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Teaching Information Systems in the Age of Digital Disruption

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ABSTRACT

The Information Systems discipline has long suffered an identity crisis. It has also been prone to program sustainability issues as a technology focus has waxed and waned over the last 50 years. This paper suggests a new approach to teaching Information Systems, utilizing the notion of "fundamental and powerful concepts." Using digital disruption as a fundamental and powerful concept, the authors argue for the core IS course and the courses that make up the major to be developed and centered around the transformation of business models, products, and services caused by emerging digital technologies. The paper includes an outline for the core IS course and the other courses in the major and concludes with a suggestion that the fundamental and powerful concept of digital disruption be used as an approach to teaching Information Systems.

Keywords: IS education, Fundamental & powerful concept, Curriculum design & development, Foundation course

1. INTRODUCTION

The Information Systems (IS) discipline has long suffered an identity crisis which has caused declining enrollments and IS departments either disappearing or being consolidated with other areas such as accounting or decision sciences. This paper proposes using digital disruption as a "fundamental and powerful concept" in focusing the IS curriculum, thereby making it more attractive and relevant to students and other stakeholders. Examples are provided for both the IS core course and electives.

2. BACKGROUND

2.1 Information Systems Curriculum/History

The content of Information Systems (IS) courses has been debated since the emergence of the Information Systems discipline during the 1970s and 1980s. Debates have centered on IS course content (e.g., what should be included/excluded, what is relevant/irrelevant, and what is the best mix of technical and managerial concepts) as well as on the intended audience of an IS course (e.g., future information technology (IT) professionals or students across a vast array of business/non-business disciplines). Although many outside the discipline

were less receptive to this inclusion and jealously guarded their own turf, IS was seen by IS academics as permeating a wide range of disciplines. Information Systems instructors have been consistently challenged to make course content both interesting and valuable, even for students that perceive little overlap or relevance between IS and their majors. Identifying and articulating the long-view of IS continues to be a struggle for IS educators, and many may argue that a long-view of IS has never been identified, developed, or articulated.

Across time, the IS curriculum has necessarily responded to the evolution of computing technologies and changes to the alignment of business and IT strategies. Historically, IS instructors have frequently been preoccupied with new, bright and shiny technologies in order to ensure that their students are exposed to the latest and greatest with-it gadgets and applications. Historical examples include IS educators' quick embrace of decision support systems (DSS), group decision support systems (GDSS), expert systems, executive information/support systems, and e-commerce technologies. Information Systems educators have also been distracted by evolving systems development methodologies including rapid application development (RAD), business process reengineering (BPR), and agile development; again, to ensure that their courses are up-to-date even if their students had little interest in system development processes. More recently, many IS programs have embraced diverse areas, such as healthcare, data analytics, and cybersecurity, and they have incorporated data analysis/visualization and computer forensics tools in their courses and curricula.

While many positive things can be said about the willingness of IS educators to embrace new technologies and to use them to provide meaningful learning opportunities for their students, there is a downside to their well-intentioned behaviors. Doing so has contributed to the IS identity crisis and questions about the legitimacy of IS as an academic discipline. In an effort to appear relevant, curriculum administrators have leapt to embrace emerging topics – essentially we are arguing that this approach has missed the forest for the trees.

2.2 Information Systems Identity Crisis

The field of IS is often described as having identity issues. Prospective majors frequently have difficulty distinguishing IS from other computing disciplines such as Computer Science (CS), Information Technology (IT), and information science (Downey, McGaughey, and Roach, 2009). It does not help when high school guidance counselors are more likely to encourage technology-inclined students to pursue CS or IT as a major because of their insufficient understanding of IS. Further confusion is created because university IS degree programs are not consistently located in the same college/school. While IS programs are most commonly found in university business colleges/schools, they are sometimes located in a college/school other than business, for instance in Engineering or Arts & Sciences. This is not all the fault of academia, but perhaps also a reflection of the confusion in many business organizational structures where the Chief Information Officer reports to the Chief Financial Officer (Kark, Brown, and Shaikh, 2018). The current debate around the appropriate reporting lines for a Chief Data Officer reflects this quandary and adds to the difficulty that has been experienced in defining an identity for the IS field (Corinium, 2017).

Among students and academic advisers in colleges/schools of business, the IS discipline is often less understood than other majors (Somers, 2010). Relative to disciplines such as accounting and marketing, there is less consensus about the purpose and importance of IS (Firth et al., 2011). The perceptions of prospective majors may also be affected by an inability of current IS majors and IS professors to articulate a coherent description of the field and the careers that the major prepares graduates to enter. This lack of identity may lead to courses being developed that are perhaps out of step with business needs and utilization of available resources or hasty course development without a detailed study of the industry to define those needs – particularly relevant for new and emerging technologies, even at the graduate level (Fernandez-Lamela et al, 2015). Gammack, Hobbs, and Pigott (2011) have argued along similar lines suggesting that Informatics (which includes Information Systems, Information Science, and Computing) needs to focus more on enduring concepts that are relevant to the gathering and use of information in any field of study rather than on the enabling technology. They propose that while the technologies are no doubt useful, ubiquitous, and powerful, such a technological view of the world does not promote greater consideration of issues important to business such as wisdom, knowledge, and understanding. Essentially, we need to work the other way around.

Fichman, Dos Santos, and Zheng (2014) describe how identity and legitimacy issues may combine to threaten the long-term viability of university IS programs. They perceive the presence of negative reinforcement loops at some universities have contributed to the devaluation of IS as a discipline and the dissolution of some IS departments. They note that disagreements among stakeholders about IS identity and its legitimacy as an academic discipline and low levels of student interest in the major can create low opinions among university administrators about the value of IS in the business core. Such low opinions of IS can result in IS being removed from the business core or relegated to a diminished role. Reduced presence in the core may produce additional negative effects, including reductions in the number of IS faculty members and diminished opportunities to recruit new majors and produce graduates. Facing falling IS enrollments in the 2000s, there was considerable discussion in the IS field encouraging a series of initiatives aimed at addressing this trend (see, for example, Dick et al., 2007; Granger et al., 2007; Looney and Akbulut, 2007; advocating, *inter alia,* the importance of IS in the business majors). When IS programs take steps to improve the case for IS in the business core, they may create positive loops that result in favorable perceptions of the legitimacy of IS as an academic program among stakeholders. Gammack, Hobbs, and Pigott, (2011) posit that while the information systems disciplines are important in their own right, they are also important in supporting other fields of study and particular ways of thinking. It seems this is an important but difficult message to get across to business school colleagues.

Fichman, DosSantos, and Zheng's (2014) observations about negative reinforcement loops for some IS programs align with Buck's (2015) program sustainability models which assert that a program without a strong and clear identity is less likely to attract or maintain the support of key constituents (e.g., students, university administrators). Program sustainability models also assert that, over time, a weak identity can

contribute to diminished program delivery capacity (e.g., faculty resources). A program's identity can be strengthened by clearly articulating its mission, goals, niche, and value.

Multiple IS educators have argued that a strong and clear identity is vital for IS (Benbasat and Zmud 2003; Agarwal and Lucas 2005; Larsen and Levine 2005). However, at the local level, persistent engagement with new technologies may have a detrimental impact on the development of a stable identity that can be recognized and described by stakeholders. When IS educators are quick to embrace newly minted, bright and shiny technologies, they run the risk of weakening program identity and stakeholder perceptions of the field as an academic discipline. While IS educators may see themselves coalescing around data analytics, colleagues in other disciplines view them as abandoning the Web 2.0 technologies and concepts that they emphasized so heavily in the not-too-distant past. When they act like members of an immature field of study, IS educators should not be surprised when colleagues in other disciplines ask what IS plans to be when it grows up.

As noted by Topi (2019), there has not been another time in the history of civilization when technology has as much global impact. Information systems have come to have fundamental roles in the lives of all individuals, organizations, and societies, but sometimes this goes unrecognized. Information systems are enabling rapid changes in work performance; artificial intelligence (AI) and IT-driven automation are changing job roles and relevancy of various professions at a pace that often exceeds the human capability to adapt (Friedman, 2016). Physical and digital systems are becoming increasingly interconnected and fully integrated, and in many contexts, individual actions are being captured in minute detail and analyzed more closely than ever before. Technology has become ubiquitous, almost a utility.

While IS as a discipline is rarely at the center of the development of technical components in today's IT systems, one of its core competencies lies in bringing the components and their capabilities together in ways that achieve individual, organizational, and societal goals (Topi, 2019). Although IS professionals may not be involved in the development of new technologies and their capabilities, they need to be able to understand how to integrate them into organizational systems in the context of specific industries, types of firms, and individual companies. And IS educators must be able to prepare their students for roles in facilitating the integration. Topi (2019) recognizes that the underlying technology set will continuously change, but there is relative stability in the individual competencies required to integrate technologies into effective organizational systems. Such competencies include discovering, articulating, and specifying system requirements; designing approaches for humans to interact with systems; and identifying data sources that are essential to organizations' operations. These competencies will continue to be relevant even when the technology components of systems are rapidly changing. Hence, Topi (2019) argues that IS educators should focus their efforts on developing enduring competencies in their students. He also contends that IS educators should help their students understand the organizational implications and potential consequences of computing-based systems that transform organizations and the approaches that should be used to avoid harmful consequences and strengthen the benefits of such systems for stakeholders.

3. FUNDAMENTAL AND POWERFUL CONCEPTS TO ENHANCE THE INFORMATION SYSTEMS CURRICULUM

Fichman, Dos Santos, and Zheng (2014) contend that IS identity and legitimacy as an academic discipline can be enhanced by centering IS curriculum and the IS course in the business core on "fundamental and powerful concepts." According to Nosich (2005, p. 104), a fundamental and powerful concept (FPC) is a concept "that can be used to explain or think out a huge body of questions, problems, information, and situations." Fundamental and powerful concepts are valuable because they make it easier for students to learn to think critically about what they read or hear. Since getting students to think critically in business contexts is a common goal of business programs, FPCs can help business students learn to think, ask questions, make rational decisions, avoid irrational decisions, and problem-solve like business managers (Fichman, DosSantos and Zheng, 2014).

Fichman, Dos Santos, and Zheng (2014) note that FPCs have not been used in IS education to help students think through what they read and the concepts to which they are exposed. Instead, students are exposed to technology-related information and are often left to themselves to connect the dots or consider the implications of the information. Many commonly used IS textbooks for the IS core course are written as a series of 12-15 different, very loosely connected topics: "these are the things you need to know about IS." In other words, the textbooks do not develop a theme. Using FPCs in IS education can make it easier for students to ask good questions about the technologies to which they are being exposed, especially new technologies, because everything they read and learn can be related to an FPC (Fichman, Dos Santos, and Zheng 2014).

By serving as signposts for teaching and research, FPCs can also help to provide IS with an identity. Information Systems program curriculum can be designed using an FPC and possibly with more than one FPC. Course content can be aligned with an FPC, and course delivery can be facilitated when potential materials are vetted for their connection with an FPC. When each segment of a course can be mapped to an FPC, courses are less likely to be perceived by students as consisting of topics with little or no connection. Fichman, Dos Santos, and Zheng (2014, p. 331) note that "An FPC can be particularly useful in core IS courses because it can ensure that rapidly changing technical topics are discussed in a business context and can help students to think critically about what they read and hear about IT artifacts and processes."

Fichman, Dos Santos, and Zheng (2014) maintain that a good candidate FPC for the IS core class should satisfy three criteria:

1. It must have high face validity. Faculty, students, business colleagues, and business executives must believe that the FPC is salient and important in the business context. When an FPC has face validity, topics only need to be credibly connected to the FPC to be viewed as valuable.
2. It should serve well as a persistent, organizing concept for the IS core course.

3. It should provide an identity for the IS core course that is distinct from other core courses.

Fichman, Dos Santos, and Zheng (2014) build a compelling case for digital innovation as an FPC for the IS core course and describe how it can be used to design the content and delivery of this course. They also illustrate how digital innovation can be used to provide a consistent theme and organizing framework across courses included in an IS program's curriculum. They note that anchoring IS programs on FPCs has both curricular and research implications and helps strengthen IS identity and legitimacy. For example, elective courses may be developed within an IS degree program to provide deeper treatment of FPCs. FPCs can also be used to bring greater emphasis to concepts addressed in required courses in the major, such as systems analysis and design or database systems. Connecting concepts in required courses to FPCs, such as those recommended by the IS2010 curriculum model (Topi et al., 2010), may help students understand and appreciate how/why these courses prepare them for careers as IS professionals. Similarly, the selection of an FPC for the IS core course can be used to identify and legitimize research programs and agendas that are likely to make sense to colleagues in other disciplines.

According to Fichman, Dos Santos, and Zheng (2014), from a research perspective, an FPC that is a good candidate for the IS core course is one that:

1. Can be linked to an extensive variety of past and potential future research.
2. Provides an opportunity to emphasize the distinctiveness of the impacts of the FPC on business opportunities, strategies, operations, and processes.

By being able to reshape the IS core course and an IS degree program's curriculum, and to enable the creation and implementation of research agendas, FPCs have positive effects on the IS field's identity and legitimacy. The adoption of FPCs makes it clearer to business students and other stakeholders why they should be learning about IT in the core curriculum. FPCs have the potential to improve student evaluation of the IS core course and to diffuse the perception that it consists of an ever-changing jumble of topics without clear relevance to business managers. In short, FPCs can strengthen the place of IS in the business core and lead to increased demand for other IS course offerings (Fichman, Dos Santos, and Zheng, 2014). Refocusing IS programs on FPCs can smooth or increase demand for IS instructors and legitimize the IS department and the research performed by its faculty. Buck (2015) argues that such a combination of positive impacts improves the sustainability of an IS program at a university.

Although Fichmam, Dos Santos, and Zheng (2014) provide an argument for digital innovation as an FPC, other concepts have been identified as potential FPCs or IS degree program anchors. Several of these are summarized in Table 1. Many of these satisfy most (if not all) of the criteria of an FPC that have been identified by Fichman, Dos Santos, and Zheng (2014).

Fundamental and Powerful Concept (FPC) or IS Program Anchor	Advocates (Researchers)
Artificial Intelligence	Wilson, Daugherty, and Morini-Bianzino (2019)
Big Data Analytics	Frieder et al. (2014)
Business Intelligence and Analytics	Chiang, Goes, and Stohr (2012); Mitri and Palocsay (2015)
Cybersecurity	Yang and Wen (2017)
Enterprise Systems	Antonucci et al. (2004)
Entrepreneurship	Lang and Babb (2015); Jones and Liu (2017)
Internet of Things (IoT)	Lensing and Friedhoff (2018)
New Industrial Infrastructure	Killmeyer and Sniderman (2019)

Table 1. Examples of Potential FPCs or Anchor Concepts for IS Degree Programs

4. DIGITAL DISRUPTION AS A FUNDAMENTAL AND POWERFUL CONCEPT (FCP)

Digital disruption may be an FPC for the IS core course and/or an anchor concept for an IS degree program. Digital disruption may be defined as a transformation that is caused by emerging digital technologies and business models that affect the value proposition of existing goods and services (McDonald, 2018). Reimer et al. (2015, p. 4) add that "digital disruption refers to advancements in digital technologies, that occur at a pace and magnitude that disrupt established ways of creating value within and across markets, social interactions, and more generally, our understanding and thinking." The emerging technologies that underlie digital disruption are often called "disruptive technologies" – technologies that create growth in the industries they penetrate or that create entirely new industries through the introduction of products and services that are dramatically cheaper, better, and more convenient (Kostoff, Boylan, and Simons, 2004). Disruptive technologies are commonly viewed to disrupt numerous (if not all) industries and types of organizations.

Both cloud computing and Big Data have been identified as disruptive technologies due to their widespread impacts. However, of the two, Big Data is a better candidate for being an FPC in an IS curriculum because of its potential to radically transform all business functions. The impacts of cloud computing on business functions and operations are less discernible than those of Big Data. While there are definite business impacts of cloud computing (such as diminished importance for investment in on-premises IT infrastructure), it is more likely to be viewed as an enabler than a cause of business transformation.

Today, artificial intelligence (AI), Blockchain, the Internet of Things (IoT), 5G, 3D printing, robotics, and virtual reality/augmented reality (VR/AR) are widely considered to be the most important disruptive technologies and sources of digital disruption (Harrington, 2018). When the criteria for good FPCs are applied, each of these technologies can arguably be viewed as having the potential to serve as an FPC for the IS core course or a program of research. However, since any of

these disruptive technologies may exemplify digital disruption, a more compelling case can be made for choosing digital disruption as an FPC for an IS core course and/or program of study. Applying the FPC criteria to digital disruption and addressing the following questions supports this choice.

Does digital disruption have face validity? Do students, colleagues, and business executives perceive digital disruption as salient and important in the business context?

Yes, digital disruption focuses on emerging digital technologies and business models that are changing the value proposition of today's products and services. Using digital disruption as an FPC exposes students to a wide range of disruptive technologies affecting all business functions (such as AI, 5G, and Blockchain). Different disruptive technologies relevant to a particular business context (e.g., for manufacturing, IoT, 5G, AI, robotics, and 3D printing) might be selected, or a single disruptive technology that IS degree program with which faculty members are most comfortable might be selected as a program theme. Interestingly, some of the disruptive technologies rely on other disruptive technologies (such as cloud computing and Big Data) that are becoming passé.

Can digital disruption serve well as a persistent, organizing concept for the IS core course?

Yes, while disruptive technologies will change over time, digital disruption will continue (and is likely to accelerate). Information Systems educators and researchers have historically demonstrated an interest in digital disruption. The quick embrace of new technologies by IS instructors has contributed to instability in concepts covered in the IS curriculum and the field's struggle for identity and legitimacy. The delivery of IS courses and their content has been shaped by emerging technologies and is likely to be further transformed in the future.

The plethora of "e-commerce" courses that sprang up in the late 1990s is a good example of how a disruptive technology is a digital disruption concept. Its incorporation into programs via the FPC of digital disruption may have legitimized its inclusion and preserved the identity of the discipline.

Adopting digital disruption as an FPC would enable IS educators to revisit historically robust explanations of how organizations address emerging/disruptive technologies such as the Beal and Bohlen (1957) Innovation Adoption Lifecycle model (Figure 1) which was extended by Rogers (1962).

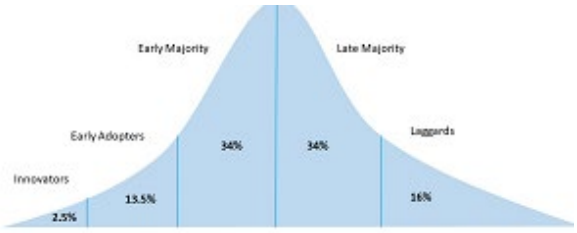

Figure 1. Innovation Adoption Lifecycle (Beal and Bohlen, 1957)

According to the Innovation Adoption Lifecycle model, Innovators include technology firms that work with technology for technology's sake and firms that adopt new technology regardless of its practicality. Early Adopters are organizations that adopt a new technology because they see its potential to provide competitive advantage and are willing to work through its deficiencies to ensure that they are among the first to realize its competitive advantage benefits. Early Majority organizations adopt the technology after Early Adopters have worked out the technology's bugs, and Late Majority firms adopt the technology after it has become a competitive necessity within the industry. Laggards, the last organizations to adopt the technology, adopt the technology when it is forced by the market to either adopt it or exit the industry.

Within the context of digital disruption, this model opens the door to healthy discussions about how a business should be organized and operated to be an innovator or early adopter. This FPC can help students critically evaluate the business implications of being early or late majority and the risks of being a laggard. It can also be used to challenge students to think about what it would be like to work for an organization in one (or all) of these innovation adoption categories.

Does digital disruption focus greater attention on how the FPC is transforming business and business organizations?

Yes, the essence of digital disruption is business transformation. As an FPC, digital disruption would create opportunities for students to read and think about the full range of the impacts of disruptive technologies on businesses, including their impacts on employment within and across industries, their potential for misuse, and their associated privacy concerns or security risks. Students can be challenged to develop compelling business cases for emerging technologies that include their potential costs and downside risks. Students are also challenged to consider innovations at the interfaces of two or more disruptive technologies (such as IoT and AI) because such interfaces are likely where future digital disruption is likely to begin. Focusing on the convergence of disruptive technologies, such as Industry 4.0 (Lasi et al., 2014) – which will be fueled by advances in AI, Big Data analytics, 3D printing, robotics, and 5G – helps students appreciate the magnitude of the impacts of digital disruption on business and business organizations.

Can digital disruption be linked to an extensive variety of past and potential future research?

Yes, the original concept of disruptive technology was introduced by Bower and Christensen (1995) and was based on studies of tangible products, including the disk drive industry throughout the mid-1980s to early 1990s. Disruptive technology later became a key component of the theory of disruptive innovation (Christensen, 1997). A disruptive innovation is a new product or service – often launched by a smaller company and targeted at a low-end market segment – that is incrementally improved until it dominates (disrupts) companies in the mainstream market. Christensen and Raynor (2003) later made a distinction between two types of disruptive innovation based on entrant market type. "Low-end disruption" initially offers a lesser product or service performance at a

lower price (to the low-end of a market) than that historically available in the mainstream market. In contrast, "new-market disruption" initially creates a new or expanded market by offering new performance attributes to a product or service that turns non-consumers into consumers. The impacts of digital disruption on society has also been the focus of past research (e.g., Latzer, 2009; Schmidt and Cohen, 2010). It has also been explored within the context of user adaptation to IT (e.g., Elie-Dit-Cosaque and Straub, 2011).

Digital disruption extends diffusion of technology theories/models (e.g., Rogers, 2003; Vishwanath and Barnett, 2011). It can be studied through the lens of technology adoption (Venkatesh et al., 2003) or organizational use of information systems (Burton-Jones and Gallivan, 2007).

Individually and collectively, disruptive technologies are the focus of current research and practical attention. Research streams with connections to mainstream IS research have been identified for several of the currently "hot" disruptive technologies, including IoT. Blockchain is increasingly pervasive in product development, supply chain, and fintech research. New business models are being created by the intersection of two or more disruptive technologies. For example, some cloud service providers are including AI capabilities in their service stacks; this combination enables businesses to quickly deploy and capitalize on mobile/cloud apps that are driven by AI and machine learning without having to make heavy investments in these intelligence technologies. This makes AI adoption more affordable and its impacts more pervasive.

The convergence of disruptive technologies similar to those mentioned above as having an effect on business transformation will undoubtedly spawn a significant volume of future research. Frameworks such as Industry 4.0 (Lasi et al., 2014) enable students and researchers to envision the business implications of the convergence of AI, Big Data, 3D-printing, IoT, and robotics. 5G will not only transform wireless communications, it will also fuel machine-to-machine (M2M) communications in Industry 4.0 as well as vehicle-to-vehicle (V2V) communications among autonomous (driverless) vehicles. This research has already begun – Davenport and Kirby (2016) proposed a convergence model which has already been cited several times in the Web of Science database, covering research topics as diverse as enterprise architecture, AI, cognitive automation, and big data in supply chain management.

Does digital disruption provide an opportunity to emphasize the distinctiveness of the impacts of the IT and IS on business opportunities, strategies, operations, and processes?

Yes, because Christensen's (1997) disruptive innovation concepts can be mapped directly to Porter's competitive forces and value-chain models (Porter, 1985), these well-worn models can contribute to a greater understanding of the impacts of digital disruption and disruptive information technologies on competitive strategy and the operations and processes that underlie value-chain components. Since IT-driven changes to the value propositions of current products and services are central in digital disruption, its salience and importance to business students and business managers are nearly impossible to discount. And, since digital disruption focuses on "creating value within and across markets" and also disrupts our "general understanding and thinking" about advancing digital technologies, the concept has exceptional potential as an FPC for the IS course in the business core as well as for an entire IS curriculum.

5. THE IMPACT OF DIGITAL DISRUPTION ON TEACHING INFORMATION SYSTEMS CLASSES

5.1 How does Digital Disruption as an FPC Impact the IS Course in the Business Core?

We propose several distinguishing modules built on digital disruption for incorporation into an IS core course oriented toward digital disruption.

- The opening module introduces digital disruption as a concept and revisits some of the major historical examples of disruptive technologies and their impacts on organizations (e.g., digital photography and the demise of Kodak, Uber and the taxi industry, Airbnb and the hotel industry). It also discusses Moore's Law (and other often cited technology-oriented laws, such as Metcalfe's Law, Nielsen's Law, and Bell's Law) with a digital disruption focus. The module concludes with a very brief introductory overview of the disruptive technologies on which the course will focus. It is envisaged that the coverage of the disruptive technologies are modified in the course as they are seen as relevant.
- A second module describes businesses as open systems and the environments (operating, industry, and remote) in which they exist. Digital disruption is discussed as an environmental change to which the business system must adapt to ensure that its products and/or services continue to have value in the market. This module is the appropriate place to discuss traditional value proposition concepts and to introduce examples of how the value propositions of existing products/services can be affected by digital disruption. It may also be the appropriate place to summarize the major components of information systems (hardware, software, people, data, etc.) and how these are evolving.
- A third module focuses on the role of information systems in competitive strategy, with special attention on how IT has been leveraged to create and sustain competitive advantage. Porter's (1985) competitive forces model is featured in this module and used to illustrate how it can be used to develop an overall strategy as well as an IT strategy for a business. The role of IS in achieving competitive advantage is discussed in this module (e.g., by enabling processes, creating/improving processes, and changing the competitive dynamics of the marketplace). The Innovation Adoption Lifecycle model and overviews of several other disruptive technologies may also be included in this module to ensure a digital disruption focus.
- A fourth module includes coverage of Porter's (1985) value chain model and how primary and support activities in a business's value chain are shaped by its competitive strategy. The module includes examples of

how value is added to products and services by primary activities; it also includes examples of how information technologies are utilized within value chain activities. Examples of changes to value chain activities caused by disruptive technologies are featured in this module.

- A fifth module provides a more detailed focus on the hardware, software, and data components of current business computing systems and how these are evolving. Special attention would be paid to cloud computing, mobility, and Big Data processing platforms. Artificial Intelligence is described within the context of software evolution, and the networking implications of IoT, 5G, and Big Data are discussed. 3D printing is highlighted as a disruptive example of the convergence of hardware and software.
- A sixth module features Enterprise Architecture (EA) as an umbrella concept for coherently tying business computing system components to business mission and strategy. The impacts of the introduction of one or more disruptive information technologies on EA components are included to illustrate how digital disruption affects organizational structure and the IT and data infrastructures currently in place to support business mission/strategy. Security architecture and infrastructure may be included in this module to illustrate the importance of addressing the security of all EA components. This includes the Defense in Depth framework, and the module challenges students to consider how security mechanisms must change to accommodate the introduction of disruptive technologies.
- A seventh module focuses on the data management and governance implications of disruptive technologies. Since some of the currently "hot" disruptive technologies (e.g., IoT, and 5G) will fuel significant expansion of Big Data, this module is oriented toward Big Data and the technologies used to process very large data sets. Students are required to consider the implications of Big Data for customer service as well as its potential to erode personal privacy and raise new ethical challenges.
- The course includes at least one module that provides an in-depth focus on a disruptive technology. This module focuses on the characteristics of the technology, how the technology works, why it is disruptive (how it is changing business models and/or the value propositions of current products/services), and how it is reshaping strategies, organizations, operations, and business processes. The goal of each module focusing on a disruptive technology improves student understanding of the technology, how/why it is reshaping businesses, and what organizations can do to maximize potential benefits and to minimize its potentially harmful impacts.
- The course also includes a module that strives to get students to focus on what organizations and individual business professionals do to effectively handle the digital disruptions that they will inevitably face. This module addresses different business structures that enable timely identification of emerging technologies with disruptive potential, and it includes a discussion of how organizations perform due diligence for disruptive technologies.
- Another module emphasizes the impact of digital disruption on entrepreneurial start-ups which create unique value propositions outside large organizations. This may include not only Uber, Lyft, and ByHours, but other innovative ideas that may not be viable without the emergence of the disruptive technology.
- Relevant hands-on exercises, simulations, case studies, and projects are incorporated into the core IS course to reinforce the application of concepts discussed in the course.

Digital disruption as an FPC for the IS course in the business core will highlight IS identity and legitimacy as a business discipline. It demonstrates the connection between information technologies, business models, and product/service value propositions, and it helps anchor the field of IS as a legitimate field of study for business students. It also may be used to reframe numerous concepts that are typically covered in an IS core course and enable them to be mapped to a consistent theme with obvious business implications.

5.2 How does Digital Disruption as an FPC Shape the Required Courses in the IS Curriculum?

The IS2010 Curriculum Model recommends six major courses in addition to the IS core course: a database course, a systems analysis and design course, an enterprise architecture course, an IT infrastructure course, a project management course, and an IS strategy/management/acquisition course (Topi et al., 2010). An IS degree program that conforms to this curriculum model and adopts digital disruption as an FPC can reshape its required courses to provide a digital disruption flavor across the curriculum.

The database course is reconfigured to include coverage of large dataset storage repositories (data warehouses) and Big Data processing platforms. Such content modification is consistent with the increased volume of data generated by disruptive technologies such as IoT. Since both small data and large data processing are likely to co-exist, at least in the short-term, the database course includes data cleansing processes such as ETL (extraction, transformation, loading). Hadoop clusters are featured as Big Data processing platforms, and MapReduce concepts are also included. Students consider the data security, management, and governance issues associated with Big Data and disruptive technologies.

With digital disruption as an FPC, the systems analysis and design course focuses greater attention on the technical and economic feasibility of systems, especially new systems that are striving to incorporate disruptive technologies within existing business computing systems. Students develop use cases for emerging technologies and consider how a disruptive technology could be depicted in a to-be process diagram. A case that requires students to redesign a business system to absorb an emerging technology is included in the course.

An enterprise architecture (EA) course is redesigned to ensure a discussion of the impacts of the introduction of one or more disruptive information technologies on EA components. This focus enables the illustration of digital disruption on organizational structures and the IT and data architectures that support business mission/strategy. Security architecture is

emphasized to illustrate the importance of securing all EA components. This course or the IT infrastructure course includes the Defense in Depth model as an organizing framework for enterprise security. This course also includes a case that requires students to critically evaluate the impacts of a disruptive technology on EA.

If digital disruption is adopted as an FPC, the IT infrastructure course is restructured to ensure that its content directly addresses the impacts of disruptive technologies on enterprise networks. Big Data generators such as IoT will dramatically increase the data load on business networks, and this course explains how and why this happens. Advances in wireless communications will accelerate rapidly with the introduction of 5G, and these changes also add considerable new data loads to on-premises' networks. With digital disruption as an FPC, greater emphasis on cloud computing services is warranted in this course. The Internet of Things, for example, is essentially cloud-based, so it is important for students to have a strong grasp on cloud computing before they can appreciate the impacts of IoT.

With digital disruption as an FPC, the project management course devotes more attention to the business case and ROI for new technologies. Students work on a case that features the adoption of a disruptive technology. The discussions of agile methodologies are reframed to describe its potential role as a digital disruption source.

The IS strategy and management course includes a deep dive into Porter's (1985) competitive forces and value chain models. Special attention should be given to the role of IT and digital disruption on markets, competitive forces, and strategy selection. Strategic choices are mapped to IT use in value chain activities. When digital disruption alters strategic direction, its subsequent impacts on value chain activities should be addressed. Digital disruption is also discussed in the context of IT management and governance.

5.3 How does Digital Disruption as an FPC Shape the IS Degree Program Electives?

An IS degree program that adopts digital disruption as an FPC is able to reinforce the program's emphasis with electives. Examples of potential course titles and their focus are identified below:

- Disruptive Technologies. This course explores the history of digital disruption and focuses on recent disruptive technologies (e.g., Big Data, cloud-computing), current disrupters (e.g., Blockchain, 3D printing, IoT), and emerging disrupters (e.g., 5G). The impacts of these technologies on business models, operations, and processes are stressed.
- Digital Innovation. This course highlights the innovative potential of digital disruption and the importance for organizations to be persistent consumers of IT-enabled innovation if they desire sustainable competitive advantage. Digital entrepreneurship is an important aspect of this course. Innovation spawned at the intersection of two or more disruptive information technologies are explored.
- Industry 4.0. Industry 4.0 provides an organizing framework in which multiple disruptive technologies are addressed, including 3D-printing, robotics, Big Data, AI, IoT, and 5G. It could enable a deep dive into each of these technologies as well as the synergistic effects of their combined use.
- Blockchain Applications. This course explores the wide range of industries that are currently being impacted by Blockchain as well as those likely to be affected in the future. Ideally, this course provides students with the opportunity to design, develop, and implement a Blockchain application.

6. DISCUSSION

Over the last 50 years, the lack of a clearly defined identity of the Information Systems discipline has impacted the content and focus of both IS curriculum and IS research. Additionally, IS departments are in jeopardy. This article proposes a different approach to developing the IS curriculum based on Fichman, DosSantos, and Zheng (2014) by adopting fundamental and powerful concepts (FPCs).

Fichman, DosSantos, and Zheng (2014) emphasize that bold steps are needed to strengthen the identity and legitimacy of the field of IS as an academic discipline. They contend that IS degree programs can benefit from adopting fundamental and powerful concepts (FPCs) that are easily recognized as being salient and important in business contexts by students, colleagues in other business disciplines, and business executives. In general, the adoption of an FPC enables an understanding of an area of study. We focus on IS as the field of study and propose digital disruption as the FPC to enable concepts in the IS curriculum to be coherently tied together and grounded within the business domain. Two educational areas benefit. First, an FPC helps the IS core course to be perceived as a true and valuable business course with relevance to all business majors and other faculty teaching in the business school, and second, IS majors gain more insights into the field. As the focus of the IS field becomes easier to define and explain, more students will be attracted to the major, and the IS core course will become more relevant to students in other majors. By strengthening IS identity and legitimacy as a discipline, FPCs contribute to IS degree program importance and sustainability. Information Systems departments become relevant at the university and are more stable.

We demonstrate that digital disruption is a good candidate as an FPC for IS degree programs because of its grounding in and impact on business markets and business models. We provide course modules for the required business IS core courses adopting digital disruption as the FPC. We offer examples of digital disruption as an FPC used to enhance the content of the other required courses in an IS degree program that conforms to the IS2010 Curriculum Model. We identify some potential elective courses for the IS program using the same FPC.

We recognize other potential FPCs and IS program anchor concepts. Most of these have strong connections to the business environment. Information Systems degree programs that are not housed in a college/school of business may need to select a business FPC or chose a different interdisciplinary FPC that has impacts beyond businesses. However, FPCs in business IS degree programs should have strong business connections and implications.

We suggest digital disruption as an FPC to help focus the IS curriculum. As IS educators, we must continue to strive to improve the IS curriculum for both majors and non-majors. All stakeholders gain from such improvements: students benefit, faculty benefit, researchers benefit, businesses benefit, IS departments benefit, and the IS field benefits.

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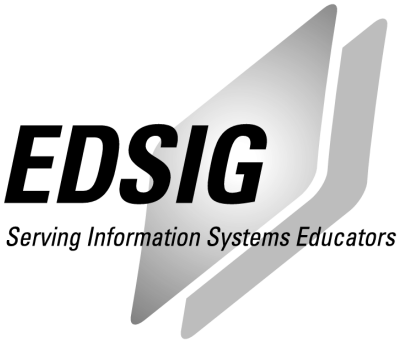

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