How Practice Diffusion Drives IoT Technology Adoption and Institutionalization of Solutions in Service Ecosystems

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Abstract

This paper proposes a framework for considering how practice diffusion drives the adoption of IoT technology and fuels institutionalization of solutions within service ecosystems. Practice diffusion requires the adaptation of a practice (using a wearable device) as it emerges across distinct sociocultural contexts. The adaptation of practices allows for the adoption of technology in different ways. New materials are linked with pre-existing meanings and competences as practices emerge and become embedded within a social structure. For IoT technologies, materials include a device and its associated digital data. Thus, practice adaptation requires linkages that enable the integration and use of both a device and data. We highlight a growing mental health crisis and the potential of wearable devices as medical aids, particularly for adolescents who spend much of their time connected to the internet. We consider important linkages to help institutionalize unique solutions for those in need.

Keywords: Practice diffusion, Internet of Things, Institutionalization, Service Ecosystems, Technology Adoption

1. Introduction

Diffusion is largely studied with respect to innovation and primarily focused on how a new technology, service or idea is adopted within a particular social context (Rogers 2003). Traditionally, the study of diffusion examines the adoption of technology through macro-level industry trends (i.e., S-curve) or micro-level behaviors and characteristics of individuals (i.e., types of adopters). However, this emphasis on broad patterns and individual characteristics limits the understanding of the meso-level processes through which diffusion occurs. To better understand complex and multi-level processes of diffusion, a systems perspective of diffusion is needed.

Service science "is the study of service systems and of the co-creation of value within complex configurations of resources" (Vargo, Maglio and Akaka 2008). This growing interdisciplinary field provides important insights into the social and systems drivers of value co-creation and innovation. Along these lines, recent advancements of a service-ecosystems and institutional perspective on diffusion underscore value cocreation as essential to systems well-being and defines innovation as a process that leads to lasting social change (Vargo et al., 2020). This work highlights the social drivers and consequences of diffusion that enable the continuation of innovation at micro, meso and macro levels of social interaction. In this view, diffusion becomes an essential, rather than subsequent, part of the innovation process because it is required for broader social change.

A service ecosystem lens provides a dynamic and multi-level context for studying innovation as a social process that leads to social change. This view contributes to conversations in service science that aim to understand how resources are integrated, value is co-created and innovation progresses (Maglio and Spohrer 2008). However, the meso-level process through which institutionalization occurs and lasting social change is made requires further investigation. Here, we explore how practice diffusion (Akaka et al., 2021), as a particular social process, leads to institutionalization as well as continuous innovation.

Practices have been recognized as a nexus of sayings, doing and understandings (Schatzki 1996) that are studied as the "smallest unit" of social analysis (Reckwitz 2002). Practice diffusion has been defined as "the dispersion of a nexus of sayings, doings and understandings (Schatzki 1996) within and across distinct sociocultural contexts (Shove et al., 2012)" (Akaka et al. 2021). It is important to note that practices are socially embedded phenomena and a practice itself does not move. Rather, each unit of a practice is comprised of several key elements – meanings, competences and materials (Shove et al., 2012) – and it is the movement of these elements of a

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practice that enable practice reproduction across systems of practices (Giddens 1984). In other words, a practice spreads through a process of practice emergence as its associated materials, meanings and competences move and are integrated within systems of practices. As practices emerge, they are adapted to fit with existing systems of practices, which are embedded within distinct social contexts.

We explore the process of practice diffusion associated with the practice(s) of using wearable devices (e.g., smart watches, rings, clothing) connected to the Internet of Things (IoT). More specifically, we consider the adoption of technology that is comprised of both a device and of data in a mental health context. We propose a framework for considering how the adaptation of device-based and data-based practices enable the adoption of technology. We argue that practice diffusion enables adoption of novel IoT technologies and can ultimately fosters institutionalization of using wearable devices across a variety of social contexts. This innovation process drives development and deployment of new wearable technologies. We argue that practice diffusion can potentially extend product lifecycles, as revealed through adoption S-curves (Rogers 2003), by shifting the focus from adoption of technologies to adaptation of practices and providing opportunities to fuel continuous innovation in service ecosystems.

2. Conceptual Foundation

2.1. Practice Diffusion

Practice diffusion as a process through which a nexus of sayings, doings and understandings is adapted across a multitude of diverse social and cultural contexts, over time (Akaka et al., 2021). Prior research highlights several core elements of practice – materials, meanings and competences – and reveals the linkages among these elements that enable the spread. These linkages include codification (links between meaning and competences), transposition (links between meaning and materials) and adaptation (links among meanings, material and competences within systems of practice). The process of practice diffusion is fueled by the formation of these linkages, which result in the emergence of a variation of a practice.

The extent to which a practice remains in tact is dependent upon the outcome of practice reproduction. In other words, as practice elements (meaning, materials and competences) move, they are linked together and with other systems of practice by processes of codification (meaning and competences) and transposition (meaning and materials). As these elements of practice are linked, a practice emerges. However, this practice exists within a new system of practices, and must therefore become adapted. The adaptation of a practice leads to different forms of practice reproduction – demarcation, imitation, acculturation, and innovation. Our primary interest here is in the innovation outcome. How does the adaptation of practice allow for the adoption of a new technology?

Warde (2005) emphasizes the multiplicity of practices in markets and explains that people engage in practices to pursue variety and fulfill wants. He draws on Schatzki's (1996) distinction between dispersed and integrative practices. According to Schatzki (1996: 91) "a dispersed practice is a set of doings and sayings linked primarily by an understanding they express…[t]heir 'dispersion' consists simply in their widespread occurrence across different sectors of social life." Integrative practices are "more complex practices found in and constitutive of particular domains of social life" (*ibid*: 98), including specialized practices, such a farming, fishing and painting. Schatzki (1996) argues that integrative practices, although distinct, cannot exist without the presence of dispersed practices and, conversely dispersed practices emerge through the enactment of a particular integrative practice.

Kjellberg and Helgesson (2006) develop a framework for conceptualizing market practice(s) that contribute to the formation of all markets. They conceptualize these dispersed practices as "bundles of practices including material arrangements that contribute to perform markets" (Araujo, Kjellberg and Spencer 2008: 8). Market practices include three broad and interwoven categories: 1) exchange practices – those concrete activities that contribute to the execution of individual economic exchange, 2) normalizing practices – those practices that establish norms for interaction, and 3) representational practices – those practices that depict what a market is and how it works. Market practice(s) include all efforts to shape markets (Kjellberg and Helgesson 2006). Vargo and Akaka (2012: 211; emphasis added) extend this market practices framework (Kjellberg and Helgesson 2006) beyond exchange to consider "resource integration [as] *a central practice in value co-creation.*" This underscores the centrality of practices in value cocreation, innovation and market formation. It allows for the consideration of interrelated micro, meso and macro levels of action and interaction that sustain and evolve various social structures.

To understand how value is created within meso-level communities, Schau, Muniz and Arnould (2009) apply a practice approach (Schatzki 1996; Reckwitz 2002; Warde 2005) in a meta-analysis of how dispersed community practices contribute to value creation. This focus on community practices led to the recognition of a number of dispersed practices that contribute to the

value creation among distinct groups of people (Schau et al., 2009; Thomas, Price and Schau 2013). The organization of dispersed practices is driven by "understandings, rules and teleoaffective structure" (Schatzki 1996: 99). Comprehending the rules and structure is critical to illuminating social behavior. To better understand how practices are organized, scholars have applied an innovation diffusion approach that focuses on the institutionalization of solutions (Vargo et al., 2020) and provides a complimentary perspective to understanding value creation and market formation.

2.2. Institutions and Service Ecosystems

Research on institutions in markets shifts the foci of social interaction and highlights the importance of dynamic social structures in influencing value creation (e.g., Humphreys 2010; Scarabato and Fisher 2013). Institutions are interrelated with practices, as institutions are also social phenomena that contribute to ongoing interactions and shape broader social structures. Giddens (1984: 17) argues "[t]hose practices which have the greatest time-space extension within such [societal] totalities can be referred to as institutions." Thus, practices that exist over time and spread across social space can be conceptualized as institutions. Institutions spread across time and space through the enactment of practices.

Institutional approaches applied to the study of markets provide insight into how legitimation, as well as innovation, occur (Humphreys 2010; Scarboto and Fischer 2013; Vargo, Wieland and Akaka 2013). Attention to institutionalization (processes of institution formation, stabilization and change – Vargo et al., 2013) has grown, as scholars strive to understand the processes by which different social structures are formed and reformed as markets emerge and evolve (Humphreys 2010; Scarboto and Fischer 2013).

Humphreys (2010) echoes Scott (1995) highlighting three types of legitimacy – regulative, normative and cultural cognitive. According to Scott (1995), the study of regulative elements focuses on the influence of majorities or authorities in developing formalized rules (laws) for others to follow. Normative elements generally emerge through more organic processes, as expectations develop through repeated actions and interactions (Scott 2001). The emergence of cultural-cognitive institutions is even less formalized and can be seen as shared understandings and common meanings without obvious sources of origin. Vargo, et al., (2013, p. 95) recognize innovation as an integral part of institutionalization and argue, "[i]nstitutions do not emerge in a vacuum; they always challenge, borrow from, and, to varying degrees, displace prior institutions". Thus, the study of institutions in markets and institutionalization as market formation requires the consideration of how institutions relate to each other, and how intersecting institutions influence the multiplicity of structure (Sewell 1992).

Importantly, a focus on institutions and institutionalization is rooted in a service ecosystems approach to innovation. This view emphasizes joint value creation at micro, meso and macro levels of interaction, and makes salient the importance of value co-creation practices (Vargo and Akaka 2012) as well as institutions in markets. Enduring practices reflect processes of institutionalization, and collections of institutions constitute institutional arrangements. These assemblages of institutions influence the dominant institutional logic in a particular social and cultural context. Institutional arrangements connect the various concepts related to social action and structures by moving beyond how the macro influences the micro (global becomes localized) to consider how the micro influences the macro (local becomes globalized).

3. Digital Technology and the IoT

Technology is essential to service provision (Bitner et al., 2010) and a central component of value cocreation (Maglio and Spohrer 2008). As digital technology advances at rapid speeds, it is increasingly evident that virtual services can replace many in-person encounters and digital platforms allow for capturing personal data in real time in a variety of ways. From banking, to retail, to education, service providers are grappling with the evolution of digital technology and how to not only balance virtual and in-person experiences, but also how to create digital feedback loops that can provide additional data to make more informed decisions.

Traditional views of technology and innovation tend to separate the development of a technology from the use of a device, which suggest that value is created in technology development and subsequently destroyed through its use (Normann 2001; Orlikowski 1992). In the case of digital technologies, the value creation process is further extended through the use of not only the device but also the data collected through human interaction with a given digital platform. Online communication platforms such as websites trace click-throughs and time spent on a page, which can be used to assess user interest in content or a product itself. In the IoT, the continuous innovation of digital devices has led to smaller (wearable) devices with larger amounts of data and the ability to track actions and interactions of people throughout their daily lives.

The development of wearable devices in the IoT is often driven by organizational efforts to collect personal data from customers anytime and anywhere

(e.g., “smart” watches). The data collected through the IoT is applied across different consumer contexts and also used to guide behavior (e.g., when to stand, breathe or exercise). More specifically, health data streams can inform a variety of actors, including medical professionals, insurance companies, patients and families, and support decisions regarding prevention, diagnosis and treatment. Although users recognize the benefits of connectivity provided by wearable devices, some are also leery about data privacy and security when adopting and using devices that continually track their behaviors and are generally unsure about how the data are being used (Cumbley and Church 2013). Understanding the complexity and adaptation of the social practices (Schatzki 1996) that guide adoption of wearable devices in the IoT is an important step in designing novel solutions that can benefit both customers and firms (Akaka et al., 2021).

Prior research regarding technology adoption generally focuses on consumer readiness (e.g., Parasuraman and Colby 2015), acceptance, and use of a particular product or idea (e.g., Venkatesh et al., 2012), with little, if any, consideration of uses of data, or the systems of practices that support or limit the adoption of wearable devices. Lack of attention towards collection and use of data and extended social factors limits the understanding of the tradeoffs associated with adoption decisions in the IoT, and how these tradeoffs influence the cocreation of value for individuals, organizations and the wider ecosystem.

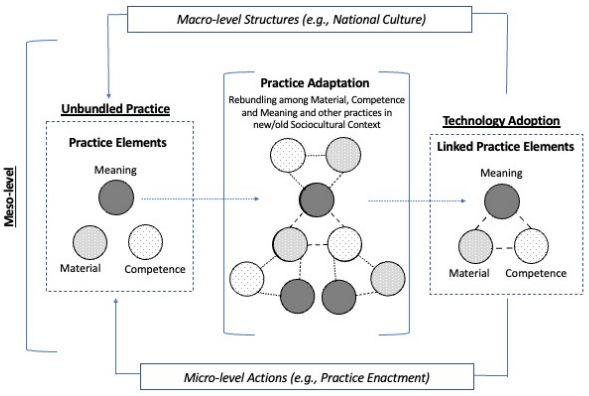
We consider the adoption of IoT technology in general, and wearable devices in particular. More specifically, we discuss the need and potential use of a wearable device in a mental health context in which patients make important decisions regarding their health journeys and patient compliance is a critical part of mental health and wellbeing. Patients could potentially use the enhanced data collected by the wearable device to improve and maintain their mental health. This is important because these technologies can potentially provide assistance with home-based mental health monitoring and can enhance the productivity of existing mental health professionals and help to address the mental health service provider shortages increasingly experienced since the COVID-19 pandemic era began. Furthermore, understanding existing systems of health practice is critical especially with adolescent populations who are comfortable with being connected to the internet but may find it difficult to adapt IoT practices with their existing systems of practice. Because IoT technologies have both a technological and a data component there is an added need for caregivers to consider the tradeoffs between informed decisions and privacy, which can be difficult to reconcile.

4. Practice Adaptation and IoT Adoption

Practice adaptation is the process through which all three practice elements (materials, meanings and competences) are linked together as they are nested within a new system of practices. This process occurs as elements of a practice, such as a material IoT device, moves into a new social structure and becomes intertwined with the pre-existing meanings and competences within that social structure. For example, when a heartrate monitor is used to detect specific inconsistencies attributed to underlying medical conditions. Because practices are social phenomena, they do not exist in isolation, as materials move, they must become linked within particular meanings and competencies (the knowledge for what to look for and how to use the device and assess the data). As a material device becomes linked to meanings and competences, a use practice can emerge within a social context. In this way, although elements of a practice can move on their own (e.g., a material artifact can move across cultures) a practice as a social unit cannot.

In order for a practice to exist it must be linked to other elements of practice that are pre-existing within a given social system. This requires adaptation of the original practice. Figure 1 depicts the process of practice adaptation that enables technology adoption.

Figure 1. Practice Adaptation and Technology Adoption



Adapted from Akaka et al., 2021

This image portrays the unbundling (Normann 2001) of a practice in which one or more of the elements of a practice (such as using a wearable device) can move into an alternative social context (such as the integration of a smart watch into a specific healthcare context). As unbundled elements of a practice move into a different social context they can align or misalign with existing systems of practice. If elements of a practice align, they are adapted and linked to other pre-existing meanings, materials and/or competences. The adaptation of a

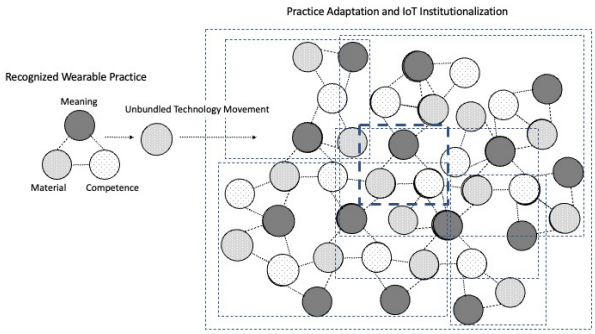
practice is especially important for the adoption or use of a technology (Orlikowski 1992) because materiality is embedded within sociality. In other words, in order for the material elements of technology to be adopted, the practices associated with those materials must be adapted within the social structure as well.

It is important to note that for IoT technologies the materiality of concern includes both the device (the hardware) and the data (the information that lives within the software). This is critical for IoT developers to know because they cannot focus solely on the device when developing new technology, they must also consider the value and the use of data, as well as the practices required to apply the technology. In this way, data becomes a material artifact that requires linkages to meanings and competences before practices can emerge. In other words, in order to deploy a new IoT technology, consideration must be paid to the adaptation of practice associated with the data, as well as the device.

5. Practice Diffusion and Institutionalization

The study of practice diffusion requires the consideration of the movement of practice elements and adaptation of practices across time and social space. This movement draws attention to the importance of institutions in enabling or hindering the spread of a practice. Institutions are essentially structured by systems of practices (Giddens 1984), or linkages between meanings, materials and competences (Shove et al., 2012) that make up the understandings, doings and sayings that underpin our daily lives (Schatzki 1992). Because of this, as practices diffuse and (re)emerge across a variety of social and cultural contexts, they become institutionalized – or normalized and integrated and embedded within those same social and cultural contexts. The emergence and embeddedness of practices influence structural change. Figure 2 illustrates how an unbundled element (Normann 2001) of a recognized practice, such as a sensor or accessory, can move into a new context as practices are adapted. When practice adaptation supports the adoption of an IoT technology, institutionalization can occur.

Figure 2. Practice Adaptation and Institutionalization



Adapted from Akaka et al., 2021

Institutionalization occurs within institutional arrangements – i.e., assemblages of social norms, beliefs and collective meanings – that play a role in the adoption of new technologies (Vargo et al., 2020). Exponential growth of innovation in the Internet of Things (IoT) draws attention toward complexity of institutional arrangements, which include institutions that guide the development and use of new sensor-based devices, as well as institutions that guide the collection and use of data that is collected by those sensors (Chandler et al., 2019). The IoT is conceptualized as "a network of entities that are connected through any form of sensor" these entities can be "located, identified, and even operated upon" (Ng and Wakenshaw 2017, p. 4).

Development of new technologies in the IoT is often driven by organizational efforts to collect personal data from customers anytime and anywhere. Furthermore, the data collected through the IoT is applied across different contexts and used to make a variety of decisions. For example, mental health data streams can inform a variety of actors, including medical professionals, insurance companies, patients and families, and support decisions regarding prevention, diagnosis and treatment. Although customers recognize the benefits of connectivity provided by the IoT, they are leery about data privacy and security when adopting and using devices that continually track their behaviors and are generally unsure about how the data are being used (Cumbley and Church 2013). Understanding the complexity of institutional arrangements that guide adoption in the IoT is an important step in designing solutions that can benefit both customers and firms (Chandler et al., 2019).

The influence of institutions and institutional arrangements has been explored with regard to innovation in general (Vargo et al., 2020) and the IoT in particular (Chandler et al., 2019). However, the way institutional arrangements are aligned and misaligned in the adoption of IoT technology remains unclear. This is important because IoT technologies have both a technological and a data component to consider and these may be difficult to reconcile. Prior research

regarding technology adoption generally focus on consumer readiness (e.g., Parasuraman and Colby 2015), acceptance, and use of a particular product or idea (e.g., Venkatesh et al., 2012), with little, if any, consideration of data. Lack of attention towards data limits the understanding of the tradeoffs associated with adoption decisions in the IoT, and how these tradeoffs influence the cocreation of value for individuals, organizations and the wider ecosystem. However, the consideration of practice diffusion as a driver of IoT innovation sheds light on how social processes enable the adoption or use of material artifacts, including both devices and digital data. Mental health is an increasingly important context for understanding how wearable IoT devices can support patient journeys.

6. Institutionalizing IoT Solutions in Mental Health Ecosystems

The use of wearable devices has been increasingly institutionalized across a variety of physical health contexts – to track step counts, activity levels and calories burned. However, a growing mental health crisis and shortage of service providers underscores the need for consideration of wearable devices for use beyond the physical to assess and monitor mental health as well (Hickey et al., 2021). Although mental health illness such as anxiety and depression as well as suicidal ideation has grown exponentially over the past decade, the ongoing COVID-19 pandemic has exacerbated the need for mental health services across a variety of social groups, particularly adolescents, teens, and young adults, in the U.S.

In 2021, the U.S. Surgeon General (hhs.gov) distributed a report that identified a national emergency – the tragic rates of adolescent mental illness. This report revealed that from between 2007 and 2018 the suicide rates among 10-24 year-olds in the U.S. increased by 57%. According to Surgeon General Vivek Murthy, "Mental health challenges in children, adolescents, and young adults are real and widespread…The COVID-19 pandemic further altered their experiences at hom, school, and in the community and the effect on their mental health has been devastating. The future wellbeing of our country depends on how we support and invest in the next generation." This "wicked problem" (Huff et al., 2017) becomes even more difficult to resolve because of the shortage of mental health medical providers and lack of resources to deal with the growing demand. Solutions to this problem are elusive. The use of wearable devices seems to be one option that can combat the demand and provide real time data that can assist caregivers in making timely and appropriate decisions.

Prior research indicates the efficacy of wearable devices for supporting mental illness through tracking of heart rate variability, which detects anxiety and stress. However, the commercially available devices are not as accurate in measurement. In addition, electroencephalogram measures are able to detect depression reliably, but are not readily available on the market (Hickey et al., 2021). This indicates an opportunity for the development of more accurate devices, but the question is, will people in general and adolescents in particular use them? And how can developers of such technologies increase the likelihood of technology adoption among groups of people who have unique systems of practice, such as the youth. We don't claim to provide specific solutions to this problem. However, to provide a pathway forward, we apply our proposed framework to consider several key steps and linkages for developing and institutionalizing solutions.

6.1. Assess the Institutional Arrangement

Although the youth in America have grown up with the internet, research suggests that less than 10% of teens in the US use wearable devices (Koch 2018). This could pose a challenge for mental health experts and parents striving to understand the physiological shifts that accompany mental illness like stress, anxiety and depression among today's youth. Thus, although the technology exists to track mental health in real-time, the use of the technology among the targeted audience is in question. In order to increase the likelihood of adoption and ultimately the institutionalization of a solution, the diffusion of particular practices must be considered.

Youth have been found to exist within a particular social context that is distinct from both childhood and adulthood, and vary across cultures (Kjeldgaard and Askegaard 2006). Thus, in order to understand how materials can be integrated into their existing systems of practice, the social norms and meanings must first be considered. In addition, because many members of this group remain under the supervision or guardianship of their parents, those systems of practice must be considered as well. Because of this, in order for a wearable device to be adopted the extended institutional arrangement, constituted by both caregivers and adolescents must be considered and tensions require reconciliation.

6.2 Identify Elements of the Desired Practice

Use of a wearable device requires the consideration of all three elements of practice: material, competence and meaning. Furthermore, in the IoT material elements of a practice include both a device and data. Thus, competence requires the ability to know how to use the

device and how to interpret and apply the data. Meanings of a device can vary, depending on the type of device (e.g., smart watch, ring, bracelet) and the data that is provided (e.g., active states or rest). Because the material elements of a wearable device are more complex, additional care must be given to considering the meanings and competence required to use the device in a meaningful way.

6.3 Link Meaning, Material and Competence

Practice adaptation is required for the integration of a wearable device such as a smart watch within a social group who does not often use similar devices. Thus, the material device and its associated data must be linked to particular meanings and competences that pre-exist within a system of practices. Connectivity to smart phones can be considered as an opportunity to transfer information since there is evidence that although teens don't often use wearables, they do often use smartphones (Koch 2018). Thus the use of the wearable device should align with pre-existing competences of using a smartphone as well. It is also important to consider the meaning of the device and the data provided. The value of each may be vastly different for the teen and for the parent who provides care. While the teen may be interested in information regarding health and wellness (e.g., an athlete wanting to perform better), a parent may be interested in the heart rate data that indicates levels of stress and anxiety.

6.4 Support Practice Emergence

When linkages between materials, meanings and competences occur, a practice can emerge. In this case, once a material device and its data can be connected with positive or valuable meanings and the user feels confident in wearing the device and interpreting the data, the use of the wearable may be repeated. As use of the wearable continues, the practice emerges and is linked within the existing systems of practice related to technology and wellbeing. The practices for the adolescent and the caregivers will vary – and parents may rely on different data than the psychologists or physicians. In order for the multi-sided digital technology to be fully adopted, practices must emerge across different users. In other words practice emergence must be supported for adapted practices within their distinct use contexts (Vargo et al., 2008).

6.5 Sustain Institutionalization of a Solution

Practice emergence does not guarantee the institutionalization of a solution or the formation of a viable market. In order for a solution to be institutionalized the associated practice or practices must be sustained. In the case of adolescent mental health, it is not enough for a few youth to try a device and caregivers to use the data to help make informed decision. Rather, institutionalization of a solution requires the repeated reproduction of a practice and the scaling of the practice throughout a given social structure. To increase the sustainability of a solution, a practice must then be diffused, via adaptation, across other social structures as well. In the case of wearable devices, what may start as a reminder to breathe may be adapted to help alleviate anxiety or cope with panic attacks that are brought on by stress and anxiety. As practice adaptation allows for the use of a wearable to be used across different situations and various sociocultural contexts, institutionalization of solutions are sustained.

6.6 Assess Efficacy of Technology Adoption

The institutionalization of a solution can lead to the development of new markets and aid in meeting the needs of particular groups. However, continuous innovation on ongoing improvements to value cocreation require the (re)consideration of the efficacy of an adopted technology. Social contexts are constantly changing – sometimes slowly and sometimes quickly. Service ecosystems are dynamic and ever evolving. Thus, the assessment of efficacy of an adopted technology, especially one that is common place, is necessary to identify changes in the environment and the gap in alignment between the current solution and evolving problem. In the case of mental health, it is likely that much iteration will be needed because the problem of mental health is rooted in a variety of individual and collective causes. An effective solution will be difficult to develop and even harder to sustain.

7. Discussion

Service science is the study of how technology, people and institutions shape value cocreation and drive innovation (Maglio and Spohrer 2008). This paper provides a meso-level process for considering how practice diffusion drives innovation within service ecosystems. More specifically, we consider how IoT technology is adopted as sustainable solutions through the process of practice diffusion. This provides important insights into the nature of diffusion and adoption of digital technologies that are comprised of both devices and data.

It is clear that there are no easy pathways forward in leveraging wearable devices in IoT to solve complex problems like mental health. However, the breakdown of practice elements helps to unpack or unbundle

(Normann 2001) the central elements for value cocreation and innovation: materials, meanings and competences (Shove et al., 2012). Thinking through the processes to develop linkages that lead to adaptation highlight the importance of transposition (links between materials and meaning) and codification (links between competences and meaning). Moreover, the connection between practice emergence and institutionalization of a solution is a critical factor in transitioning from a short-term gimmick (e.g., fad diets) to a long-term solution (e.g., developing healthy eating habits).

In many ways, practice diffusion extends the context of value cocreation beyond a particular service system (Maglio and Spohrer 2008) to an extended service ecosystem (Vargo and Lusch 2011) of potential solutions and plausible outcomes (Weick 2005). Because of this, the process of value cocreation demands consideration of multiple levels of action and interaction as well as various perceptions on value (Vargo et al., 2008). Innovation, then, becomes based on adaptation rather than adoption and modified solutions are needed to solve common problems across a variety of social and cultural contexts.

The proposed framework depicts how practice adaptation enables technology adoption. However, because technology is socially embedded (Orlikowski 1992), technology itself evolves as it is used by different people across a variety of contexts. In this way, technology is an operant resource – one that is capable of acting on other resources (Vargo and Akaka 2012). Ultimately, technology shapes the social structures in which it is embedded. It does this through the diffusion and adaptation of practice – or the linking of materials, meanings and competences within existing systems of practice. Once practices emerge within a systems of practice, the social structure changes, solutions are institutionalized, and new markets form. It is the formation of new markets that can potentially solve wicked problems because unlike public policies, competing markets coexist everywhere. They afford individuals with options and provide multiple potential solutions for a given problem. This is especially important with wicked problems, when there is no one size fits all and solutions need to be adapted to survive.

8. Conclusion

This paper proposes a framework for considering how practice diffusion drives IoT technology adoption and the institutionalization of solutions. We draw attention to an emergent situation that is known as the mental health crisis in the U.S. We use this as an example of a complex and systemic problem that can benefit from leveraging IoT technology and advancing its application in unique and specific ways. We hope this exploration of practice diffusion and technology adoption broadens the conversation regarding value cocreation to consider the materiality of data as well as devices and the important linkages associated with both. We invite others to join in this effort to understand how practice diffusion can help to solve wicked problems and advance our understanding of value cocreation and innovation in service ecosystems.

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