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Review Article

The World Needs Massive Ubiquitous Environmental Innovation and Entrepreneurship to Remedy Its Predicament

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Abstract

The world suffers from a wide variety of problems, like climate change, ocean acidification, ecological destruction, loss of biodiversity, lack of clean water and air, and an abundance of plastic waste. The aim here is to explore how more innovation and entrepreneurship can be encouraged to focus on a wide array of environmental issues in hopes that it can be more formally embraced as a valid and useful approach to adapting to climate change and improving the condition of the environment. Innovation is defined as the action of creating a new method, idea, product, or service, while entrepreneurship is defined as the activity of setting up a new business that involves financial risks for the hope of profit. Therefore, a coupling of innovation with entrepreneurship leads to an activity of transforming a new idea, product, service or method into a new business that involves financial risks for financial gain. Design Thinking, Lean Startup and storytelling, are modern, human-centered, tools that accelerate innovation and entrepreneurship, lowers the risks, and increases the likelihood of success of each. Professionals in Science, Technology, Engineering and Mathematics (STEM) and Business need to learn these methods and embrace them so that the rate of positive impact can be accelerated across the globe.

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The world, its environments and its inhabitants suffer from a wide variety of problems, like climate change, ocean acidification, ecological destruction, loss of biodiversity, lack of clean water and air, and too much plastic waste (MEA 2005). Many, if not all, of these problems resulted from humanity's complex journey over the last century and a half as it harnessed the power of rich new energy forms with a plethora of co-evolving technical innovations. This growth in energy use coupled to technology evolution fed and satisfied the growing number of consumers and their expanding desire for material wealth. Reigning in the unwelcomed by-products and by-actions of this long-term expansion has been the goal of government of regulation going back at least to the 1970's. While it is unthinkable what the world would look like without having had 50 years of environmental regulation, it is painfully evident that regulations have been inadequate at containing the devastation.

When we realize that human ingenuity is to blame for a large part of the problem, we should wonder how that same ingenuity can be re-directed to solve the many problems. For instance, mechanical engineers can design, construct and operate coal-fired power plants, but they can also do the same for wind turbines. The world's wealth of ingenious human capital should be focused on innovating products, services, methods and ideas that serve to make life and the environment more sustainable. However, to transform ingenious ideas into impactful ones requires that they be put into practice at large scales. This is where entrepreneurship comes in.

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Entrepreneurs work within the capitalist system to "scale" ideas so the summation of small benefits can have a large impact. For example, it is not enough for a material scientist to create a unique material with miraculous properties that the world has never seen. The idea has to be translated into a product that can be manufactured and sold to many, many customers.

Wind and solar power in the energy industrial sector are examples where legal remedies and government financial incentives encouraged innovation and entrepreneurship by lowering the financial risks. The sub-sectors have evolved to the point where they are now the fastest growing energy sub-sectors, representing 12% of electricity production worldwide and 11% in the US (US EIA 2021).

Modern entrepreneurs, to be successful, first clearly identify the value proposition or benefits that a particular product has for a specific customer segment. For instance, startup companies bringing electric vehicles to market tend to find "Product Market Fit" by selling high-end electric SUV's to high-income, environmental braggarts. The entrepreneur then scales this "Fit" by selling to as many consumers in that segment as they can. They also scale by adjusting the value proposition of a product so that it aligns with other customer segments. Making slight modifications to the product to create new value propositions for new segments is also a part of scaling and innovating.

Design Thinking (Razzouk and Shute 2012) [1] is a process that attempts to accelerate innovation by focusing on the needs of the consumer. Practitioners of Design Thinking ask a basic question: "what pains does my potential customer have that I can remedy with a new solution?" It is a human-centered approach to design that begins by identifying the customer's problems, then moving into ideating, prototyping and testing possible solutions. Design Thinking leads to shorter development cycles because it starts with the customer and embraces rapid ideation and testing. That is, it promotes failing fast and often on the

pathway to success. Before there was designing thinking, engineers and designers might work meticulously for months or years on developing a product from new technology for a customer that they did not understand. This older approach often wasted time and resources because the solution was not aligned with a real and common problem.

Ingenious people capable and interested in working on improving the environment should learn to use Design Thinking. It will make them much more efficient at developing solutions that have the potential for success. There are many programs online and at universities that offer some form of Design Thinking (Greenberg 2021) [2].

Lean Startup is the second key tool for successfully advancing innovation and entrepreneurship (Euchner and Blank 2021) [3]. It is a relatively new approach, perfected in Silicon Valley, for developing a viable and scalable business model that commercializes an innovative product to launch a technology-based startup company. Like Design Thinking, it prioritizes understanding the customer's needs first. It requires adherents take a "get out of the building" approach to develop empathy for customers. This is accomplished through customer discovery, whereby the budding entrepreneur interviews potential customers to uncover their processes of thinking and feeling, to see how the act and behave under given scenarios, and to understand the mental models they use to navigate their decision making. Customer discovery leads to a better understanding for what the customer needs and how best to reach them with a marketing strategy. It speeds up the process for finding Product-Market Fit; aligning the value proposition with specific customer segments. It includes tools like the Business Model Canvas (BMC) for quickly mapping out an outline for a business model (Osterwalder and Pigneur 2010) [4]. The BMC includes 9 key elements: Customer Segment, Value Proposition, Customer Relations, Channels, Revenue, Costs, Key Activities, Key Resources, and Key Partners. The 9 elements are organized to fit on a single sheet of paper so it is easy to visually capture the connectedness needed for an enterprise. The National Science Foundation in the US has embraced Lean Startup as the approach for its I-Corps program, whereby university-based inventors and their graduate students are coupled with a business mentor to participate in a 7-week workshop to determine what commercial potential their technology has.

Another key element of entrepreneurship is storytelling (Suzuki et al 2018) [5]. Being able to relate the impact that your solution can have in solving real people's problems to multiple audiences, like investors and funding agencies, is important. Storytelling is exceedingly useful for startups to express their brand so that it resonates with their key customer segment [6,7].

Innovators that trace their heritage to technical fields like science and engineering

are generally not known for their ability to understand and communicate with non-technical people. They may tend to resist Design Thinking, Lean Startup and storytelling, since each method places people at the core. However, for the rate of impactful innovation to accelerate through entrepreneurship, technical innovators need to develop an understanding and appreciation for these human-centric methods. The condition of the world's environment could be improved immensely as more technical professionals embrace these techniques.

Conclusion

The unprecedented scale of the world's environmental problems calls for unprecedented acceleration of the use of large-scale problem-solving tools. One such tool is the coupling of innovation with entrepreneurship. While government intervention has helped slow the rate of environmental devastation during the last 50 years or so, it alone is insufficient for fixing the massive problem. Personal consumerism represents a vast amount of the world's economic production. To reverse the indirect linkage between consumerism and environmental devastation, massive and ubiquitous environmental innovation and entrepreneurship is needed. Here we reviewed three modern tools, Design Thinking, Lean Startup, and storytelling, that accelerate the rate of effective innovation and successful entrepreneurship. Professionals in STEM and business should embrace these tools to reverse the environmental devastation occurring across the globe.

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