Systematic Innovation, its application and the potential role of the SISIG in democratising innovation

Farhad Fassihi, GEP TEC Ltd. & Chair, SISIG, IEEE UK&I

Introduction

Innovation has been practiced throughout the human history and the progress and achievements enjoyed today is primarily due to innovation and efforts of those with visions for a better future and their dedication to turn visions into reality. Innovation is a human trait influenced by personal characteristics and attributes. Preoccupation with innovation is not new and dates back to early parts of the 20th century. Every aspect of innovation has been the subject of investigation in pursuit of its better understanding and its route causes. This includes its prerequisites, innovators' attributes, attitudes and approach to socio-economic conditions that give rise to its emergence. Innovation is the only concept that has been utilised in every aspect of our lives and in every field of human endeavour, ranging from science, engineering, business, technology to sport and arts, providing a tool for delivering improvements. Since the contribution of innovation to human knowledge and progress is well understood, it is about time to turn the table by utilising knowledge, wisdom and scientific principles to systematically improve the pursuit of innovation. The objective of this brief discussion is to explore application of collective knowhow to incorporate existing and emerging knowledge to improve quality and frequency and success rate of innovative attempts and to widen the circle of innovation practitioners at every level.

Innovation

Perceptions of innovation and its nature has changed in line with advances in human knowledge and scientific progress. Historically, *Creativity* was associated with all ingenious human activities including innovation. Ancient Greeks and Romans believed that creativity was not from humans but divine intervention, occurring through influences exerted from unknown spiritual sources for mysterious reasons. Humanism and rationalisation of human activities later dislodged the myth and established that creativity is a human trait. Creativity was also considered as "mystical art" and put it in par with *magic* where it could be conducted by a small group whose powers and skills were beyond comprehension by the masses. Such assumptions were also quashed as it became clear that even master magicians rely on rules and explainable principles that although difficult to figure out by the audiences, when exposed by insiders, understood by the average observers, eliminating its mystical gloss. Other strongly held beliefs referred to innovation as "art" and linked it to pure creativity in opposition to those who considered it as "*science"* and the pragmatic application of knowledge, hard facts and logic.
In reality all these claims were based on beliefs consistent with human understandings and attitudes of its time. These contradictions and variations may be explained by the example of "*describing the elephant in a darkened room".* Each observer expressing a specific subject attribute as they come across according to their unique vantage point and experience. In reality, innovation is likely to be the combination of different rational observations from different perspectives of those investigating the phenomenon. What is clear is that innovation is not a product but a complex process. It is formed through application of skills (hard and soft) to achieve extraordinary results. Perhaps the best description of innovation can be presented as:

"an activity where creativity is guided through rational thinking with the objective to add value"

When talking about "value", it is not important "which or whose value" but the fact that there is value and it can be measured against an appropriate benchmark. Furthermore, it is important to keep in mind the link between innovation and enterprise or turning "creativity" and "innovation" into profitable commercial ventures. Although innovation can be theoretically considered independent of enterprise, in practice, it is the enterprise that shapes and determines the anticipated values and is its key driver.

Systematic Innovation (SI)

Research suggests that innovation is often undertaken by individuals possessing unique sets of personal characteristics and attributes. It is the uniqueness of individuals' attributes, characteristics, skills and experiences that makes them and their approach to innovation unique. Historically, the success rate for innovation attempts is fairly low. Some estimates put the success rates for officially recorded attempts at less than 2%. Although this seems to be low, but this is the norm. Systematic Innovation started as a means to rationalise the innovation process to improve success rates and increase its frequency by harnessing innovative powers through a structured approach. Systematic Innovation is not a new concept and numerous attempts has been made to formulate processes that dates back to the early parts of the 20th century. "*Phase-Gate, TRIZ, SCAMPER, and Design-Thinking, SIT"* are some of the most recognisable systematic innovation methodologies. Almost all the above methodologies follow an elaborate path with predetermined principles, rules and supporting tools that are developed for dealing with challenges faced by innovators in achieving their objectives. To better understand SI, it is helpful to review the basics of these propositions to understand the background, progression and the thinking behind SI.

Phase-Gate

Phase-Gate was initially developed during the 1940s to support investment decisions for development of large infrastructure projects; (mechanical and chemical engineering, etc.) This approach was soon recognised as a viable tool for managing large scale complex projects and many leading organisations including NASA adapted and adopted its variations in managing their innovative projects (phased review). Whilst the classical Phase-Gate process consisted of 5 Phases and 4 Gates, variations with up to 8 phases has also been reported. The idea is that developments take place at each step *(phase)* before it is passed through an assessment point *(gate)* prior to moving the process to the next stage. The outcome of the assessment at each gate could be one of the possible outcomes of "*Go, Kill, Wait/Hold, Recycle/Review or Conditional go"*.

TRIZ

TRIZ is the acronym for the Russian expression translating as: "Theory of Inventive Problem Solving". TRIZ is based on the research conducted by G.S. Altshuller and his colleagues since 1946. In the course of this development, millions of patents have been analysed and classified to identify the common themes and underlying approaches for solving different classes of problems. The prime application of TRIZ was in engineering applications but has since been further expanded to deal with non-engineering problems. To use TRIZ, problem solvers should know the 5 TRIZ principles ("*Ideality" or Ideal Final Result; (IFR*), *"Contradiction", "Functionality", "Use of resources" and "Space, Time, Interface")* and consider it when analysing problems. Process starts by defining problems according to one of the generic problem patterns, identify the generic solution, before rendering the generic solution in terms of the specific problem to work out a specific solution.

Design-Thinking

Design Thinking" is a systematic approach with emphasis on clients and their needs and empathy with their problems. Empathy requires feeling the same as the client and understanding of their pains and appreciation of their environment and aspirations. Design thinking process focuses on experimental approach and an iterative process of; *"design, prototype, customer feedback, evaluation, redesign".* Its ideation principles are based on Osborne's idea transformation techniques. The notion of *"don't tell me, show me"* is an integral vision of Design-thinking approach to new product design process. As clients are not homogeneous groups with exact same needs, empathy is not limited to one client group and should cover every possible existing and potential client. Due to the nature of this methodology, it is suited to certain types of innovative projects where prototyping is feasible and can be used for validation and establishment of viability and suitability.

SCAMPER

SCAMPER is built on the original ideas defined by Alex Osborne in 1939, the Brain-storming technique whose objective was "*to tackle problems commando fashion"*. These ideas were further developed to create the initial 10-point approach which was proposed during the 1950s. Bob Eberle further refined the approach and developed the SCAMPER methodology during the 1960s for enhanced ideation for the design of new products. SCAMPER is an acronym made up of 7 words, each describing one of the potential creative steps for systematic generation of new ideas. The SCAMPER process asserts that applying 7 creative steps of: "*Substitute, Combine, Adapt, Modify, Put-to-other-use, Eliminate and Reverse/Re-order"*, when applied to the original idea would create alternative new ideas. SCAMPER has retained some of the key rationales of its predecessors, whilst it has moved away from some of the complexities; recommending a much simpler approach which is easier to follow. SCAMPER can be utilised to guide the creative thinking process more effectively by utilising the 7 creative steps as prompters during brain-storming or mind-mapping sessions.

Systematic Inventive Thinking (SIT)

SIT is a development dating to early 1990s, by two Russian researchers who worked on the TRIZ project after they migrated to Israel. SIT is heavily influenced by TRIZ approach and thinking. SIT focuses on two aspects of creativity; idea generation and problem solving. The foundation of this method is the ideas adopted from TRIZ, articulating that inventive solutions share common patterns, leading to a focus on similarities rather than their differences. SIT seems to have attempted to enhance and simplify TRIZ to make it easier to use and apply. SIT places the *"close world principle"* which existed in TRIZ, at the centre of its focus. SIT is based on 5 core techniques of *Subtraction, Division, Multiplication, Task unification and Attribute dependency*. Once inventor defines the "problem world" they should consider the SIT principles and apply relevant techniques to solve problems.

Innovactive (Active Innovation)

This is a new development inspired by process observations and review of the existing methodologies to offer a new perspective. The foundation of the approach is a foundation and a structured process model based on "systems thinking" principles. A major difference of Innovactive with its predecessors is that whilst it deals with innovation as a process, it considers humans and their impact on the process as a central pillar of the approach. Innovactive is quantitative and covers the entire innovation process rather than the ideation and problem solving. Another significant characteristic of this model is the incorporation of "enterprise" as the key driving factor in the systematic innovation. Its approach is staged with built-in flexibility to cater for the requirement of innovation subjects. Innovactive principles influence innovators' thinking and approach whilst its systematic process guides innovators' approach, with a series of tools and techniques steer them towards success. Techniques utilised as part of Innovactive are established tools and techniques developed by experts from different disciplines. As ideas are at the heart of innovation, uninhibited idea generation has been encouraged, without prejudging them. Mind-mapping and Brainstorming have been chosen with recommendation to utilise the SCAMPER techniques as prompter for the ideation process. Innovative recognise the link between the innovation subject and its nature and expertise & experience of the innovator and recommend a flexible approach to suit. As such, it does not place any restrictions in adopting existing and/or emerging ideation methodologies. It also advocates and actively encourages embracing of the latest developments in technology, especially AI, advanced optimisation techniques and social media.

Recap

As highlighted in this brief review, almost all structured methodologies have common themes. They are:

- Systematic and have been defined, organised and managed accordingly
- Acknowledge the importance and value of scientific approach to problem solving.
- Rationalise a complex process with a set of principles that guides user perspectives and approach
- Recommend appropriate techniques for the successful execution of various tasks as part of any innovation attempt.

There are also differences between the methods which is based on the knowledge, beliefs and attitudes at the time of their development. Even within the obvious differences, they have more similarities that can spotted at first glance. The 40 *TRIZ*, 7 *SCAMPER*, and 5 *SIT* techniques although signify the differences, at the same time point to similarities in approach in the face of differences. Even some of the differences observed are superficial. For example, TRIZ's *Extraction*, SCAMPER's *Elimination* and SIT's *Subtraction* principles point to identical approach in generating new alternative ideas despite the use of alternative terminologies.

IEEE UK&I SISIG, Role and Objectives

What is clear is that today's societies need innovation more than ever before. Raising the innovation capability within today's society is possible if barriers are identified and addressed accordingly. IEEE as a leading professional organisation can play an important role in achieving this objective through SISIG with active promotion of innovation and building capabilities through various means and tracks. Creation of the SISIG is an attempt to focus on this need and provide a vehicle to direct developments and utilise the support of IEEE membership, networks and partners. SISIG objective can be highlighted as:

- ❖ organising regular meetings and publications that reflect SI research conducted by academic and industrial experts and promote further discussion and facilitate development of enhanced SI methodologies.
- ❖ promote interdisciplinary investigation and R&D programmes to further explore SI and consider the potential application and impact of the latest technology developments in its advancement. In particular investigate the potential application of emerging technologies (AI, social media, optimisation, etc.) and their potential impact on systematic innovation approach.
- ❖ encourage utilisation and adoption of SI knowledge and skills by active and potential innovators, through seminars, workshops and CPD programmes, to promote innovation continuity and increasing the potency of innovative efforts.
- ❖ encourage participation in innovation and innovative activities by inspiring the wider public and facilitate its development through coherent and effective educational programmes. Suitable training programmes should be structured and put individuals at the heart of the process and cater for the needs of aspiring innovators from all backgrounds. In line with this ambition, SISIG could participate in developing training programmes and support for teaching of innovation at schools alongside the STEM subjects as part of students' extra-curricular programme.

SISIG can also move to define standards and recommend appropriate processes and practice in conjunction with other competent authorities to help realise more innovative societies.

IEEE SISIG should lead the way and fulfil its global mission and help shape the future of human societies by assisting individuals in thinking more creatively. Creative and innovative individuals build the foundation for more prosperous societies through enhanced innovation and innovation tendencies. Utilising the IEEE networks, influence and members expertise is the ultimate goal of the SISIG in achieving its core objectives. Reliance on the pool of elite innovators would only go to some stage in their aspirations.