initialization: Construct a base version of the idea, problem and/or system.
- Collect: Learn from previous and associated works on the topics stored in libraries, the Web, and other sources.
- Relate: Consult with peers and mentors at early, middle, and late stages.
- Create: Explore, compose, and evaluate possible options.
- Invent: construct creative output into viable option.
- Innovate: implements viable options successfully in practice.

It builds primarily on the mega-creativity framework by extending it with an innovative perspective and includes initialization as the first activity and innovation as the last activity which is defined as an implementation of a process that users work through for themselves successfully. It requires motivation on the organizations part. Software tools and how they are to be used are worked through by the users (Tornatzky & Fleischer, 1992). This is important because in a business environment we must manage the processes and ensure that they result in useful outcomes. Indeed, management includes the act of getting people and ideas together to accomplish desired goals and objectives using available resources efficiently and effectively. The problem has been that creativity and innovation activities have not been conducive to efficiencies and effectiveness in the short term.

To address the problem, the basic idea is to identify an agile process that through repeated cycles (iterative) and in smaller portions at a time (incremental) (Figure 2), allows managers to take better advantage of a variety of software tool features that promote creative and innovative efforts. The repeated cycles (iterative) and in smaller portions at a time (incremental) would be conducive to efficiencies and effectiveness because of its incremental nature, while promoting creativity and innovation short term (1 iteration) or long term over many iterations.

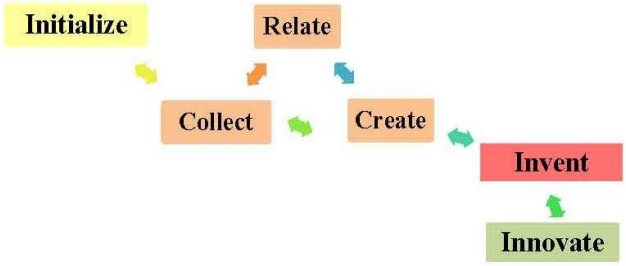

Figure 2. The Agile Process for Organizational Innovation

We can capitalize on the interdependency of current and past software tools to gain some efficiencies and effectiveness, while promoting software tools that enhance creativity and innovation. For example, we can continue to use the tools of the 1990s (word processor, spreadsheet, presentation, email), while promoting the use of software tools that incorporate collaboration, reuse, living documents features as well as quicker authoring cycles (Table 1). The strategic promotion by managers of software packages and the specific design features that promote creative moments can make the difference in an organizations ability to innovate. Therefore, agility is the key to addressing the interdependency of current and past software tools while promoting creativity and innovation in organizations.

Proposition 2a. Organizations will be most agile if they capitalize on the interdependency of current and past software tools to support creativity, invention and innovation.
Proposition 2b. Organizations will be most effective at using the agile process of creativity, invention and innovation if they promote new software tools and/or features that offer support.

Table 1. Software Tools That Support the Agile Process for Organizational Creativity, Invention and Innovation

ACTIVITIES			TASKS	EXAMPLE OF SOFTWARE SUPORT TOOLS
INITIALIZATION		Construct a base version of the idea, problem and/or system.	**Identifying** and defining vision, goals and objectives at a high level	Office suites (e.g., Microsoft Word, Excel, PowerPoint, Access)
Iteration Activities	COLLECT	Learn from previous and associated works on the topics stored in libraries, the Web, and other sources.	**Searching** and browsing digital libraries, the Web, and other resources. **Visualizing** data and processes to understand and discover relationships	Web Portals, web databases, XML Syndication (RSS and Atom), Visio, Records management, Search engines.
	RELATE	Consult with peers and mentors at early, middle, and late stages.	**Consulting** with peers and mentors for intellectual and emotional support.	Collaborative applications and workspaces, E-mail and calendaring, Instant messaging (IM), Web conferencing, Social software.
	CREATE	Explore, compose, and evaluate possible solutions.	**Thinking** by free associations to make new combinations of ideas **Exploring** solutions—What-if tools and simulation models **Composing** artifacts and performances step-by-step **Reviewing** and replaying session histories to support reflection	Office suites, Blogs, Collaboration super platforms (e.g., IBM Lotus Notes / Domino, Microsoft SharePoint), Content analytics, Content management, Document management, Wikis)
INVENT (PRODUCT/ PROCESS)		Manifestation of creative composition.	**Constructing** creative output into viable option.	Software expertise (technical, procedural and intellectual knowledge) is required that is project specific.
INNOVATE (PRODUCT/ PROCESS)		Implements change successfully in practice.	**Transitioning** the invention into something that is useful (motivation needed) to the organization.	Any software support tool used in the previous activities (as needed), Microsoft Project can help manage change.

7. Discussion and Conclusion

The mega-creativity frameworks goal is to suggest improvements for web-based services, personal computer software tools and calls for integrating creativity support tools. Improvements include reducing the distraction caused by poorly-designed user interfaces, users' attention can be devoted to the task. Some creativity tools already exist, but could be enhanced to ensure smooth integration across novel tools or word processors, presentation graphics, email, databases, spreadsheets, and web browsers. In an effective design, available functions would be in agreement with problem-solving strategies, leaving the users to concentrate on creativity (Ben Shneiderman, 2002a). The Agile Process for Organizational Innovation is an extension of this research.
The agile process offers great potential for managers to iteratively enhance the evolving creativity of the organization. At each iteration: learning, consulting exploring, composing, evaluating possible solutions are made, and new insights are added until a successful innovation is implemented. This is becoming a necessity as managers face an evolutionary shift in how we interact with software and each other. Old concepts such as collaborative editing are changing as web 2.0 continues to evolve and take hold in organizations.

This research capitalizes on these changes and gives managers a process that can strategically take advantage of workers who are learning to think in rapidly produced, hyperlinked, searchable content chunks instead of ponderous, static, e-mailed documents. Creativity and innovation should not be caught in the paradigm of the software support tools of the 1990s (word processor, spreadsheet, presentation, email), when there is a need for collaboration, reuse, living documents, and quicker authoring cycles in the twenty-first century. The promotion of creativity can be enhanced by allowing time and assigning the task each week for investigating a software tool.

A repository of tools would have templates, wizards and creative examples. Allow an add-on product that focuses on creativity, inventions and innovation. In summary, creativity is a process that has long been seen as a mysterious (Boden, 2004; B. Shneiderman, 2000) Indeed, creative ideas are unpredictable and sometimes they even seem to be impossible. Yet they happen and are important to individuals and organizations. Shneiderman (2007) offers a slight shift in focus and terminology, when compared to Shneiderman (2002), but the goal still remains the same; to enable more people to be more creative more often. Three propositions were deduced from the literature and developed into an agile process that can strategically promote creativity and innovation. The research design is sound and therefore the prospects that it could actually be implemented are very good. Future research should follow Shneiderman (2007) and take into consideration the opportunity to enrich the research on creativity and innovation with methods that include process research, case studies, and interviews with small numbers of users over weeks and months. As a researcher, my goal (as I move forward) is "…. to capture the processes that precede breakthrough incidents and to collect evidence that supports hypotheses about how software support tools can used to strategically promote creativity and innovation.

8. References

Boden, M. A. (2004). *The creative mind : myths and mechanisms* (2nd ed.). London ; New York: Routledge.

Brennan, A., & Dooley, L. (2005). Networked creativity: a structured management framework for stimulating innovation. *Technovation, 25*(12), 1388-1399.

Carroll, J. M. (2002). *Human-computer interaction in the new millennium*. New York; Boston ; London: ACM Press ; Addison-Wesley.

Couger, J. D. (1996). *Creativity & innovation in information systems organizations*. Danvers: Boyd & Fraser.

Cropley, D. H. (2006). *The role of creativity as a driver of innovation.* Paper presented at the IEEE International Conference on Management of Innovation and Technology.

Farooq, U., Carroll, J. M., & Ganoe, C. H. (2005). *Supporting creativity in distributed scientific communities* Paper presented at the Proceedings of the 2005 international ACM SIGGROUP conference on Supporting group work Sanibel Island, Florida, USA.

Farooq, U., Carroll, J. M., & Ganoe, C. H. (2007). *Supporting creativity with awareness in distributed collaboration*. Paper presented at the Proceedings of the 2007 international ACM conference on Supporting group work, Sanibel Island, Florida, USA.

Gardner, H. (1993). *Creating minds : an anatomy of creativity seen through the lives of Freud, Einstein, Picasso, Stravinsky, Eliot, Graham, and Gandhi*. New York: BasicBooks.

Hessels, J., van Gelderen, M., & Thurik, R. (2008). Drivers of entrepreneurial aspirations at the country level: the role of start-up motivations and social security. *International Entrepreneurship and Management Journal, 4*(4), 401-417.

Mackenzie, K. D. (2000). Processes and Their Frameworks. *Management Science, 46*(1), 110-125.

Maiden, N., Gizikis, A., & Robertson, S. (2004). Provoking creativity: imagine what your requirements could be like. *Software, IEEE, 21*(5), 68-75.

Mattia, A. (2011). *The Strategic Use of Software to Promote Creativity and Innovation in Organizations.* Paper presented at the Southern Management Association Savannah, Georgia.

Mattia, A. (2012). Linking the Creative Process to Innovation Through Software Enabled Activities. *International Journal of Management & Information Systems, 17*(1).

Rank, J., & Frese, M. (2008). The impact of emotions, moods, and other affect-related variables on creativity, innovation and initiative in organizations. *Research Companion to Emotion in Organizations,(New Horizons in Management Series)*.

Shneiderman, B. (2000). *Supporting creativity with powerful composition tools for artifacts and performances.* Paper presented at the System Sciences, 2000. Proceedings of the 33rd Annual Hawaii International Conference on.

Shneiderman, B. (2002a). Creativity support tools. *Commun. ACM, 45*(10), 116-120. doi: http://doi.acm.org.proxy.library.vcu.edu/10.1145/570907.570945

Shneiderman, B. (2002b). *Leonardo's laptop : human needs and the new computing technologies*. Cambridge, Mass. ; London: MIT Press.

Shneiderman, B. (2007). Creativity support tools: accelerating discovery and innovation. *Commun. ACM, 50*(12), 20-32. doi: http://doi.acm.org.proxy.library.vcu.edu/10.1145/1323688.1323689

Shneiderman, B., Gerhard Fischer, Mary Czerwinski, Mitch Resnick, & Myers, B. (2006). Creativity support tools: Report from a U.S. National Science Foundation sponsored workshop *International Journal of Human--Computer Interaction, 20*(2), 61-77.

Terry, M., & Mynatt, E. D. (2002). *Recognizing creative needs in user interface design*. Paper presented at the Proceedings of the 4th conference on Creativity \& cognition, Loughborough, UK

Tornatzky, L., & Fleischer, M. (1992). *The process of technological innovation*: Lexington.

Warr, A., & O'Neill, E. (2005). *Understanding design as a social creative process* Paper presented at the Proceedings of the 5th conference on Creativity & cognition, London, United Kingdom.