Evolution Of Human Problem Solving From Hunter-Gatherers To Modern Day Innovation

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Abstract*— Wise men (Homo Sapiens) have survived countless natural disasters, catastrophic diseases, food shortages and dramatic shifts in climate. They adapted to harsh conditions, excelled at hunting animals and made complex stone tools. They a) discovered fire, gravity and antibiotics, b) invented wheels, photography and print machines and c) built smart devices through rapid innovation. Although certain groups of humans like Neandertals never survived, they showed immense cognitive capacities for solving problems. Such capacities have evolved with us. We inherited methods from our ancestors to help us tackle problems at hand. Cycles of discoveries and inventions occurred during the human history but why are we so concerned with innovation today? This brief paper attempts to identify similarities and differences in methods that we use to solve problems. It also outlines the built-in traits that helped our ancient ancestors to solve their complex problems similar to the way they assist us to innovate rapidly and efficiently in modern ages.

Keywords*— discovery, invention, innovation, problem solving, hunter-gatherers

I. INTRODUCTION

Problem solving skills, creativity and ability to share knowledge have been the indispensable part of human behaviour. These skills not only helped humans to survive extinction but also led them to a series of incredible discoveries and inventions. In recent centuries, the number of life-changing discoveries and inventions was considerably higher compared to the previous eras which was partly due to the rise of consumer culture and the growth in the number of universities and research labs [1]. Discovery, invention and innovation is the noticeable and consistent cycle of knowledge transformation [2].

The first phase of creating knowledge is discovery. A key characteristic of a discovery is originality and novelty, because it is the first articulation of a phenomena, an event or an action that is not previously known, recognised or demonstrated. Genuine discoveries are based on a scientific method which ensures their validity and reliability. They are often well documented and are independently reproducible. Discoveries by nature are malleable and are, therefore, subject to correction, revision and rejection.

Early men, equipped with a probing mind and evolutionary advantages, solved problems through small incremental discoveries. They were capable of adapting and connecting different ideas (e.g. Neandertals varied their tool making operations based on the raw material available to them [3], Mayans Tun calendar shows the systems thinking ability of the Mayans [4]).

The main motive for early humans to observe their surroundings and discover the natural laws in their environment was to gather food and survive. Their discoveries were powered by their creativity, curiosity and imagination. To be able to use such discoveries in a tangible manner, humans invented primary tools and techniques either independently or collectively in their small gatherings. This was illustrated in many groups and tribes such as the indigenous Siberian community [5]. The complexity evident in the discoveries of the early humans reveal the presence of cognitive skills and conceptual capacities. They could evaluate a situation and use different processes to solve problems. They had the capacity for planning strategies, mapping/modelling the territory in both time and space [6] [7].

The modern human, on the other hand, has a very methodical approach to discovery. The discovery is often initiated by defining a set of well-formed hypotheses in a formal setting such as a university, school or a research lab. They are tested and verified rigorously. The results are then documented and published. The findings are subject to immense scrutiny and inspection. Finally, the knowledge is shared with peers. The newly discovered knowledge will form the basis for others to work or advance upon.

The second phase in the cycle of knowledge is an invention which is something that is not previously demonstrated to be possible or practical. A key attribute of invention is feasibility coupled with novelty (i.e. discovery). The invention and discovery do not have to occur at the same time. One or more prior discoveries could be used to form and assess the feasibility of an invention. The inventions are more tangible than discoveries. They may be further refined until they reach some optimum shape/form. Inventions are capable of being mass produced, distributed and supported.

The main motive for early humans to come up with inventions was to extend the capabilities of their body (i.e. to reach places that were unreachable by foot or do things that were impossible to do with bare hands). Their inventions were often not mass produced initially. They also were not concerned with optimising their inventions and were happy to settle for a good enough solution. The early inventions were mainly occurred to solve a specific problem and did not have a significant commercial intent or purpose.

Modern humans, however, invented not only to extend the capabilities of their body but they often went beyond that with a vision to extend their life expectancy and quality. They very much have commercial intent for the invention. They consider mass production, distribution and availability. They would then attempt to further optimise their inventions to reduce cost and improve quality. The evolution of prefrontal lobe in modern human has significantly increased their ability in concept formation, strategy development and working memory [8] all of which are the necessary elements for transforming an idea from discovery to invention.

Innovation is the third and final phase in the cycle of knowledge transformation. Innovation is a process connected to the novelty (discovery) and feasibility (invention) of the prior knowledge. It eliminates the economic and operational constraints of the end user's requirements in the marketplace. An innovative product or service often has something of

value, which is available to the market in a consumable form. It is mandatory that it offers the correct functionality, in the right physical shape at the reasonable price. Chesbrough [9] argues that innovation means invention implemented and taken to market. Joseph Schumpeter, an Austrian economist, defined invention "as an act of intellectual creativity undertaken without any thought given to its possible economic import, while innovation happens when firms figure out how to craft inventions into constructive changes in their business model".

Innovation is a relatively new concept and requires an ample understanding of market and the requirements of the target customers. An innovation usually remains in the market until replaced by another innovation offering greater functionality or better price. Such replacement will have sequentially transformed knowledge from discovery, to invention followed by innovation [10].

II. Modern Day Innovation

Successful innovation has the power to increase earnings and stock price. It can also improve employee and customer satisfaction dramatically. Most importantly, it maintains and increases a company's global competitiveness. These factors will subsequently guarantee the future growth of most business ventures. Innovative companies have an advantage over their competitors with the potential to fuel future growth and attract long term investments [11]. Although a one of innovation may be able to produce profit, it may not be able to satisfy a long-term growth. Therefore, it is important to make sure that the firm's innovation processes are sustainable [12].

Idea generation, problem solving and implementation are the core phases of an innovative process [13]. Analytical or verbal reasoning, attending to feeling in listening to the 'self' and the interaction between conscious and nonconscious reasoning can encourage idea generation and problem solving [14]. Previous studies suggest that it is important to focus on a manageable number of ideas, in areas of importance during an innovation process. It is equally important to deliberate for a moderate length of time on promising ideas [15].

III. Discussion and Conclusion

Innovation and commercial success go hand in hand. Innovation requires a right environment to be nurtured. Giving employers the autonomy and freedom to present their ideas, experiment and fail would promote the innovative mindset. It is important to enable employees to learn and master their craft as having the domain knowledge/expertise can accelerate the process of generating an innovative idea. The employers need to have a sense of purpose and a clear and enduring vision. Feedback loops and proper reward system should be in place for the benefit of the employers.

Innovation is a mindset and covers different disciplines including and but not limited to engineering, science, economics, management, supply-chain, marketing and human resources. It is an alternative way to think about business strategies and implementation. The innovative mindset can start from a small section of the business and then applied on the remaining elements of the business. It is therefore critical to make sure that all of the functions of an organisation have resources and capability to practice innovation.

To simplify the process of innovation, the author proposes the following roadmap which covers not only the transformation of knowledge cycle but also identifies the requirements of a sustainable innovation. The road map may be used by an individual new to the innovation process or a company promoting systemic innovation:

1. Generate idea
2. Research idea (is it feasible?)
3. Research market (is it economical?)
4. Plan (how to penetrate the market?)
5. Implement
6. Test the market and tune the product
7. Receive feedback for future innovation

In this paper, the author attempted to outline the journey that the humans took to be able to rapidly innovate and create value while doing so. Innovation is a necessary element of sustainable success. Democratising innovation is critical as individuals should not shy away from innovating. Providing the right training, autonomy and tools to individuals allow them to exercise an innovative mindset. Students and pupils as well as employers should feel encouraged to generate and implement ideas. In this competitive economy, it seems that innovation will inevitably become a natural process of bringing an idea to market.

IV. Works Cited

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