Educating an Innovative Workforce for the Digital Economy

Emergent Research Forum Paper

Ruben Mancha
Babson College
rmancha@babson.edu

G. Shankaranarayanan
Babson College
gshankar@babson.edu

Abstract

Understanding that innovation, specifically, digital innovation is a critical need for survival in today's digital economy, this research-in-progress looks at four traits (individual entrepreneurial orientation, entrepreneurial self-efficacy, digital literacy, and information technology self-efficacy) of individuals that may determine their success as digital innovators. We describe a theoretical model with its foundational underpinnings along with associated hypotheses to understand the role of these four traits in creating a digital innovator. Using a survey instrument to collect data, our preliminary analyses reveal that three of the four traits play a key role. We believe this understanding will help us design and deliver the technology curriculum of the future that generates a workforce capable of digital innovation.

Keywords

Digital innovation, entrepreneurial self-efficacy, IT self-efficacy, digital literacy, workforce.

Introduction

Innovation is a major driver for economic growth (U.S. Chamber of Commerce Foundation, 2016; Rosenberg, 2004). In its 2016 "Enterprising States" study, the U.S. Chamber of Commerce Foundation reported that approximately 50% of the U.S. annual GDP growth is attributed to increases in innovation. In particular, innovating with digital technology is considered important for our society to meet the pressing economic, social, and environmental challenges. Beyond investing in technology infrastructure and innovative environments, organizations need a workforce that can innovate with digital technologies.

In this context, it is important to delineate innovation and digital innovation. Rogers (2003) defines innovation as an idea or an object that is perceived as new by an adopter. Innovation is the translation of an idea or invention into a good or service that creates value for consumers. Digital innovation is a subset of innovation. Fishman et al. (2014) define it as a product, process or business model that is perceived as new, requires some significant changes on the part of the adopters and is embodied in or enabled by information technology. Fishman et al. state that digital innovation is a fundamental and powerful concept that is required in the core IS curriculum. In this research-in-progress, we identify some traits, attitudes, and skills of individuals that enable digital innovativeness, a characteristic central to digital innovation. Thiedieck, Lippitz, and Pfeifer (2013) identify an innovative employee as one who possesses a visionary view on challenges and solutions, is open to change, has excellent communication skills, is persuasive, can independently seek resources and solutions, proactively pursues ideas to create economic value, is curious, honest, and able to inspire others. We examine the characteristics of a digitally innovative employee.

We posit that digital innovation in today's digital economy is different from analog innovation of yesteryears. Digital innovation relies on platforms that permit quicker recombination and experimentation and thereby hasten the innovation process (Mancha and Iyer, 2017). Further, digital innovation in today's digital economy spans two distinct domains: the digital domain, a “constellation of technologies” (Arthur, 2009) where digital objects can be configured and analyzed; and the physical domain, where the products and services with digital components are consumed and/or create value (Mancha and Iyer, 2017). In this study we propose that digital innovators belong to different breed, compared to the analog or traditional innovators. This is because the digital domain is rather new and markedly different in its characteristics,
Educating an Innovative Workforce for the Digital Economy

demanding a different set of traits and skills. Being a technology expert may make you really good with technology, but it does not translate into innovating with digital technology. Similarly, possessing an entrepreneurial bent may not provide you with any significant advantage when it comes to digital innovation. In this paper, we examine four particular individual characteristics that we believe influence digital innovativeness. Our objective in this paper is to understand the role of each of these characteristics on digital innovativeness with the ultimate intention of designing curricula to educate the digital innovator.

The remainder of the paper is organized as follows. In the next section we present the relevant theoretical foundation for the study described here. We then describe the theoretical model used in this research along with the related hypotheses. We further describe the questionnaire and the data collection process before presenting our results. Finally, we discuss the key findings and their implications before concluding with the directions for further ongoing work.

Related Literature

The importance of business students having a strong educational foundation in Information Technology (IT) and digital innovation has been emphasized by Fishman et al. (2014). The authors believe this to be critical so that future leaders can transform organizations that are becoming dependent on digital innovation. The authors use a framework that includes process, product, and business model innovation and includes four stages of the innovation process: discovery, development, diffusion, and impact. Based on this framework, the authors present a case for adopting digital innovation as a Fundamental and Powerful Concept. In examining the implications for teaching IT/information systems (IS)/information management (IM) courses, the authors state that students must be educated about digital innovation and this should be done using dedicated IT/IS/IM courses. Our research in this paper supplements the arguments made by Fishman et al. (2014). In an attempt to understand how to create a consolidated class or a set of such classes, we examine the individual characteristics of a student and how these relate to digital innovation. We believe this understanding will help us design and deliver the core curriculum that can educate the digital innovators of the future.

We adopt the view that a digital innovator is a master of the digital domain and has the strategic view of the business to translate the innovation into an enterprise or physical domain. To determine success in the physical domain we argue that the digital innovator must possess an entrepreneurial orientation that will help him or her to digitally transform the enterprise. To successfully create such a transformation, the digital innovator must possess entrepreneurial self-efficacy that gives him/her the confidence to execute this transformation from the operations, marketing, and financial perspectives, besides taking the necessary risks. As a master of the digital domain, the digital innovator has the digital literacy to understand the capabilities of digital technologies. Moreover, the digital innovator has a playful attitude towards technology that allows him/her to derive a strategic understanding of its benefits and shortfalls. We discuss each of these characteristics to lay the foundation of our theoretical model.

Langkamp-Bolton and Lane (2012) have expanded the Entrepreneurial Intent construct proposed by Thompson (2009) and proposed an instrument for measuring Individual Entrepreneurial Orientation (IEO). They have defined the concept of Entrepreneurial Orientation at the individual level by combining characteristics of Entrepreneurial Orientation, individual’s traits, attitudes, and behaviors, and the individual’s entrepreneurial intent. In this paper, we adopt this idea of IEO as an important characteristic for a digital innovator. A digital innovator in today’s digital economy is not only a master of the digital domain but also possesses the ability to translate this into the physical domain. A digital innovator would do so by leveraging the technology to digitally transform the enterprise. We posit that to make that translation from a digital domain to a physical domain the individual must have an entrepreneurial orientation. This is not to say that everyone with an entrepreneurial intent will be an innovator, but, our argument is that the entrepreneurial intent is necessary to leverage the innovation to create the transformation. We hence adopt Individual Entrepreneurial Orientation (IEO) as an independent variable that affects Digital Innovativeness (DI), the dependent variable. To operationalize this IEO we adopt the metrics proposed by Thompson (2009) and we adopt the instrument developed and tested by Langcamp-Bolton and Lane (2012), both of which have been widely used by researchers in the past.

Another characteristic that we believe is relevant to digital innovation is Entrepreneurial Self-Efficacy
Educating an Innovative Workforce for the Digital Economy

(EntrepSE). First proposed by Chen et al. (1998), this characteristic predicts the likelihood of an individual becoming an entrepreneur. It refers to the strength of an individual’s own belief that he or she can successfully execute the key tasks of entrepreneurship, viz., marketing, innovation, management, risk-taking, and financial control. From the perspective of this research, EntrepSE is critical to complete the execution of the digital transformation in the physical domain. We hence posit that EntrepSE is a necessary trait for a digital innovator. To operationalize this construct, we adopt the accepted metrics proposed by Chen et al. (1998).

While the above two individual characteristics, IEO and EntrepSE, arguably relate to any innovative endeavor, in our study we focus on a digital innovator. To understand the impact of technology-specific traits on digital innovation, we examine two additional independent variables: digital literacy and information technology self-efficacy. We operationalized digital literacy (DL) by asking survey participants to identify the correct technology to be used in a particular scenario, out of a list of nine technologies. Our rationale is that subjects with high DL have extensive knowledge about the capabilities of technology solutions. In addition to being a digitally literate, a digital innovator also possesses self-efficacy when using information technologies. To understand this, in our research, we adopt the IT self-efficacy instrument developed first by Cassidy and Eachus (2002). The self-efficacy concept was first presented by Bandura (1986) as part of the Social Cognitive Theory and defined as one’s belief in one’s ability to succeed in specific situations to accomplish a task. Cassidy and Eachus (2002) developed the Computer User Self-Efficacy (CUSE) to measure the self-efficacy of an individual in the context of computer-related tasks. This was further adapted to cover digital self-efficacy to measure the self-efficacy of an individual in this digital domain. For our research, we believe that self-efficacy with information technologies is an antecedent to digital innovativeness. Digital innovators firmly believe that they possess the ability to apply and leverage digital components to innovate. To test this notion, we adapt the digital self-efficacy instrument by Cassidy and Eachus (2002) to create the instrument operationalizing Information Technology Self-Efficacy (ITSE).

Agarwal and Prasad (1998) introduced the Personal Innovativeness in Information Technology to further explain why certain individuals readily adopt new information technologies and, propose an instrument to operationalize this construct. This construct explicates the role of individual traits in technology adoption. The authors state that personal innovativeness as a construct is important to study the individual’s behavior towards innovation. They define this construct as an individual’s willingness to try our new information technology. Rogers (2003) notes that innovators seek information about new ideas actively. He further suggests that innovators have a greater exposure to mass media and do not place much reliance on the subjective evaluations of other members in their social system about adopting a new innovation. Following this rationale, Agarwal and Prasad (1998) state that individuals with a higher personal innovativeness will develop more positive perceptions of the innovation. In our research, we define this construct of Digital Innovativeness (DI) as a way of measuring the knowledge a digital innovator gains about the digital component by actively seeking information about it, perceiving its benefits, and importantly, the willingness of the digital innovator to try out new digital components. As stated by Macha and Iyer (2017), the digital innovator leverages his/her social network for expertise and information. This too is consistent with the personal innovativeness construct suggested by Agarwal and Prasad. In doing so, the digital innovator establishes a mastery of the digital domain. Further, the construct also explains the innovative behavior of the individual. We hence adopt the instrument developed in Agarwal and Prasad (1998) to operationalize the Digital Innovativeness (DI) construct in our research.

Theoretical Model

As argued in the previous section, our theoretical model (Figure 1) uses the above-described four constructs as antecedents for digital innovativeness, our dependent variable. We argue that entrepreneurial orientation is a key individual trait that determines the individual’s ability to be a digital innovator. A digital innovator needs to be able to successfully execute the innovation in the physical domain to transform an enterprise. We posit that an individual’s entrepreneurial orientation will be related to that individual’s digital innovativeness. Our first hypothesis (H1-alternate) states that the IEO is correlated to that individual’s digital innovativeness.

Entrepreneurial self-efficacy (EntrepSE) is the individual’s confidence in their ability to execute the
transformation of the digital innovation in the physical domain. The digital innovator has to not only create the plan for the digital transformation but also have the confidence in executing the plan for completing the transformation. Hence our second hypothesis (H2-alternate) states that the EntrepSE of the individual is correlated to that individual’s digital innovativeness. We have argued that digital literacy (DL) is a necessary antecedent for digital innovativeness. DL is a way of measuring the knowledge a digital innovator has about the digital domain and what it is possible in it, perceiving its benefits, and importantly, the willingness of the digital innovator to try out new digital components. We argue that this characteristic is related to the digital innovativeness of the individual. Hence our third hypothesis (H3-alternate) states that DL of a person is correlated to that individual’s digital innovativeness. Our final hypothesis (H4-alternate) states that the IT self-efficacy (ITSE) of the individual is correlated with the digital innovativeness of that individual. A digital innovator firmly believes that he/she possesses the ability to apply and leverage digital components to innovate.

![Figure 1: Research Model](image)

**Methodology**

We developed a survey instrument to measure the above constructs. The instrument incorporates measures that operationalize the independent variables mentioned and digital innovativeness. We first pre-tested the instrument for validity, to later administer the survey to 180 students. The students were sophomores in the core Managing Information Technology course and graduate students in a core Information Technology course. This is the required ITM course where we discuss information technology concepts as well as the strategy for leveraging ITM for innovation and digital transformation. All of the students were taught by the same instructor and hence consistently graded on all course deliverables. Of the 180 responses we received, 172 were valid responses and the other 8 were incompletely filled and hence discarded. Out of the 172 valid responses, 115 were provided by undergraduate students and 57 by graduate students.

**Results**

We analyzed the data using regression. The results of our analysis are shown in Table 1. As can be seen, we did find that there is a significant correlation between IEO (Individual Entrepreneurial Orientation) and DI (Digital Innovativeness). This correlation is positive – the higher the IEO of the individual, the higher the capability for digital innovativeness. We found a similar support for H2 and H4 – in both cases, we found a significant correlation. Based on H2, we can conclude that there is a significant positive correlation between EntrepSE (Entrepreneurial Self-Efficacy) and DI (Digital Innovativeness). Based on H4, we find that there is strong positive correlation between ITSE (IT Self-Efficacy) and DI (Digital Innovativeness). Interestingly, we did not find a similar support for H3. Based on the results, we accept the null hypothesis that there is no correlation between DL (Digital Literacy) and DI (Digital Innovativeness).

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<th>Coefficient</th>
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<tr>
<td>IEO</td>
<td>0.587***</td>
<td>0.125828</td>
</tr>
<tr>
<td>EntrepSE</td>
<td>0.371***</td>
<td>0.079741</td>
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**Discussion and Conclusion**

Empirical evaluation of the model showed that digital innovativeness is positively related to individual entrepreneurial orientation, entrepreneurial self-efficacy, and information technology self-efficacy. Individual entrepreneurial orientation, beliefs of self-efficacy about the entrepreneurial endeavor and beliefs of efficacy about the use of technology to accomplish objectives are individual characteristics that can be developed in educational environments through project-based learning and other experiential activities.

The negative finding related to digital literacy indicate that memorization-based teaching about digital technologies is not related to digital innovativeness. Instead of learning how particular technologies as used, the future workforce should engage in using such technologies, understand its pros and cons, delve deep into its applications, experiment with it, and by doing so, build their confidence (i.e., self-efficacy).

This research-in-progress identifies the importance of three individual traits: entrepreneurial orientation, entrepreneurial self-efficacy, and IT self-efficacy in the level of digital innovativeness, critical for the survival of the modern enterprise. By hiring employees exhibiting high levels of these traits, by promoting a culture of experimentation, and by educating its workforce to be more entrepreneurial and gain confidence in its abilities to execute and deploy digital technologies, organizations can secure their strategic position and a business landscape driven by digital innovations. After all, as Mark Andreessen anticipated: “software is eating the world.”

**REFERENCES**


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Table 1. Results for variables predicting Digital Innovativeness (n=172, *** p < 0.001)

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<thead>
<tr>
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<th>DL</th>
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<tr>
<td></td>
<td>-0.002</td>
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<td>R²</td>
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