

# Normalized Literature Analysis with the Theory of Innovation Ability Training

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**Abstract:** With the rapid development of the global science and technology and advent of an new era, human slowly step into the era of knowledge economy dominated by knowledge and the production, circulation and consumption of its products. The advent of knowledge-based economy proposes a new requirement for the innovation ability of human. The article presents a normalized comparison and analysis into the theoretical literature about innovation ability training. A large number of achievements have been made in theoretical trend, research method, system construction and subject status of the innovation ability study. In summary, the current research results have been ambiguous in thinking model and transformation to form innovation ability. It is widely believed in the study on innovation ability that it is an organic bond of both intelligence factor and nonintellectual factor.

## 1. Introduction

“Innovation ability” is also called creativity. Alois Schumpeter first proposed in 1912 the basic concept of innovation theory. J. P. Guilford proposed in 1950 the concepts of “narrow sense of innovation ability” and “generalized innovation ability”, who defined it as the competent and external behavior that values the individual thought. He believed narrow sense of innovation ability means the one to form creation, while generalized innovation ability is the creative personality. J. P. Guilford pointed out that innovation ability is not an unitary capability, which instead is a relatively comprehensive capacity jointly made up of different abilities.

## 2. Four dimensions of innovation ability study

Though there are a variety of cognition and viewpoints for innovation ability study, the relatively acceptable research structure by people include the following aspects: creative individual, creative process, creative product and creative environment.

### 2.1 Creative individual

Creative individual means a personal ability a man possesses which can facilitate the formation of innovation ability and can help complete product innovation. The paper mainly involves the personality trait those with excellent innovation ability possess. With regard to the study on innovative personality, there are two famous scholars internationally, Guilford and Sternberg. In 1981, Barron and Harrington summarized the personality characteristics, who both believed it should include the following features: have aesthetic abilities and broad hobbies and interests; like digging into complex problems; be energetic; can judge things by oneself; have autonomy, self-confidence and self-awareness, as well as the ability to handle or adapt to obviously antagonism or mutual conflict in self-concept; and insist on one's innovation ability.

### 2.2 Creative process

Creative process means the process to form innovation ability. The current study focuses mainly on the aspect of cognitive psychology. The study is the one based on information processing and cognitive pattern of psychology. Herman Helmholtz, the famous Germany physiologist, proposed in 1896 three-stage theory based on creative study. Its first stage, accumulation stage, is the one investigation of the problems; the second stage, the incubation stage, is the one of thinking and

research into the problems; the third stage, enlightenment stage, is the one to suddenly find a solution.

Afterwards, Henry Bornkelly, a France Mathematician, formed “four-stage theory” based on three-stage theory. The French Adama verified in detail for this theory.

In 1960s, Jacobs Goros proposed to add one more stage prior to the accumulation stage of three-stage theory by Hermenhertz: the one to discover or make explicit the problems. Goros believed that innovation ability is more than solving the existing or constantly occurring problems in people’s life during its formation process. Actively and effectively seek for and find the problems others do not perceive and solve them are an important constituent part for innovation ability.

### **2.3 Creative product**

Creative product means achievements produced during the creative process. “originality” and “appropriateness” are the general connotation in the study on innovation ability products. Amabile believed that most of the experts and scholars accept the concept proposed by Stein in 1953, namely, innovation ability can produce a brand new consequence, which makes people more satisfied. The definition emphasizes “originality” and “practicability” of the products.

### **2.4 Creative environment or place**

Creative environment or place means the factors to affect innovation ability, namely, a variety of environment factors, the ones to produce pressure or demand and to stimulate such ability.

## **3. Theoretical development of innovation ability study**

The western study on innovation ability can date back to as early as Plato of ancient Greek. With years of development, study on innovation ability has successfully realized the conversion from one-dimensional theory to multi-dimensional theory, whose evolution process changes with the era development. In earlier stage, study on innovation ability by the experts and scholars mainly focused on six aspects, namely, mysticism, pragmatism, psychological dynamics, psychological measurement, cognitivism and social personality.

In recent years, people are inclined to researching innovation ability from system view. Creativity system view points out that innovation ability come into being by the combined action of different factors. Specifically, these factors include: knowledge composition background for an individual; style to perceive things and solve problems; traits of personality and character; motivation to solve the problems; life background, cultural background and even the overall background of the whole society of an individual.

The development of western study on innovation ability is divided into “initial stage, development phase, in-depth and popularity stage”. Professor Gan Ziheng divided the development of overseas creative study into three stages, that is, ancient times, modern times and contemporary era. The ancient times stage means Demokritos in around fifth century BC to the first half of 15<sup>th</sup> century. Its outstanding representatives are Aristotle, Quintus Horatius Flaccus and others, who made explicit the concept of imagination and creative ability. Modern times stage means from the latter half of 15<sup>th</sup> century to the early half period of 19<sup>th</sup> century. The stage mainly expounds the artistic creation by Vinci.

Since the modern times, study on creation is mainly based on two ways. One believed that creation is a noema course, and the other thought it is based on a special ability.

## **4. Influence factors of innovation ability**

Study on innovation ability derived from 1950s in the United States. Scholar Guilford published in 1950 the famous speech about “innovation ability”, drawing the curtain of its study. He proposed in 1959 the three-dimensional structure. The model is the main approach to study the intelligence at that time, which believes intelligence is the three-dimensional space made up of the interaction of operation, content and result.

“Multi-factor theory” of innovation ability thinks intelligence factor is not the only factor to make up the factors for innovation ability, which instead is composed of by knowledge reserve, experience factor and personality factors of an individual. These factors include knowledge, experience factors; intelligence factor; nonintellectual factor. Feldnhusen proposed the following viewpoint when studying innovation ability based on multi-factor. He believed that innovation ability study can be carried out from perspective of perceptual ability, creativity and reflective ability. Tian Youyi thought that innovation ability is not a simple overlay of the above-mentioned three capacities, which instead is comprehensive ability in combination of personal quality.

## **5. Three sides of innovation ability**

Amabile proposed “three-component model” when he studied innovation ability in 1983. It is believed in the model that the formation of innovation ability is inseparable from job motivation specific field of people and the skill levels they possess. Tian Youyi (2006) thought in his model that relevant skills of innovation ability can be summarized as the following aspects. 1. Cognitive style: people break the natural thinking mode when finding and solving the problems. In other words, they have the ability to break the thinking set. 2. People develop and develop new knowledge structure, mode or ideas, as well as new approaches to solving the problems. 3. Working mode. For example, if people can focus their attention in work, if they can lie over the minor problems or contradiction, and if they can maintain vigorous passion for work.

Gruber and other believed if integrating human’s emotion with knowledge reserve and motivation, then development system model for innovation ability will be created. Sternberg put forward side model of innovation ability created in combination of personality, intelligence and style that made up of an individual. It was Csikszentmihalyi who raised the system model of innovation ability where an individual, domain and scope interact with each other.

Feldman, the typical character for the system theory of development view, thought the interaction between a man and circumstances is indispensable for having high level innovation ability. On this basis, he proposed three-component innovation ability model. Tian Youyi, Sternberg and others discovered the close relations between the formation and development of innovation ability and six resources based on long-term study. Specifically, the six resources are: intelligence factor; knowledge and experience; thinking style; personality trait; behavioral motive and environment stimulus. Of them, the resource that can best manifest innovation ability is intelligence factor, including comprehensive ability, analysis ability and practice ability.

It is believed in innovation ability composing model that such ability is made up of three key components: professional knowledge skills, creative thinking skills and intrinsic task motivation. Amabile thought that the decisive effect of intrinsic motivation is better than that of extrinsic motivation and that innovation ability level depend mainly upon the intrinsic motivation of an individual.

## **6. Measurement of innovation ability**

Measurement of innovation ability is one of the capacity measurements. The distinct differences between measurement of innovation ability and intelligence measurement are: the former stresses measuring the unknown, novelty and unique answers and the approaches to solving the problems; the latter underlines the unique and definable answers and approach to solving the problems. The development of measurement of innovation ability changes with the changing understanding of people in innovation ability and research thought. Before 1950s, innovation ability was perceived as the capacity only for the talents, and the concern about the outstanding innovation ability of the creative talents. Because outstanding innovation ability could be recognized out of its unique creative output or achievements, there was no concern about its assessment. After 1950s, innovation ability was regarded as psychological trait owned by everyone that can be developed and measured. People turned their attention to the innovation ability of an average person. Thus the researchers developed a large number of tools to measure and assess the innovation ability.

## 7. Conclusions

Creative thinking ability is the cornerstone of innovation ability, the main component for creation. Creative thinking usually undergoes preparation period, creation stage, illuminational stage and verification stage. The effect of sensibility and insight is to find the problems. Efficient memory is an important ability for knowledge accumulation during creation stage. Fluency, originality and flexibility of thought is the guarantee for the efficient functioning of all components of innovation ability. Originality and insight is the weapon to break the intrinsic thought and viewpoint. Ability of expression is to express the achievement of the innovation ability, the most important step to create effective productivity. These components interrelate, interact and intercoordinate with each other to made up of the complete structure of innovation ability.

With an in-depth study on innovation ability, people gradually realize such ability will come into play with interaction with favorable environment besides the internal condition such as intelligence factor, motivational factor and personality factor. A proper environment is indispensable to cultivate the personality trait, motivation and creative skills relevant to innovation ability.

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