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Innovating by Combining: A Process Model

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Abstract

Innovation studies receive more and more attention recently. Recombining previous workable solutions to generate new solutions is considered to be a generally useful strategy to innovate. However, there are few studies aiming at developing operational process model for innovating by combining except for the model proposed by Majchrzak, et al. Majchrzak, et al used grounded theory to build a model of knowledge reuse process for innovation. But this model is not operational enough for industry people to use. We extend this model by (1) providing a theoretical foundation for it, (2) providing two search criteria, surface similarity and structural similarity for the scan step, and (3) providing a tool called insight matrix for the in-depth analysis step.

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1. Introduction

Innovation studies receive more and more attention recently (Sheu and Lee, 2011, Duggan, 2013), especially in China. China's State Council has issued an opinion to further boost mass entrepreneurship and innovation, and has unveiled a ten-year national plan, Made in China 2025, which is designed to transform China from a manufacturing giant to a world manufacturing power. Made in China 2025 and Germany's Industry 4.0 are largely similar. Industry 4.0 focuses on the development smart factories. To say they are smart, it means that those factories fully-automatically produce fully customizable products. Industry 4.0 is currently more of a vision than a reality, but it is one with potentially far reaching consequences; and the concept continues to evolve as people think of innovative ways to implement it. All of those phenomena suggest that we are undergoing a fourth industrial revolution. Innovative integration of cyber and physical systems becomes the most difficult problem to solve.

One stream of innovation studies focuses on how to recombine previous workable solutions to generate new solutions (Favaro, 2014). Those studies have investigated many questions such as (Petruzzelli and Savino, 2014, Savino, et al., 2015), does the recombination of old components positively influence the creation of successful innovations?, what are the mechanisms underlying the successful recombination of old components?, what are the main characteristics of old components that contribute to enhancing innovations' success?, how to provide access to a variety of knowledge elements?, etc. However, there are few

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studies aiming at developing operational process model for innovating by combining, except for (Majchrzak, et al., 2004). Majchrzak, et al used grounded theory to build a model of knowledge reuse process for innovation.

However, this model is not operational enough for industry people to use. First, one important step of that model is called *scan*. It means searching for existant solutions for a problem. This model only provides broad guidelines that hard to follow. Second, another important step of that model is called *analyze in depth*. It means how to recombine the searched solutions to solve a given problem. But this model gives no clue to do that job. Finally, there is no solid theoretical foundation for that model. So our objective is to extend the model proposed by Majchrzak, et al. First, we provide a theoretical foundation for it. Second, we extend the *scan* step by providing two search criteria, surface similarity and structural similarity. Finally, we extend the *analyze in depth* step by providing a tool called insight matrix developed by (Duggan, 2013).

The contribution of this research lies in that we provide a more operational process model for innovating by combining. The rest of the paper is arranged as follows. We first provide a theoretical foundation for innovation by combining, then develop a more operational process model, and finally give a summary of this paper.

2. Theoretical Foundation

Knowing the nature of innovation, although not necessarily, can facilitate innovation. According to James Webb Yong (2003, pp. 15-16), “an idea is nothing more or less than a new combination of old elements”, and “the capacity to bring old elements into new combinations depends largely on the ability to see relationships.” There are no such things called original ideas which are generated from nothing. Every new idea must grow out of some other ideas. Following this line of thinking, Murray (2009) proposed a six-step model to solve problems, and Duggan (2013) designed a three-stage model to generate innovative ideas.

Duggan’s three-stage model includes the rapid appraisal stage, the "what-works" scan stage and creative combination stage. Rapid appraisal is about breaking the problem into "chunks" or more discrete elements, often known as decomposition. This simply makes a larger problem an association of smaller problems or challenges. The what-works scan entails looking across industries, geography and time to see if anyone, anywhere has created a solution to any of the smaller "chunks". If so, can we adopt or modify the solution elsewhere to the problem at hand? The third step, creative combinations, asks us to look for creative solutions across what Duggan calls the Insight Matrix.

Many other creative problem solving methods, such as TRIZ, share the same principle. TRIZ is based on the principle: somebody, sometime, somewhere has already solved your problem or one similar to it; innovation means finding that solution and adapting it to the current problem.

3. Process Model for Innovating

Based on the theoretical foundation laid by James Webb Young and Duggan, and the process model proposed by (Majchrzak, et al., 2004), we develop a process model for innovation by combining as shown in Figure 1. This process model includes three steps: problem (re)formulation, search and evaluate (which inclues three sub-steps: scan, briefly evaluate, and analyze in depth), and fully develop. Each step will be elaborated in the following paragraphs.

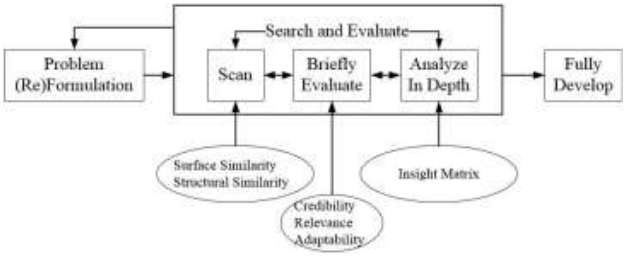

Fig. 1. Process model for innovating (Adapted from Majchrzak, et al., 2004)

3.1. Problem formulation

Einstein and Infeld (1966, p. 92) argued that “the formulation of a problem is often more important than its solution, which may be merely a matter of mathematical or experimental skill. To raise new questions, new possibilities, to regard old problems from a new angle, require imagination and marks real advance in science.” This is really true for innovation. However, there is no mechanic process that ensure our best problem formulation, and it needs many iterations to formulate a good problem. Duggan recommends a documented problem statement, which makes good sense, and keeping the statement in a draft form, since as you work through the exploration process you may discover information that will lead you to change the initial problem statement. According to De Bono, “the best definition of a problem can only be reached by finding the solution and then working backwards to the definition” (De Bono, 2004, p. 32). Problem formulation is not the focus of this research. So we have to leave