Digital Strategic Initiatives: Conceptualization and Illustration

Gabriele Piccoli[1, 2] & Joaquin Rodriguez[2]

[1] University of Pavia, Pavia, Italy, e-mail: gpiccoli@cct.lsu.edu
[2] Louisiana State University, Business Education Complex, Baton Rouge, United States of America, e-mail: gpiccoli@cct.lsu.edu, jrod122@lsu.edu

Abstract This essay responds to calls for discerning so-called IT "x" and digital "x" phenomena. Research in this area promises to make an important contribution since the emergence of digital "x" labels runs the risk of diluting the core of IS literature. Our paper advances a preliminary definition of key constructs: digital strategic initiatives and digital resources, differentiating the latter from traditional conceptualizations of IT or IS resources. It also delineates two different approaches to the execution of digital strategic initiatives: a) orchestration of digital resources and b) creation of novel digital resources. We demonstrate the first one with a case illustration of home grocery delivery and the second with the case of a dark kitchen provider in the restaurant industry.

Keywords: digital strategic initiative, digital resources, IT/IS resources, value creation, value appropriation.

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1 Introduction

What is a digital strategic initiative? How does it differ from a generic strategic move or an IT-enabled Strategic Initiative? How can optimal digital strategic initiatives be *designed*, *implemented* and *sustained* over time by a firm intent on creating and appropriating economic value? These questions are central to the information systems discipline, and information systems research is best positioned to contribute to our collective understanding of digital innovation and digital transformation phenomena. It is however paramount that such contribution be based on sound ontological and definitional grounds, because the "consequences of ignoring ontological considerations of this kind are significant […] This problem is likely to be especially severe in the digital context" (Faulkner and Runde 2019, p. 1283).

To contribute to the discourse, this paper explores the *structure* and *design* of Digital Strategic Initiatives (DSI) - defined as *identifiable competitive moves* that depend on *digital resources* to *create and appropriate economic value*. Because they are competitive moves, DSIs are devised and implemented by organizations. As with any designed artifact, "to imagine a better design, the designer must know the relationships between structural elements" (Baldwin and Clark 2000, p. 34). It follows that when the structural elements change, as with the increasing availability of digital resources, the relationships between those structural elements change, and they create new design possibilities. Therefore, the premise of this paper is that in digital strategy the role of digital resources in crafting strategic initiatives, and the outcomes that are likely to occur from these initiatives, will be directly impacted by the nature of such digital resources. Specifically, the paper advances a precise definition of key constructs: digital strategic initiatives and digital resources, differentiating the latter from traditional conceptualizations of IT or IS resources.[1] The paper also delineates two different approaches to the execution of DSIs: a) orchestration of digital resources and b) creation of novel digital resources. We demonstrate the first one with a case illustration of home grocery delivery and the second with the case of a dark kitchens provider in the restaurant industry.

[1] For the remainder of the paper we will use the shorthand "IT" to refer to IT or IS resources, assets and capabilities.

2 Digital Strategic Initiatives

The strategic information systems literature defines IT-enabled strategic initiatives as "identifiable competitive moves that depend on the use of IT to be enacted, and are designed to lead to sustained improvements in a firm's competitive position" (Piccoli and Ives 2005, p. 748). This research tradition conceptualizes strategy "not as the making of a few discrete 'one time' decisions, but as the configuration of interrelated and interlocking activities. Thus, IT-dependent strategic initiatives do not simply consist of the building of a computer system or application that, allegedly, generates competitive advantage until it is successfully replicated; rather, they consist of the configuration of an activity system, dependent on IT at its core, that fosters the creation and appropriation of economic value" (Piccoli and Ives 2005, p. 748).

In keeping with the same conceptual level, DSIs are identifiable competitive moves that depend on the use of digital resources to create and appropriate economic value. Of interest to this discussion are only those strategic initiatives that could not be feasibly implemented by the firm without a core of specific digital resources. By definition, DSIs are predicated on digital resources use. The adoption of the term "digital" is intentional here, and it signals a substantive departure from the term "IT-dependent" (Piccoli and Ives 2005). While many authors and theorists agree that there is a difference between IT phenomena and digital phenomena (Hanseth and Lyytinen 2010; Kohli and Grover 2008), introducing new terminology begs the question of why the old label is not descriptive of the new phenomenon (Baiyere et al. 2017; Rodriguez and Piccoli 2018). This challenge is addressed in the next section.

3 Digital Resources

While digital resources play a central role in digital innovation (Henfridsson et al. 2018) the literature stops short of providing a first principled definition of the digital resource construct. One that draws on previous IS research, while identifying critical differences between the traditional conceptualization of IT resources and digital resources (Kohli and Grover 2008; Lusch and Nambisan 2015).

In line with IS research, we define resources as "assets and capabilities that are available and useful in detecting and responding to market opportunities or threats" (Wade and Hulland 2004, p. 109). Assets are "anything tangible or intangible the firm can use in its processes for creating, producing, and/or offering its products (goods or services) to a market" while capabilities are "repeatable patterns of actions in the use of assets to create, produce, and/or offer products to a market" (Wade and Hulland 2004, p. 109). IT assets are typically hardware and software (e.g., IT infrastructure, information repositories), whereas IT capabilities stem from organizational competencies (e.g., IS-business partnership, software development skills). While this focus was appropriate in a context dominated by "IT boxes," with the increasing pervasiveness of digitalization (Tilson et al. 2010; Yoo et al. 2010), *digital resources* are emerging as a key construct for explaining "digital phenomena" (Henfridsson et al. 2018). Digital resources are a specific class of digital objects that a) are *modular*, b) *encapsulate objects of value*, either assets or capabilities, c) that are accessible by way of a *programmatic bitstring interface*. We devote the remainder of this section to clarifying and supporting this definition. We do so by first reviewing the ontology of digital objects, and then exploring the ontology of digital resources in order to clarify their differences with traditional IT resources.

3.1 Digital Objects

An object is an enduring, structured collection of elements. They are comprised of distinct components, objects themselves, organized in a discernible arrangement (Faulkner and Runde 2019). Objects can be grouped in two distinct sets: material and nonmaterial. This classification depends on whether they exhibit spatial attributes, like volume or mass. Thus, while the touch screen of an iPhone is a material object, the phone's iOS operating system is a nonmaterial object. Hybrid objects, a subset of material objects, are comprised of both material and nonmaterial elements (e.g., a working iPhone running iOS).

Bitstrings, a type of nonmaterial object, are "the sequences of 1's and 0's used in computing to represent information in binary form" (Faulkner and Runde 2019, p. 804). Bitstrings, separated in program files and data files, occupy a central role in digital computing. By way of encoding and inscription, bitstrings assume the role of bearer of other nonmaterial objects (Faulkner and Runde 2013). This ability to bear nonmaterial objects of value "is arguably the single most important feature of the bitstring [leading to the conclusion that] the demand for bitstrings is a derived one, arising from demand for the nonmaterial object inscribed into a bitstring, rather than for the bitstring itself, and where multiple layers of nonmaterial bearer may exist between the bitstring and the ultimate object of value" (Faulkner and Runde 2019, p. 1293). This property results in a layering of nonmaterial bearers such that the object of value is far removed from the ultimate physical bearer. In other words, while ultimately requiring a physical carrier (e.g., a solid-state drive), nonmaterial objects are increasingly inscribed into layers of bitstrings that abstract further and further away from the constraints of the physical bearer.

3.2 Environmental Context of IT x versus Digital x

While ontologically sound and built from first principle theorizing, the original definition of digital objects does not allow for a differentiation between IT phenomena and digital phenomena. The above ontological arguments consider any hardware/software system rooted in the Von Neumann digital computer architecture and the stored program concept (Von Neumann 1945) as a digital object. Replacing the traditional IT "x" concepts presents an opportunity to create improved conceptual clarity that considers the distinctive characteristics of novel digital phenomena. In the remainder of this section we show that, broadly speaking, digital phenomena occur in an environmental context that is *infrastructural*, *combinatorial* and *servitized*.

a) Infrastructural: IT has left the boundaries of corporations to permeate virtually any aspect of society, in large part thanks to the Internet (Hanseth and Lyytinen 2010). Localized and bounded IT infrastructures increasingly give way to digital information infrastructures – "unbounded, evolving, shared, heterogeneous, and open installed bases of capabilities" (Tilson et al. 2010, p. 754) configured as "evolving sociotechnical systems comprising an installed base of diverse information technology capabilities and their user, operations, and design communities" (Hanseth and Lyytinen 2010, p. 4). The above definition highlights the recursive and shared nature of digital information infrastructures. They are socio-technical artifacts (Silver and Markus 2013) that are comprised of similar elements that non-exclusively contribute to the functioning of other information systems (Henfridsson and Bygstad 2013).

b) Combinatorial: Technological progress stems from the combination and recombination of evolving elements components into new structures, leading to a constant state of combinatorial technology evolution (Arthur 2009). An important driver of combinatorial evolution in technology is the availability and variety of elements that serve as the "building blocks" of new structures such that "the more there is to invent with, the greater will be the number of inventions" (Arthur 2009, p. 21). In the information systems context, modules are digital objects characterized by varying degrees of openness and unboundedness (Yoo et al. 2010). To the extent that the interfaces of digital objects do not share assumptions or data with a specific design hierarchy (i.e., they are unbounded), and they are amenable to address unexpected tasks (i.e., they are open), the resulting components become available to organizations that can easily integrate them into novel recombinations (Clark 1985; Yoo 2013).
c) Servitized: While the combinatorial nature of digital phenomena pertains to their nature as digital objects, servitization captures the managerial and contractual characteristics of digital phenomena. The technical aspects of artifact design (e.g., design rules and task structure) are accompanied by a contract structure, explicit or implicit, that provides the framework for possible activities (Baldwin and Clark 2000). Such contract structure must fit the task structure underlying the design and production processes of the firm's outputs. Servitization represents the contractual availability of resources as services, rather than assets. Recent research on digital platforms has discussed the role of boundary resources in governing the interactions between the platform and its users (Eaton et al. 2015). Generalizing from this early work we note how servitization is a direct implication of the ontology of digital objects in that these elements of the information infrastructure are shared open and unbounded (Yoo et al. 2010), but they are also highly abstracted. However, the defining characteristic of servitization is not in the nature of what is being servitized. Rather servitization is about the codification and inscription of the contract structure into bitstrings. The result is that relationship and governance is dynamic and agile, enabling organizations that engage in combinatorial evolution to obtain the service on an as needed basis and to pay for it on a consumption basis. The ability to encode into bitstring the contract structure represents a fundamental shift compared to traditional intra- or

inter- organizational IT systems (Rai et al. 2006) where both governance and technical agreements required lengthy negotiations and ad-hoc formal agreements.

3.3 Digital Resources

We conceptualize digital resources as a specific class of digital objects that a) are *modular*, b) *encapsulate objects of value*, either assets or capabilities, c) that are accessible by way of a *programmatic bitstring interface*. Digital resources leverage the primary characteristics of the bitstring: the capacity to bear objects of value, either assets or capabilities. Digital assets encapsulate nonmaterial or hybrid objects borne by bitstrings. Digital capabilities encapsulate competencies borne by bitstrings. As a consequence, digital resources are nonmaterial objects in their own right, divorced from their physical bearers. One of the defining characteristics of digital resources is their modularity. As any modular component enforcing the information hiding principle (Parnas 1972), digital resources abstract the details of their inner working and restrict points of interactions with other resource to their interface. Thus, the interface is the "preestablished way to resolve potential conflicts between interacting parts of the design" (Baldwin and Clark 2000, p. 73) and with each new layer of abstraction, the complexity of previous technological evolutions (Arthur 2009) is "hidden away" into a new module (Baldwin and Clark 2000). In the case of digital resources, the potential conflicts handled by the interface and its design pertain to both the technical and governance decision space. As shown by the proponent of modularity theory, the technical aspects of artifact design (e.g., design rules and task structure) are accompanied by an explicit or implicit contract structure, that provides the framework for activities within the design hierarchy (Baldwin and Clark 2000). It follows that a defining characteristic of digital resources is the design and structure of their interface as a *programmatic bitstring interface*. It is the bitstring nature of the interface, we argue, that warrants referring to this class of digital objects with the new label of *digital resources*.

Consider digital payment processor Stripe. The firm exposes a set of digital resources that enable developers to plug a payment module into their applications. In the context of DSIs, Stripe exposes digital capabilities because it encapsulates objects of value, the ability to programmatically process payments, as a modular component, accessible through a digital interface. Stripe's digital capabilities are not only modular and accessible by way of a programmatic bitstring interface instantiated as a set of APIs that regulate both the technical and governance aspects of resource utilization. But they are also portable, a special case of digital resource, because Stripe provides the translator modules, in the form of client-side libraries that developers must import into their own applications, to make requests to the Stripe API. Stripe offers translator modules in the most widely used programming languages (i.e., Ruby, Python, PHP, Java, Node, .NET) in order to make its digital capabilities widely portable and product agnostic. As such, they are leveraged for process payments in different design hierarchies (e.g., website, iPhone app, Amazon Echo skill).

In summary, digital resources are *structurally different* from IT resources as originally conceptualized. Where IT resources where categorized as either technical, like IT infrastructure or business applications (Melville et al. 2004), or managerial, like technical IT skills or IT management skills (Wade and Hulland 2004), digital resources are socio-technical artifacts. Their technical characteristics as well as their contract structure are embedded into the digital object and interface. Note as well that digital resources could not exist outside of their infrastructural, combinatorial and servitized digital environment. This context provides the "terroir" necessary for digital resources to emerge, develop and be harvested into value creating DSIs.

4 Digital Strategic Initiatives: Two Illustrations

With a clear definition of digital resources as the building blocks of DSI, we identify two different approaches to the execution of Digital Strategic Initiatives (DSI). As noted above, DSIs are identifiable competitive moves that depend on the use of digital resources to create and appropriate economic value. It follows that there are two pathways to DSI value creation: a) orchestration of digital resources and b) creation of novel digital resources. The first consists in leveraging existing digital resources and recombining them in a novel value creating proposition (Henfridsson et al. 2018). The second consists in building a valuable digital resource around unique objects of value that can be made available to external organizations by way of a programmatic bitstring interface. We provide two illustrations that are presented as "pure exemplars" for illustrative purposes.[2]

[2] The two cases are not intended to be rigorous analyses of the two DSI archetypes. Rather, they are illustrations aimed at clarifying the definition of DSI and at providing examples of digital resources.

a) Instacart focuses on grocery delivery intermediation, enabling customers to select items from about half a billion listings across twenty thousand locations and have the order delivered to their door under two hours. The analysis will show how a DSI like Instacart grocery delivery relies on a complex blend of digital resources, traditional IT assets and capabilities, as well as complementary resources (see Table 1). Digital resources are core to the initiative's success, in the sense that the initiative could not be feasibly executed without them.

b) Cloud Kitchens is a provider of "smart kitchens" that are optimized for delivery only restaurants. Cloud Kitchens enable restaurateurs to pay for the space as they go, with contracts as short as one month. The kitchen infrastructure is a physical asset that is rented to the restaurateur, who is able to customize it and configure it with specialized equipment her restaurant concept requires. But Cloud Kitchens develops and offers an array of digital resources that a restaurateur can orchestrate, along with their cooking and management skills, into a value proposition of food delivery.

Table 1: Examples of resources orchestrated by Instacart and created by Cloud Kitchens

Firm	Resource	Type	Description
Instacart	Grocery catalog	IT Asset	Digital representations of 500,000,000 grocery items (price, name, image), from over 20,000 supermarkets. Data is compiled from grocers and is owned by Instacart.
Instacart	Maps	Digital Asset	Instacart incorporates maps exposed by Google in its shopper and customer apps.
Instacart	Cloud-first Development	IT Capability	Instacart developed custom predictive models to make millions of item listings easily browsable at scale. To do so it leveraged AWS Elasticsearch, and historical purchase data.
Instacart	Payment processing	Digital Capability	Instacart collects money from the customer and immediately pays the grocery stores, handling any adjustments, refunds or discounts. It integrates payment processing capabilities exposed by Stripe.
Instacart	Fraud prevention	Digital Capability	Instacart ensures the use of legitimate credit cards. It integrates a fraud prevention capability exposed by Sift.
Cloud Kitchens	Online order processing	Digital Capability	Cloud Kitchens enables restaurateurs to receive delivery orders from major food delivery platforms (e.g., Deliveroo). Orders are consolidated and integrated into one order flow for the kitchen.
Cloud Kitchens	Food delivery	Digital Capability	Cloud Kitchens exposes food deliver capabilities to its tenants by relying on partnerships with food delivery platforms.

Table 1 lists some of the characterizing resources in the Instacart and Cloud Kitchens cases. In the case of Instacart, an orchestration type DSI, we identify and describe IT resources and digital resources – both assets and capabilities. For Cloud Kitchens we identify and describe two digital capabilities the firm creates and makes available to its restaurant customers.

5 Discussion and Conclusions

The two examples of DSI illustrate how such initiatives are enabled by the infrastructural, combinatorial and servitized competitive environment that fosters the development and feasible use of digital resources. Contrast Instacart with a firm that aimed to provide the same value proposition in 1996: Webvan. Webvan, the largest failure of the dot-com era, closed its doors in June 2001 after spending over $1.2 billion in funding. In order to provide home delivery, Webvan had to hire drivers, build warehouses, purchase trucks, write custom made software for customer ordering and order fulfillment, buy servers and run their IT infrastructure in dedicated datacenters. Conversely, Instacart could leverage the existence of a digital information infrastructure that includes a full stack of networking hardware and communication protocols enabling real-time data exchange and mobile devices in the hands of customers and freelance shoppers. Whereas Webvan had to purchase a fleet of trucks, hire drivers and grocery pickers, a fixed cost investment (McAfee 2002). Instacart relies on freelance "shoppers" who work self-scheduled flexible hours and receive variable pay depending on the number of deliveries executed. For technology infrastructure, Instacart relies on Amazon Web Services (AWS) RDS storage and the EC2 computing. In other words, Webvan had to custom develop an integrated technology infrastructure and use internal resources to offer its value proposition. Conversely, Instacart orchestrates digital, IT and complementary resources relying on the ability to access them services built upon an underlying shared, open infrastructure and recombine them into a cohesive value proposition (i.e., two-hour grocery delivery).

The two examples also illustrate how digital resources differ from the traditional conception of IT resources. While not negating the existence and value of traditional IT assets and capabilities, the cases show how digital resources differ in their structure and composition. Digital resources are cohesive wholes (i.e., modules) that can be readily recombined with other technology or complementary resources by connecting through a digital interface. For example, a restaurant that leverages the Cloud Kitchens online ordering digital capability would interface its independent or intermediated ordering presence (e.g., Deliveroo) with the Cloud Kitchens module and receive orders for preparation and delivery. Similarly, Instacart leverages Stripe's fraud prevention capability by integrating it with its app via Stripe's API.

The premise of this paper is that information systems research is best positioned to contribute to our collective understanding of value creation and appropriation in the digital era. The discipline has accumulated a wealth of knowledge about the strategic role of information systems, and such knowledge is instrumental in understanding how digital strategic initiatives can be *designed*, *implemented* and *sustained* over time. Yet, given the proliferation of digital "x" constructs that parallel well-established IT "x" ones, it is critical to surface the difference between IT phenomena and digital phenomena. We believe this is even more important at this time when the emergence of digital "x" labels run the risk of diluting the core of information systems literature and its potential influence on organizational and business research. To the ongoing discourse we contribute a precise definition of key constructs: digital strategic initiatives and digital resources, and an illustration of two different approaches to the execution of digital strategic initiatives: a) orchestration of digital resources and b) creation of novel digital resources.

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