Designing the Way Forward:
The Role of Design Thinking in the Era of Digital Creativity

Pelin Bicen
Suffolk University

Naveen Gudigantala
University of Portland

Information Age as the successor to the Industrial Age highlights the ubiquitous digital era, in which the technology is creatively shifting how companies are connecting with their customers, learning their latent needs, and meeting them with unique offerings. This creative transformation requires different set of processes and mindset known as design thinking. Different from reliability driven thinking, design thinking prescribes a human-centered innovation process that emphasizes insight, observation, collaboration, and a deep understanding of the users. It transforms businesses and influences their innovation strategies. The goal of this article is to discuss how digital technology platforms are creatively utilized to convert fundamental human needs into profitable demand by adopting design thinking process. To illustrate the effective way of implementing design thinking process, we showcase five digital creativity projects where design thinking philosophy is the main driver. Based on this discussion, we propose further research questions to be examined for future research projects.

INTRODUCTION

Over the last three decades, also known as the Information Age, organizations have been facing major changes worldwide as a result of progress of globalization and the striking pace of technological advancement (Soma, Termeer, & Opdam, 2016). Different from Industrial Age, in which the main focus was on total-quality management and efficiency, Information Age is about an economy where knowledge is a unique resource and the rapid production of knowledge and innovation is essential to organizational survival in highly competitive complex landscapes (Alcaer, Cantwell, & Piscitello, 2016). Notable features of Information Age are that growth is exponential, change pervades social and institutional structures, and there is a migration from companies creating for people, to companies creating with people, to people creating for themselves (Schwab, 2016). As a result of this rapid pace of landscape change, individuals are seeking more meaning and control over economic activities such that they don't want to be stereotyped as consumers; they find innovation without emotion uninteresting and unappealing; they oppose management styles that lack any real humanity; and they prefer companies creating with them as well as providing opportunities to create for themselves (Neumeier, 2009). Technology is a strong trigger for today's dynamic, competitively intensive, highly volatile, and

unpredictable markets. This intensity demands companies to be creative and radically innovative to be sustainable in the long term. Intense pressure for radical innovation has put firms into a position to hire creative individuals, form highly cross disciplinary teams, and provide them with inspiring workspaces so that they can form novel and meaningful solutions to the wicked problems of the Information Age (Howkins, 2010; Montag, Maertz, & Baer 2012).

If it is widely accepted by companies that creativity is the most wanted ability in the knowledge economy to succeed, why don't we see more success stories? The answer, we would suggest, is the need to clarify how creativity may be achieved in fast paced ever changing market places. And, in the current paper, we argue that design thinking philosophy is a powerful and effective way to tap into the capacity to be creative and innovative in the era of digital technology. We exemplify and discuss five innovative initiatives in which design thinking has enabled digital creativity to result in innovative solutions. Finally, we discuss potential research questions for future studies.

CREATIVITY AND DESIGN THINKING

The prominent creativity theorist Csikszentmihalyi (1997) defines creativity as a process to bring something into existence genuinely new that is valued enough to be added to the culture. In his definition, he highlights the system aspect of creativity where there are mainly three parts: domain (a set of symbolic rules and procedures); field (people who judge the novelty and meaningful aspect of the idea and, thereby, its contribution to the domain); and the creator. That means creativity occurs when a person, using the symbols of a given domain, has a novel idea or sees a new pattern, and when this novelty is selected by the appropriate field for inclusion into the relevant domain. In short, creativity as a systemic phenomenon does not happen in isolation, rather it takes place in a sociocultural context (Amabile, 1983). Furthermore, how well suited the respective domains and fields are to the recognition and diffusion of novel ideas changes the level of creativity in a given place at a given time (Amabile et al., 1996).

Given that creativity does not begin and end with a person and the greatest spur to it may come from changes outside the individual, how can today's knowledge focused digital era management foster creativity in their organizations to make a long-lasting change in society? Design thinking philosophy offers just such an answer to this question. Design thinking has been an important subject matter in the business world over the last decade (Seidel & Fixson, 2013; Verganti, 2008). The most central aspect of design thinking methodology is its focus on deep user understanding. This aspect enables companies to reach rich user insights and discover their unarticulated needs, which eventually leads to radical insights. Discovering unarticulated needs means not only examining the foreground (e.g., how do people behave?) but mostly the invisible background (e.g., what motivates people to behave that way?). It requires companies to be engaged in non-linear processes for solving complex problems that are hard to conceptualize and articulate (Seidel & Fixson, 2013). It demands sense-making skills, which are exploratory rather than confirmatory (Weick, 1993).

Design thinking integrates what is desirable from human point of view with what is technologically feasible and economically viable (Brown & Katz, 2011). Successful innovation and sustainable competitive advantage are the result of peaceful co-existence among these three criteria: technological feasibility, business model viability, and desirability.

As we asked earlier, why are there not more success stories when it comes to creating truly innovative products/services that make a long-lasting change in our society? Answer to this question lies in a management philosophy that still believes in techno-centric view of innovation, where companies look for technological breakthroughs first, and only afterwards will they start thinking about how technology can provide benefits (Brown, 2009). However, as Peter Drucker (2006) discussed in his classic work, Innovation and Entrepreneurship, reliance solely on technology is highly risky. What we need and design thinking philosophy offers is human-centric view of innovation. Importantly, strong emphasis on fundamental human needs and not the artificially manipulated desires is what drives design thinking.

Figure 1 summarizes design thinking process, which starts with a curious question. As we mentioned earlier, though Industrial Age thinking has brought breakthrough changes and technology improved the

standard of living, it has also left us vulnerable to natural and man-made catastrophe and, as a result, trapped us in a tangle of what sociologists Rittle and Webber called "wicked problems" – problems so tricky, malignant, and aggressive that they seem insoluble. In their own terms, defining wicked problems itself is a wicked problem (1973). Excess consumption, poverty, obesity, education, global warming, and overpopulation are some of the wicked problems world faces today. On the business side, aligning business strategy with customer experience, balancing long-term business goals with short-term demand, being profitable and still be able to meet the challenge of eco-sustainability are few of the wicked problems companies face today (Norman, 2013).

Treating wicked problems requires systems approach, and this is where design thinking comes into play. Design thinking is an iterative process rather than a step-by-step, linear one. It is the harmonious balance and dynamic interplay between analytical (e.g., mastery) and intuitive (e.g., originality) thinking. As Martin (2009) and Brown (2009) describe, design thinking follows a knowledge funnel. It starts with the mystery (imagination), follows by heuristic (ideation), and ends with algorithm (implementation). Imagination brings a variety of forms of mysterious questions, heuristic helps the mystery down to manageable size and organize exploration of possibilities, and algorithm converts the general rule of thumb to a simplified solution formula. This process requires different kind of logic that Martin (2009) calls "abductive logic" which is about what could be rather than what it is or should be as declarative logic demands. Abductive logic is the fine balance between exploration and exploitation (Leavy, 2010; March, 1991). It is at the heart of design thinking process. It is less certain, thereby, has more space for intuition than analytical thinking; and, has greater consistency and replicability than intuitive thinking. Its objective is not to derive a conclusion that is declared to be true or false. As Martin (2009) indicates, it is a modal reasoning; its main objective is to posit what could possibly be true.

As mentioned, design thinking process of innovation starts with a mysterious question that triggers our curiosity but elude our understanding. Since there is no proven way to approach the mysterious problems, design thinkers take the logical leap of the mind and formulate a heuristic. In this formulation, they use three overlapping criteria (constraints) to generate creative ideas. These are technological feasibility, business viability, and desirability. Though the reconciliation among these three criteria is the main point in design thinking process, the most important consideration is given the desirability or what we call the fundamental human needs part of the triad. Design thinking process takes a different stand in the search of fundamental human needs. Rather than relying on the declarative logic and use quantitative/analytical approach to learn what people may want/need, it embraces the abductive logic approach and uses empathy-driven insightful research techniques (e.g., ethnographic research design) which is mainly based on observation.

The process of design thinking and its human-centered approach helps people articulate the latent needs they may not even know they have (Meinel & Leifer 2012). This insightful approach helps companies draw useful inferences about peoples' behaviors and their hidden needs, understand them better, and, thereby, make them well connected with each other. Further, feasible technology and viable business model components of the triad in the design thinking process provide clarity and increase accessibility to domain knowledge (Brown & Katz 2011). Well connectedness with the rest of the society, centrality and accessibility to the domain knowledge, clarity and structure eventually increase the rate of creativity, which is a necessary ingredient for radical innovation. Overall, design thinking is a power train for sustainable performance: a curious question triggers design thinking process; design thinking drives creativity; creativity powers radical innovation; radical innovation builds demand; and demand sustains profits.

FIGURE 1
DESIGN THINKING-BASED PROCESS MODEL OF INNOVATION
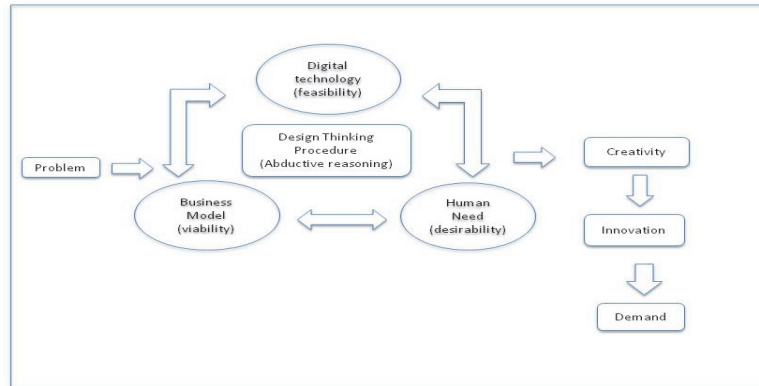
DESIGN THINKING IN THE ERA OF DIGITAL ECONOMY: A TALE OF FIVE DIGITAL CREATIVITY PROJECTS

This section discusses the role of digital creativity in enabling innovation through design thinking. Consistent with the above discussion, drawing from Brown's (2008) work, framework used for this section comprises of three steps in design thinking which influence innovation activities. The first step involves inspiration, which characterizes the opportunities, problems, or both that inspire a human-centered solution. The second step of ideation constitutes creating and testing new ideas. This step relies heavily on generating creative ideas or frameworks. The final step is implementation, in which the ideas generated are executed to provide solution. This framework is presented in Figure 2.

FIGURE 2
FRAMEWORK OF DESIGN THINKING AND INNOVATION
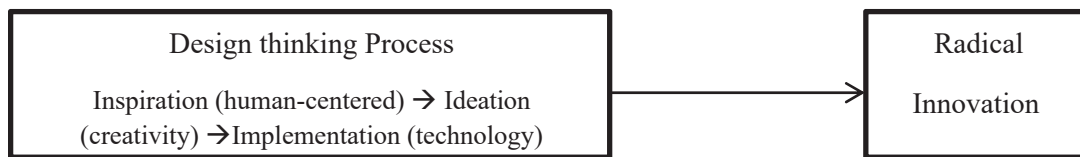
It is possible that solutions to many problems can be found with creative ideas which do not require any digital technology. For instance, students of Stanford business school worked on a group project to research and design a low-cost incubator for new born babies in the developing world. The students visited Nepal and talked to families and doctors and realized that babies in severe danger were the ones who were born prematurely in remote areas far from hospitals. Intense observation and multiple interviews with healthcare personal and families led to the conclusion that what the families needed was not a low-cost incubator, but a reliable way to keep babies warm for long hours. These babies were facing hypothermia, the inability to regulate body temperature. These insights contributed to the student team developing a miniature sleeping bag, which contains a special heat-storing wax that stays at a constant temperature for up to 6 hours. This infant warmer costs 99 percent less than a traditional incubator and has the potential to save millions of low-birth-weight and premature babies (Kelley & Kelley, 2012). This example illustrates the use of creativity in developing an innovation using design thinking framework consisting of inspiration, ideation, and implementation but without the need for any digital technology.

In contrast, the following five projects describe the role of design thinking in making creative use of digital technology. The distinction between the prior example and the following examples lies in the

creative use of digital technologies in enabling design thinking to innovate. While creativity enables better ideas to emerge, digital technologies enable implementation and execution of such ideas.

Project 1: Gram Power - Affordable Electricity to Poor

About 400 million Indians live without access to grid-based electricity, and as a consequence use kerosene, which releases significant amount of carbon dioxide into the atmosphere (Friedman, 2013). In addition, power theft and energy losses in India are as high as 58 percent (GramPower, 2013). Providing affordable electricity and reducing energy losses is a challenging problem in India and in many other developing nations.

Gram Power is a company that uses cutting-edge Smart Grid technologies to provide 24/7 electricity with a pay-as-you-go prepaid model. As a result of using this technology, a rural household in India can now get access to electricity for as cheap as 20 cents per day which provides energy for nine hours of lighting, six hours of ceiling fan, television, and charging a cell phone. This innovation uses a Smart micro-grid system to generate power using solar, biomass, and conventional grid. The use of smart meters in every household enables to create a remotely manageable communication network. This network is used to eliminate theft, optimize power supply, and allow wireless payments. This technology is selected among the top 10 Cleantech innovations by NASA in 2011 (GramPower, 2013).

Briefly, Gram Power developed an innovative solution to affordable power access using design thinking approach. The human-centered design was used to find a solution, which creatively used a smart-grid based generation system and digital technology-based distribution system to create an innovative business model. The design thinking process of keeping the customer needs at the heart of the solution has driven the need to creatively develop a smart distribution system as part of the solution.

Project 2: Code for America

The U.S. federal, state, and local governments have an IT budget of $140 billion, which dwarfs the market for video games (approximately $10 billion) and iOS app market (approximately $2 billion) (Code for America Accelerator, 2013). However, according to an estimate by the Office of Management and Budget, one quarter of government's major IT programs have serious management issues, including duplication and cost overruns. It usually takes several years for governments' IT projects to be fully implemented. Therefore, there is an opportunity for governments to use the power of web, massive data, and cutting-edge technologies to quickly develop innovative software applications to better serve their citizens.

Code for America (CfA) is a non-profit organization, which through its programs, enlists the support of programmers, city experts, and technology leaders to connect governments with the resources needed to leverage the power of web to develop innovative software applications. For instance, CfA's fellowship program recruits volunteer web developers, designers, and entrepreneurs for a year of public service and invites cities to work with them. The fellows engage the community, develop ideas to create apps, open datasets, and host events that create new possibilities for the government to serve their communities. So far, 26 CfA's fellows have created 21 apps for the cities of Boston, Philadelphia, Seattle, Austin, Portland, etc. (Drell, 2012). A fellow developed an app in Boston which asks people to adopt a fire hydrant which is buried in snow and to make it usable. Though this may seem an app of limited applicability, it is possible that these apps can go viral and may serve a different need at another place. The 'adopt a fire hydrant' idea was adapted by the City of Honolulu but modified it to allow citizens to adopt tsunami sirens to check their status (batteries are often stolen from these sirens). If a government were to develop these apps, it would take them several years and cost tax payers a substantial amount of money (Drell, 2012).

Code for America's fellowship program represents an innovative approach to involve and empower citizens, develop technologies quickly, and make a difference to peoples' lives. This project uses design thinking approach of human-centered solution finding to aid governments, and the creative use of digital technologies provide innovative solutions.
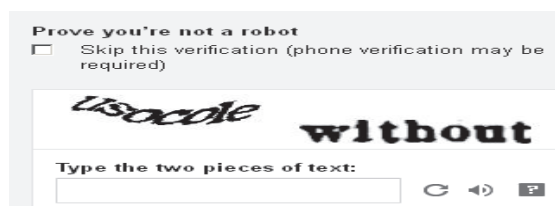
Project 3: reCAPTCHA

Books and text written before the computer age are now being digitized to make them accessible for search on the Internet. However, the optical character recognition (OCR) software used for recognizing words in scanned images of text is not perfect as OCR still cannot recognize about 20 percent of the words. In contrast, humans are highly efficient at transcribing such print but are very expensive to employ (Von Ahn et al. 2008). This situation presents a significant problem for the Google Books project and the non-profit Internet archive project, which work to digitize millions of books and text. The challenge is to digitize text accurately by employing humans in a massive scale and in an inexpensive way.

The solution to this problem is provided by the reCAPTCHA project. CAPTCHAs are used as security mechanism to distinguish humans from computers on the Internet. For instance, it is important for websites such as Ticketmaster to stop automated programs from purchasing tickets in bulk. Hence, these websites should allow only humans to register and stop any bots from accessing the websites. CAPTCHAs are images containing several distorted characters that appear at the bottom of a web registration form. Users are asked to type these characters in a textbox to prove they are human. Humans across the world are estimated to type around 100 million CAPTCHAs every day (Voh Ahn et al., 2008). The reCAPTCHA project, which allows users authenticate themselves as humans, also has been designed to digitize text on the Internet one word at a time. For instance, a user is presented with the following two words to type in the textbox presented in Figure 3. The system only knows answer to one word (without). But if a user correctly types the answer to this known word, a certain degree of confidence can be attributed to the correctness of the unknown word typed by the same user. If a certain number of users type the same word for the unknown word, that word is chosen as the correct spelling. The reCAPTCHA system has been deployed and completely digitized the New York Times archives, where more than 13 million articles in total have been archived, dating from 1851 (Gugliotta 2011). The system has been reported as displaying over 100 million CAPTCHAs every day.

The reCAPTCHA project illustrates the power of using abductive logic in creatively solving a problem which otherwise would have been very difficult to solve using reliability driven conventional methods. The design thinking approach enabled the project team to think in an unorthodox way and ask the "what-if" question to solve the problem. The initial application of CAPTCHAs just served the needs of websites in differentiating humans from bots. However, such effort resulted in millions of hours of wasted time. The mental effort of millions of users is creatively redirected to solve one of the most challenging problems of digitization of books through the design of reCAPTCHA project.

FIGURE 3
AN EXAMPLE OF reCAPTCHA

Prove you're not a robot
☐ Skip this verification (phone verification may be required)

usacode **without**

Type the two pieces of text:

Project 4: Tesco's Use of Virtual Stores

South Korea remains a tough market for retail companies to do well, and even the most powerful brands like Walmart and Carrefour have struggled in this market. TESCO HOMEPLUS is a company which is currently in the second position in South Korea's retail market but they faced a bigger hurdle to overcome to become no.1 – they had fewer number of stores compared to the leader, E-mart. The challenge faced by HOMEPLUS is to become industry leader in South Korea, but without increasing its stores (Fioretti, 2019)

After studying people through interviews and hours of observations, TESCO HOMEPLUS found that South Koreans work long hours and, thereby, time is the most valuable asset. Among their priority list, grocery shopping comes at the bottom. It is one of the most dreaded activities. On the other hand, South Koreans are technologically savvy with more than 90 percent of the nation population own smart phones (Wiggers, 2019). TESCO HOMEPLUS decided to take the store to the people in a virtual form. The company created virtual stores in subway stations with the displays looking exactly like those in the actual stores. Customers can use a smart phone application to scan the QR code for a product they would like to purchase, complete the order, and pay, and the shipment will be delivered to their homes often on the same day. This initiative worked wonders for TESCO HOMEPLUS as its online sales increased by 130 percent making it the number one player in online market and a close second ranked company in offline market (Meurville, Pham, & Trine 2015).

Online shopping is nothing new but the challenge lied in making it more user-friendly and convenient. Through virtual stores and the use of smart phone application, TESCO HOMEPLUS made shopping very convenient for the time-starved and busy South Koreans. The people liked the idea because it met their latent need and turned the waiting time at a subway station into shopping time. TESCO HOMEPLUS' virtual store idea won the 2011 mobile creativity Grand Prix award at the Cannes Lions creativity festival for redesigning the way people used mobile technology.

Project 5: Kaiser Permanante's Process Innovation

With unprecedented and growing market and technology pressures, health care systems are challenged and forced to develop a more robust capacity for better aligning current and future needs with where, how, when and with whom health occurs. Successful health care systems will have the ability to innovate in delivering services that cut across organizational, political, geographical and sectorial boundaries (Roberts et al., 2016).

Design thinking's sole focus on being empathy-driven and intentionally cross functional are sorely needed in the siloed healthcare industry. This example considers a large healthcare provider Kaiser Permanante and its doctors, nurses, and administrators.

A recent project concerns some of the challenges faced during nursing-staff changes at Kaiser hospitals and ways to reengineer them. One of the problems faced was that nurses frequently spent the first 45 minutes of each shift at nurses' station learning from the departing nurse about the status of patients. The method of communication varied from hospital to hospital and the nurses compiled information in different ways which included using available scrap of papers, scrubs, etc. Even after spending considerable time, the nurses often failed to learn some issues that are important to patients. For many patients the shift change felt like a hole in their care. Due to this process' inefficiency and common mistakes assisted with it, the system had to be redesigned.

After hundreds of hours of observations and interviews, and going through internal reports and notes, the final redesigned process included modifications concerning how information is exchanged and the way digital technologies was used. The new process required nurses to exchange information in front of patients rather than in nurses' station. Second, a new software was designed to be used by nurses in shifts to input patient information throughout the shift rather than doing it at the end. The software created customized reports for each nurse at the start of the shift.

Such redesigned effort, with creative changes in the process and the use of digital technologies, provided better patient care and reduced preparation time for nurses. Kaiser learned that with the new process, the average interval between a nurse's arrival time and time at first contact with a patient had been reduced by more than half. This new shift process is now being implemented across the Kaiser system. This project illustrates the use of design thinking in enabling digital creativity to make process innovations possible.

In conclusion, this section presented five projects that used abductive logic and design thinking process to creatively use digital technologies for innovation. The Gram Power project creatively used a smart distribution system to provide affordable electricity; Code for America creatively devised programs that used volunteers to quickly build and implement apps for improving government services;

reCAPTCHA project creatively used the power of crowd sourcing to digitize text on the Internet; TESCO HOMEPLUS' creative use of online shopping made grocery shopping a comfortable experience for busy and tech-savvy South Koreans; and, Kaiser Permanente's process changes with digital technology improved patient care and hospital staff's productivity. In each of these projects, the use of digital creativity in enabling innovation efforts is a worthy contributor. However, as amazing as these efforts finally look, organizations still struggle with design thinking-based innovation efforts and the use of digital creativity. Our understanding of factors influencing digital creativity to emerge, and the influence of design thinking in enabling digital creativity is still in nascent stages. In our next section we discuss some important questions for future research.

DISCUSSION AND FUTURE RESEARCH QUESTIONS

This paper discusses design-thinking philosophy for using digital creativity for sustainable innovation. To make design thinking a part of innovation effort requires involving design thinkers at every step of the innovation project, taking a human-centric approach in addition to technological focus and business viability considerations, using rapid experimentation and prototyping, and hiring talent that has interdisciplinary skills (Brown, 2008). However, many challenges remain at the organizational, team, and individual level as firms try to implement design thinking practices. Although there has been an increase in efforts in understanding design thinking process and how it elevates creative thinking and boosts innovation efforts, there still needs to be more research efforts to understand its role and impact in creative thinking and innovation process both at the team and the organizational level. We believe that future research should investigate the following questions to improve our understanding of how digital creativity can be enhanced during the design thinking process.

Seo, Lee, & Chae (2013) have conceptualized creativity in organizational context into organizational creativity and creativity management. Both these factors are likely to be influenced by organizational design. In this context, an important question to investigate is what type of organizational design enhances creativity in design thinking process? For instance, Google allows their employees to spend twenty percent of their time working on a project of their own design. The rationale is to free up substantial time for employees to enable them to unleash their creative instincts. Projects such as GMAIL, Google News, Google Talk have been claimed to be some of the products that resulted out of this initiative (Boulton, 2008). This particular design from Google appears to be a good first step towards enhancing organizational creativity. However, what type of creativity management is required to maximize the outcomes from employees' creativity efforts in this situation still remains to be investigated.

Second, what type of organizational structure promotes creativity in design thinking process? Many design thinking projects require rapid experimentation and prototyping. This effort requires employees with varied skills and backgrounds to work together to innovate. For instance, Nordstrom innovation lab uses design thinking approach to innovate. The lab teams build a product every week or two with an objective of rapid experimentation and prototyping using design thinking principles. Successful ideas from experimentation are passed onto other teams for complete development. The teams work in a collaborative studio with post-its and note cards. This kind of open environment, lean startup, use of digital technology, and agile learning with design thinking approach enables Nordstrom to create many ideas. One of the ideas developed by the lab team included creating a sunglass iPad app inside a Nordstrom store in a week by interacting with customers and using their feedback. This example opens up a question: which types of organizational structure promote creativity in design thinking for innovation?

When we study the literature on design thinking, it is not challenging to see the different discourses in the literature. Johansson-Skoldberg, Woodilla, & Cetinkaya described (2013) five discourses in the design thinking literature: design thinking as (i) the creation of artefacts (Simon, 1969), (ii) a reflexive practice (Schön, 1983), (iii) a problem-solving activity (Buchanan, 1992), (iv) a way of reasoning/making sense of things (Lawson, 2006), (v) creation of meaning (Krippendorff, 2006). It will be interesting to study what

are the similarities and differences among these discourses, what leads to different discourses, and how literature since then evolved based on these discourses.

CONCLUSION

As the center of economic activity in the developed world shifts inexorably from industrial manufacturing to knowledge creation, innovation has become an important survival strategy. It is no longer limited to the launch of new physical products, but also new sorts of processes, services, and ways of communicating and collaborating (Brown & Katz 2011).

The acceleration of movement through the stages of design thinking is the most effective formula for sustainable innovation in the Information Age. Design thinking paradigm by using integrative thought process places people at the core of solution finding. Its nuanced approach involves reaching out to people, observing their experiences, and using those deep insights to inspire new ideas. This human-centered approach relies heavily on creativity and technology to come up with a solution.

In this study, we discussed the role of design thinking aided by digital creativity in formulating innovative solutions and provided research questions for future research. While design thinking requires technology, it doesn't necessarily have to be digital technology. We illustrated five design thinking projects in which digital creativity played a vital role in formulating innovative solutions. These projects serve as a testimony to the success of innovation efforts using design thinking approach. By highlighting the role of digital creativity, we hope to inspire a generation of future work that sheds more light and improve our understanding of the role of digital creativity in innovation through design thinking.

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