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► **To cite this version:**

Gustav Du Plessis, Hanlie Smuts. The Diffusion of Innovation Experience. 20th Conference on e-Business, e-Services and e-Society (I3E), Sep 2021, Galway, Ireland. pp.318-329, 10.1007/978-3-030-85447-8_28 . hal-03648114

HAL Id: hal-03648114

<https://inria.hal.science/hal-03648114v1>

Submitted on 21 Apr 2022

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The Diffusion of Innovation Experience

Leveraging the human factor to improve technological adoption within an organisation.

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Abstract. The evolution of digital technologies is by its very nature, disruptive, compelling organisations to reconsider the relationships among employees, customers, and suppliers. In addition, organisations must carefully consider their strategies to fully exploit the digital revolution's benefits as these technologies are diffused across organisations at an accelerated pace. Organisational strategies related to technological advancement such as cyber-physical systems, artificial intelligence, and new forms of human-machine interaction, must therefore address economic benefit for the organisation, while minimising job dislocation, preventing digital exclusion, and reducing risk of marginalisation. In order to devise a comprehensive approach, the aim of this study is to suggest a model, The Diffusion of Innovation (DOI) Experience, which organisations may reference to encourage and facilitate the adoption of, and adaptation to, technology by employees within organisations. Such a model is relevant in the context of facing organisational transformation as it focuses on the individual employee experience and reaction to change, specifically within the context of adopting a new technology. By applying the DOI Experience Model, organisations can improve their change management practices with regard to technological change, and subsequently increase the success rate of technology adoption within the organisation.

Keywords: Diffusion of innovation, technology adoption, technology adaption.

1 Introduction

Over the past two centuries, technological growth has been categorized into four periods, known as industrial revolutions. Each industrial revolution not only significantly improved the technology of its time, but greatly improved on the technology of the preceding revolution [1]. This trend of continuous increase in technological improvements witnessed through each industrial evolution can be explained by Moore's law, a forecasting model that suggests technology grows exponentially [2].

The current (fourth) industrial revolution has seen unprecedented levels of technological advancements, introducing rapid and abrupt changes that disrupt the status-quo across all industries [3, 4]. Consequently, organisations are forced to implement digital

transformation strategies, and in some cases, change their entire business model to ensure that they stay competitive and survive in the long term [5, 6].

Considering that disruption concerns technological advancement, and its impact on an organisation's business model, the frequency and timing of technology adoption is crucial [6]. By keeping Moore's law in mind, it can be assumed that the severity and frequency of disruption will only increase over time, meaning that organisations will need to continually adopt new technologies to succeed [2, 7].

Timely technological adoption could therefore be considered a key element of organisational success [6], and can be viewed from both an organisational and individual perspective. This means that while an organisation makes the initial strategic decision to adopt a technology, it is up to the individuals within the organisation to actually adopt to and use the technology. Ultimately, without individual acceptance, the adoption of any new technology introduced from an organisational perspective will most likely not succeed [8].

This paper proposes a model that organisations can use to encourage and facilitate the adoption of technology by individuals within their organisation. The suggested model will focus on the individual experience or reaction to change, specifically within the context of adopting a new technology.

The remainder of the paper is structured as follows: in section 2 we provide the background to the study and the approach to the study is discussed in section 3. In section 4, an overview of the data analysed is presented, and section 5 details the proposed model. We conclude in section 6.

2 Background

Research over the last decade scrutinised the wide array of factors that influence organisations and their performance [9]. Although these studies are thorough on the effects on the economy, the change caused by technology must be considered [10]. According to Li et. al. [11], the view from top management related to changes such as digital transformation, is key to an organisation adopting new technologies [11]. This adoption needs to begin internally by establishing a culture of responsiveness that must be understood and applied both internally and externally [12, 13].

In the following sections diffusion of innovation and the human factor in adopting and adapting to new technologies will be discussed.

2.1 Diffusion of Innovation Theory

Diffusion of innovation theory by Rogers [14], in summary, suggests that individuals within a social system (such as an organisation) will adopt technology at a different rate, depending on how innovative they are. The innovativeness of an individual refers to how early they will adopt a new technology or idea, in comparison to the average member within a social system. Within this framework, individuals fall into one of five adopter categories, namely: innovators, early adopters, early majority, late majority,

and laggards [14]. Each adopter category comprises of individuals with similar levels of innovativeness, as described in Table 1 below.

Table 1. Adopter Categories [14]

Category	Description
Innovators	Innovators are very eager to try new ideas, technologies, or innovations and desires or invites risk. Innovators are not always as integrated into, or respected by other members of the social system.
Early Adopters	Early adopters are respected by members in their social system, has the highest degree of opinion leadership. The individuals in the early majority, late majority, and laggard groups will often check whether these individuals have adopted before trying or using a new technology or idea.
Early Majority	Adopts just before the average member of a social system. Does not want to lead adoption, but are willing to adopt once necessary and others have started to do so.
Late Majority	Very sceptical of new innovations and will only adopt once most of their peers have done so.
Laggards	Laggards do not want to adopt any new innovation and are content with the past and current way of doing things. They are the last to adopt, and will often not adopt, or only adopt when it is too late.

The bell curve in Figure 1 below illustrates the distribution of each category within a social system [14]. Considering the innovativeness of individuals within each adopter category, there is a clear distinction between the first and second half of individuals. The first half will adopt a new technology eagerly or after some persuasion, while the second half will resist change and adoption to varying degrees.

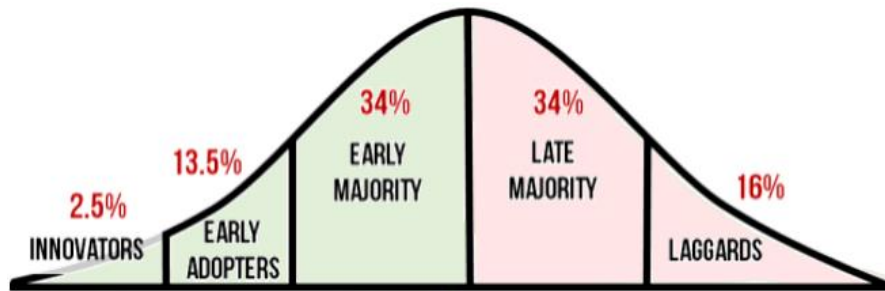


Fig. 1. Technology Adoption Curve [14]

This, unfortunately, illustrates that even though the introduction of a new idea, innovation or technology may have obvious advantages, achieving adoption by most of the individuals within a social system is often extremely challenging [14].

2.2 Accounting for the Human Factor

While Diffusion of Innovation Theory (Section 2.1) is successful at categorising individuals into adopter categories, it is important to account for the individual perspective of technology adoption within a social system as well, as their adoption is a significant element of success [8].

Within the context of an organisation as a social system, technology adoption will often be seen as a change management process, in which the organisation will attempt to guide individuals through change.

Two popular models organisations utilise to facilitate change, Kotter's Eight Step Change Model [15] and Lewin's Three Step Model [16], emphasises transformation and aims to encourage change, but ultimately does not account for the individual experience of the change or transformation process. To account for how individuals experience change on a personal level, one can look at models or theories that explain how individuals experience change, loss, or grief. These models or theories contain stages or phases that differ significantly from transition or change management models used by organisations.

Models or theories with similar phases are Kubler-Ross (1967) [16–18], Fink (1967) [16], Grant (1996) [16], Reynolds (1994) [16], Bupp (1996) [16] and Perlman and Takacs (1990) [16]. For the purpose of this paper, the five phases of the Kubler-Ross Grief Cycle will be used. It documents the phases through which individuals pass when dealing with loss or grief, such as facing their own death due to the diagnosis of a terminal illness, or the death of a loved one. The model describes 5 phases, which ultimately lead to the acceptance of the loss or change [17]. Table 2 briefly describes each phase in the context of a person losing a loved one,

Table 2. The Stages of Grief – Kubler-Ross Grief Cycle [18]

Phase	Description
Denial	The person experiencing the loss of a loved one is in shock and disbelief, and cannot believe or fathom that the person he or she has lost is truly gone, and that they will never “walk through the door” again.
Anger	Anger is not necessarily logical. It manifests in different ways, such as being angry at the person for leaving them, anger at yourself for not doing something to stop it from happening, or anger at a third party. Anger is usually the front line of feelings such as sadness, loneliness or hurt and is the first stage of the healing process.
Bargaining	Before a loss, such as the diagnosis of a terminal illness of a loved one, the person would “bargain” that they would do anything if their loved one would be spared, for instance “I will never be angry at my father again if he lives”. After a loss, the person gets lost in past through guilt and “if only” or “what if” statements, trying to bargain the pain away and yearning for the past.
Depression	The depression stage sets in when the person moves from the past to the present. In this stage, grief hits harder than the person could ever have imagined. They withdraw from life, and get lost in a vacuum of grief and sadness.

Acceptance does not mean that everything is better or “okay”. It means that the person has recognised and accepted the new reality, and can slowly start moving on from grief, trying to have more good days than bad days.

Although the death of an individual or their loved ones may seem like an extreme comparison to an individual’s experience of adopting a new technology, the cycle of dealing with change and loss is appropriate when considering the adopter categories at Section 2.1.

For example, when adopting to technological change in an organisation, an individual that falls into the Late Majority or Laggard groups could experience various forms of loss or grief, such as: increased uncertainty and anxiety, the loss of normality, the loss of comfort and possible humiliation in front of their peers. In contrast, individuals that fall in the Innovator or Early Adopter categories will have a positive experience to technological change, and will eagerly adopt any new technology [14].

3 Research Approach

The aim of this paper is to present a model that organisations can use to encourage and facilitate the adoption of technology by individuals within their organisation. In order to achieve this outcome, we followed a design science approach where the aim of the research output is on utility [19]. The implementation of this utility, as an outcome of the design science process, must be defined clearly [20, 21], and its application may be refined through utility evaluation [11, 22].

The integrated model, the utility, in Section 4, titled “The DOI Experience Model”, will be synthesized mainly from the two theories which have been discussed in this paper. *Firstly*, the phases of the Kubler-Ross Grief Cycle (Section 2.2) will be adapted slightly to fit the narrative of individuals who are experiencing change due to technology adoption within an organisation. *Secondly*, the adopter categories, as per the Diffusion of Innovation Model (Section 2.1), will be used to identify facilitators and inhibitors to the adoption of technology, with the support of Chasm Theory (Section 4.2). *Lastly*, an integrated model will be presented (Section 4.3), with an application guide (Section 5) that can be used by organisations to apply the model in conjunction with their chosen change management models or processes. The application of the model will assist organisations to improve their change management practices with regard to technological change, ensuring that organisations may leverage and benefit from adoption of and adaption to digital technologies.

4 Integrated model - The DOI Experience

The DOI Experience Model, when used in conjunction with other change management tools and processes, will ensure that individuals within an organisation are comfortable and eager to use the new technology before it is officially implemented, and ready to switch once the new technology when it replaces the previous.

4.1 The Five Stages of Technological Adoption Cycle

By using an adapted version of the Kubler-Ross Grief Cycle (Section 2.2) to recognise individual experiences, organisations can address how different groups of individuals process technological adoption within the organisation [14, 16]. In the first step of the utility design process, the original five phases were adapted to present five suggested stages that describes an individual's experience when adopting a new technology, and whether their reaction to change is positive or negative. The five stages are illustrated in Figure 2.

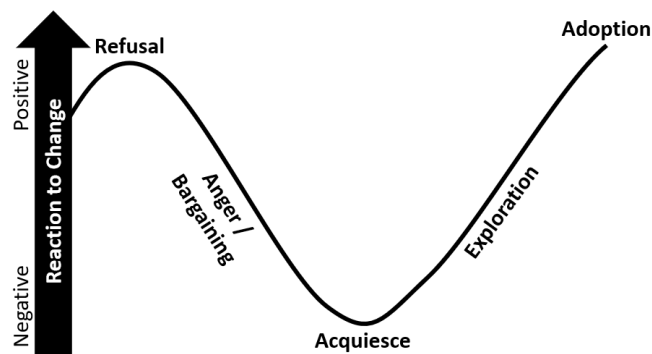


Fig. 2. Individual Technology Adoption Cycle (Adapted from [16])

The first phase, *Refusal*, refers to when an individual outright refuses to adopt any new technologies or innovations – in this phase, they are still positive about the change, because in many cases they believe it will not happen if they refuse, similar to denial in Section 2.2. In the next phase, *Anger/Bargaining*, the individual realises that that change is inevitable, but will still resist through demonstrating anger and/or trying to negotiate their way out of the adopting; as they move through this phase, their reaction to change becomes increasingly negative. In third phase, *Acquiesce*, the individual stops resisting and reluctantly accepts that adoption will ultimately be necessary, but does not necessarily approve. In this phase, the reaction to change is at its lowest point, as the individual feels forced into changing. During the *Exploration* phase, having accepted that they will need to adopt a new technology, individuals start exploring the new technology for themselves. As they see the potential benefits of the new technology, their reaction to the change gradually increases. Finally, *Adoption* means that the individual is comfortable to use the new technology through exploration, feels positive about the change, and will willingly adopt the new technology once it replaces the current one.

4.2 Facilitators and Inhibitors

The second step of the utility design process, examined the scope and impact of individuals on a change. When examining each category of Diffusion of Innovation Theory

(Section 2.1), it can be seen that individuals within those categories are either a facilitator or inhibitor to change. Innovators and Early Adopters (Section 2.1), from here on referred to simply as Early Adopters, will be a facilitator to technological adoption, and will speed up the change process for an organisation by eagerly adopting new technologies. Considering their positivity towards, and eagerness to adopt new technologies, they will not experience the Individual Technology Adoption Cycle as illustrated in Figure 2. These individuals should be seen as change champions, and be utilised by the organisation within their larger change management process; for example, if the organisation is applying Kotter’s Eight Step Change Model (Section 2.2) they should form part of the minimum mass of change coalition [15].

Mainstream Adopters, which include the Early Majority, Late Majority and Laggards categories (Section 2.1), will not experience adoption in the same way. The individuals in each of these categories will initially be an inhibitor to change, and go through the Individual Technology Adoption Cycle, starting with Refusal, and ending with Adoption. From a change management perspective, it is important to consider that each category within the mainstream adopters group will go through the Individual Technology Adoption Cycle (Figure 2) at a different pace. For example, the Early Majority should theoretically move from Refusal to Adoption in much shorter timeframe than Laggards, as depicted in Figure 3 below.

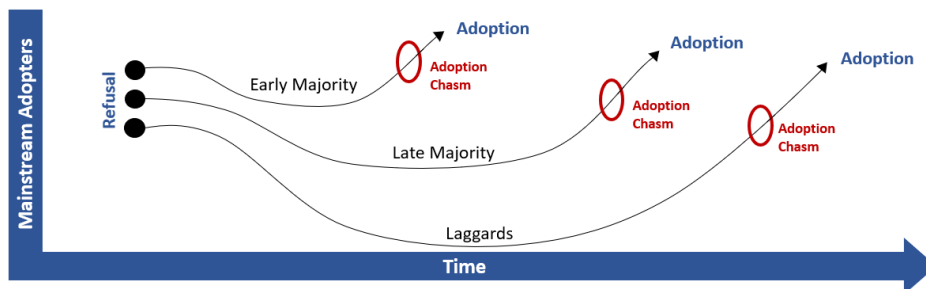


Fig. 3. Mainstream Adopters Change Timeline (Adapted from [14, 23])

Adoption Chasm. Once an individual in the mainstream group reaches the adoption stage, they become a facilitator to change. This shift is described as an adoption chasm, which is indicated by the red circle on each line in Figure 3 above. The principle of this shift is based on Chasm Theory, which describes the pivotal point when adoption of a new innovation crosses from the early market to the mainstream market; “crossing the chasm” is generally regarded as an indicator of market adoption and success. [23]. In the context of this model, the pivotal point refers to when an individual, and ultimately adopter category, moves from Exploration to Acceptance (Figure 2), adopts the new technology within the organisation, and finally becomes a facilitator to change.

4.3 Integrated Model

Figure 4 below presents the design utility, an integrated model, that was synthesised from the theories and principles discussed throughout the paper, more specifically Figure 2 and Figure 3. It presents an overall model to illustrate how various types of individuals experience change on a personal level, due to technological adoption within an organisation.

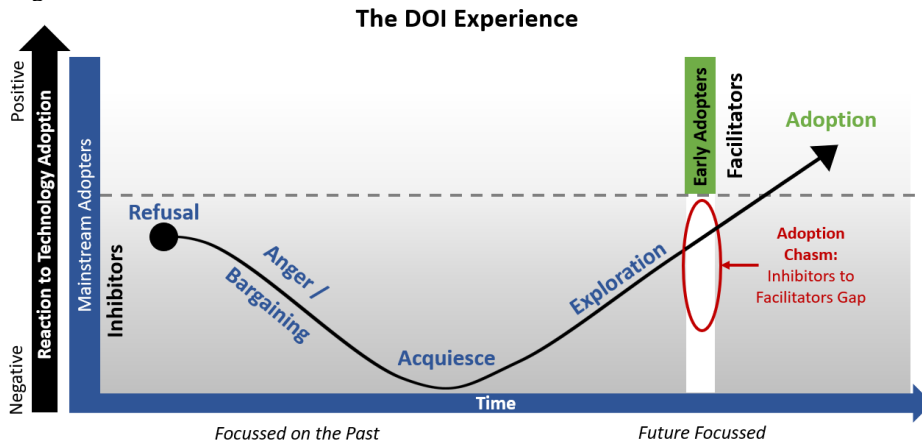


Fig. 4. Integrated Model: The DOI Experience

The vertical arrow on the y-axis refers to how the individual reacts to the change (shifting between positive and negative) as they progress through the Individual Technology Adoption Cycle (Figure 2). The Individual Technology Adoption Cycle is depicted by the arrow spanning from Refusal to Adoption on the x-axis, *Time*.

Early Adopters (Innovators and Early Adopters from Section 2.1), shown on the top right of the model, are facilitators from inception, as they are change champions that do not go through the entire technological adoption process. Mainstream adopters, regardless of adopter category (Section 2.1), all start as inhibitors at the refusal dot, and then move through the Individual Technology Adoption Cycle (Figure 2), albeit at different paces (Figure 3); as they progress through the cycle, their reaction will turn more positive, and their perspective will shift from past to future focussed. Finally, when each mainstream adopter moves through the adoption chasm from exploration to adoption, they become facilitators that can be leveraged by the organisation to implement the new technology, and speed up the adoption process.

5 Model Application Guide

The final step of the design process guides the implementation guide of the utility. When applying the proposed model in a real-world setting, it is important to note that it should not be used in isolation. The aim of this model is to work in conjunction with change management principles, models and/or processes, and increase the efficiency

by taking individual experience into account. Secondly, although individuals (in this context employees) need to be assigned adopter categories, it is important to do this without assigning labels to individuals, as this could result in conflict and reduce transparency, which ultimately impedes change and adoption. The suggested application phases below will ensure that individuals do not feel labelled, while utilising the knowledge of each adopter category to improve change management processes.

To effectively use this model, the organisation will need to track individual usage of the new technology to some degree, and be willing and able to do a phased or parallel transition from the old to the new technology. This means that before an organisation fully implements the new technology, they need to successfully onboard individuals on the new technology through a testing phase where they are allowed to learn and adopt the technology before official implementation.

5.1 Phase 1: Discovering Early Adopters

Depending on the size of the organisation, Early Adopters (which include Innovators and Early Adopters discussed at Section 2.1) can be identified in different ways. Smaller organisations can have managers identify these individuals, since they would know their workforce more intimately. In larger organisations, Early Adopters can be identified by sending out a survey with relevant questions with regard to technology adoption, and the possibility of changes to systems and processes and the individual's reaction towards it.

Once Early Adopters have been identified, they should be given first access to the new technology, system, or innovation, with the purpose of testing and providing feedback based on their experience. Based on the feedback received, the organisation could make changes to improve the user experience. Although these individuals could be incentivised for their feedback at this phase, depending on the change, it may not always be necessary as they would often be eager and excited to try something new. Once feedback from this group has been incorporated, the other three groups should be given access to the new technology to start the DOI Experience process. The ultimate goal of Phase 1 is to attain buy-in from Early Adopters, as the majority of the group is respected in the organisation (social system), and their acceptance will steer the next group, the Early Majority, to try the new technology and initiate their path through the DOI Experience.

5.2 Phase 2: Converting Mainstream Adopters

Once the buy-in of Early Adopters has been secured, mainstream adopters should be notified of the adoption of the new technology. As illustrated in Figure 3, the three groups of mainstream adopters will progress through the DOI Experience model at a different pace, the process of which is shortly described below. It is critical to note that change management actions will be necessary to enable the progression of Mainstream Adopters through the DOI Experience.

Winning Over the Early Majority. Once individuals that fall in this group are notified that a new technology needs to be adopted in the near future, they will start their

progress through the DOI Experience, starting with Refusal, followed by Anger/Bargaining. However, considering the profile of the Early Majority (Section 2.1), it can be assumed that they will quickly reach the Acquiesce stage and move on to Exploration, simply because the Early Adopters have “approved” the new technology. Once they have started the Exploration stage, individuals in this group will cross the Adoption Chasm and reach the Adoption stage. According to diffusion of innovation theory (Section 2.1), once this group has reached the Adoption stage, roughly 50% of the individuals within the organisation will have adopted the new technology, and be ready to use the new technology once it is implemented.

Supporting the Late Majority. The Late Majority group will start their path through the DOI Experience at the same time as the Early Majority, however, they will take much longer to reach the Adoption stage, and require more support and convincing than previous groups. As discussed in Section 2.1, the Late Majority will only adopt once most of their peers have done so, and once it is absolutely necessary. These individuals could remain in the Refusal and Anger/Bargaining stages for an extended time, and will need extra support, whether through training or other incentives or actions that usually form part of change management procedures to guide them through the DOI Experience. As an increasing number of individuals within the organisation reach the Adoption stage (Early Majority individuals), the increased pressure of peers adopting over time, along with the provided support, will initiate the shift to Acquiesce, Exploration and ultimately Adoption of the Late Majority.

Pressuring Laggards. Once the Early Adopters, the Early Majority and the Late Majority have successfully moved to the Adoption stage, roughly 84% of the individuals within the organisation will be ready to use the new technology. As the last 16% to accept change and adopt, Laggards will need convincing and pressure applied to them to move from Refusal or Anger/Bargaining to Acquiesce, meaning they have accepted that change will happen. Once the Acquiesce stage has been reached by a Laggard, meticulous support should be given to ensure that they successfully move through the Exploration stage and reach Adoption. As this last group moves through the DOI Experience, the most stubborn individuals may not reach the Acquiesce stage in time, and the new technology could be implemented before they have reached the Adoption stage. In this scenario, to ensure successful implementation, it might be necessary to provide them with an ultimatum, such as “fit it or be replaced”.

6 Conclusion

The evolution of digital technologies compels organisations to consider the impact of technological change on employees, customers, and suppliers. Furthermore, organisations must also contemplate the pace at which these technologies are diffused across organisations in order to fully exploit the digital benefits. Employees are at the centre of organisational actions as they apply these digital benefits and in order to support organisations with a comprehensive approach, we presented the DOI Experience Model developed through a design science research process. Organisations may reference the DOI Experience Model to encourage and facilitate the adoption of, and adaptation to,

technology by the organisation’s employees. By applying the DOI Experience Model, organisations can improve their change management practices with regard to technological change, and subsequently increase the success rate of technology adoption within the organisation, ultimately preparing the organisation to benefit from their chosen digital technology implementations.

6.1 Limitations

As discussed in Section 5, the paper suggests a theoretical model to improve change management activities within an organisation’s holistic change management approach, and should not be used in isolation. It has thus not been validated in a practical environment or application, and it is uncertain how it would align with holistic change management models such as Kotter’s Eight Step Change Model [15] or Lewin’s Three Step Model [16].

6.2 Future Research

Although the “DOI Experience Model” presented in this paper is derived from grounded theoretical perspectives, it needs to be applied in practical scenarios in order to test its validity. Future studies should consider implementing this model as part of a technological adoption change management process, and apply findings from real world application to validate, improve and/or alter the model. Considering the rapid pace of technology adoption within the digital sector, specifically within digital native enterprises [24], future research that focuses on organisations within the digital sector will scrutinise the validity and practicality of this model at the highest level, as change and adoption will happen quickly and continuously. In addition, design principles applied during the design of this utility, may be extracted, further enhancing potential contributions from this research scope of work.

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