



Major Models and Theories of Cryptocurrency Technology Adoption: A Theoretical Review

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Abstract

A review of a selected theories that influence the adoption of technology will serve as the objective of this paper. In this work, we attempt to discover traits that might improve the possibility of acceptance and ongoing usage of technology such as cryptocurrency adoption. More specifically, we focused on Rogers' Innovation Diffusion Theory (IDT), Theory of Technology Acceptance (TAT), and Technology Acceptance Model (TAM)/TAM2/TAM3, Theory of Reasoned Action (TRA), Unified Theory of Acceptance and Use of Technology (UTAUT), and Theory of Planned Behaviour (TPB). When researching the tendency of individuals to adopt certain technologies, researchers draw from a wide variety of conceptual frameworks and analytical approaches. In this review, social psychology and its applied notions have been utilised most frequently. As a primary theoretical foundation, the theories centre on people's intentions to engage in a specific behaviour (i.e., adopt and utilise ICT), which is the emphasis of the theories. Research on the adoption and usage of information and communication technologies has made extensive use of both the Theory of Reasoned Action (TRA) and the Theory of Planned Behaviour (TPB). They are two of the key intention-based theories, which means they give the core theoretical underpinnings for other adoption theories, such as the Technology Acceptance Model (TAM) and the Enhanced Technology Acceptance Model. Both the transpersonal relationship analysis and the transpersonal behaviour analysis begin with the fundamental premise that individuals deliberately choose whether or not they will engage in a certain behaviour. In this sense, the adoption and usage intentions are typically seen of as a primary outcome variable that is influenced by a variety of independent variables. This is because of the way that they are typically studied. In the following, we will discuss significant theories regarding the adoption of technology.

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Keywords: Technology acceptance, Rogers' Innovation Diffusion Theory (IDT, Theory of Technology Acceptance (TAT) and Technology Acceptance Model (TAM)/TAM2/TAM3, Theory of Reasoned Action (TRA), Unified Theory of Acceptance and Use of Technology (UTAUT) and Theory of Planned Behavior (TPB), Technology Adoption theories and models.

1. Introduction

The paper presents selected theories of technology acceptance in the light of cryptocurrency adoption. The term "adoption-diffusion theories" refers to the process that involves the gradual dissemination of an innovative idea over the course of time. The process of adoption relates to an individual deciding whether or not to integrate an innovation into their daily routine, whereas the process of diffusion takes on the adoption of an innovation by a group over a period of time. In the most recent decades, the rate of new scientific discoveries has quickened, and concurrently, the rate at which new technologies and inventions

are being developed has quickened as well. While some of these technologies have captured the interest of ordinary individuals and quickly gained ground in the communities, some of them have been largely rendered obsolete after a period of time. The accurate recognition of the demands and the impacting variables for the adoption of new technology is the aspect that needs to be thought about in line with the development of new technology. This is the factor that needs to be considered. As a result, a great number of scholars have conducted research on the subject and come up with a variety of conceptual frameworks for explaining the process by which people embrace a technology.

The most recent few decades are famous for the technological developments that have taken place. The rapid pace at which new technologies are being developed has resulted in the production of previously unimagined products. These technologies have paved the way for a great number of new ideas and discoveries that were unimaginable in the past.

From the time that man first discovered fire to the time when he invented the wheel was hundreds of years apart.

There was a tremendous difference between innovations or products that were innovative, but as time went on, the gap got less and less significant. Every day in the modern world brings with it some new advancement in technology. In light of this, the purpose of this article is to provide a comprehensive review of the topic at hand by investigating the most significant models or theories related to user acceptance and adoption since 1962 up to the present time. Additionally, the development of various theories and models of technology acceptance during these years is evaluated in order to provide a full picture of the subject matter.

1.2 Rogers' Innovation Diffusion Theory (IDT)

One of the most popular models for analysing the process of transmitting any kind of innovation via the members of a system is called the innovation diffusion theory (IDT), and it was first developed by Rogers (1995). The timely spread of an innovation throughout a social system is the primary focus of this theory. It describes five different types of adoptive parents, five different stages of the adoption decision-making process, and five different adoption considerations.

Rogers (1962) proposed the theory of innovation diffusion, seeks to answer the questions of how, why, and at what pace innovative ideas and technology move throughout a social system. It considers change as being principally about the evolution or "reinvention" of products and behaviours so that they become better fits for the needs of individuals and groups. This shifts the focus away from convincing individuals to change and places it on the evolution of products and behaviours hence the process of innovation diffusion is not the individuals who change but rather the innovations themselves.

On the other hand, diffusion is the process by which an innovation is disseminated among the members of a social system over the course of time and through specific channels Wani, T. A., & Ali, S. W. (2015).

It is argued that the majority of frameworks for directing innovation diffusion and/or adoption studies are derived from Rogers' Innovation diffusion Theory (IDT), despite the fact that there are multiple frameworks for guiding these types of studies (Wani, T.A. and Ali, S.W., 2015). Wani, T.A. and Ali, S.W (2015) gives a detailed account of IDT. One of the oldest theories in the field of social science is called the Diffusion of Innovation (DOI) Theory, which was proposed

by E.M. Rogers in 1962. It was initially used in the field of communication to explain how, over the course of time, an idea or product gathers momentum and diffuses (or spreads) among a particular population or social system (Yuen, K.F., *et al* 2021). People as members of a social system end up adopting a new idea, behaviour, or product as the ultimate consequence of this spread of information (Gledson, B.J. and Greenwood, D., 2017). A person is said to have adopted something when they do something differently than what they had been doing in the past (for example, when they buy or use a new product, when they acquire and perform a new behaviour, etc.) (Pinho, C., *et al* 2021). The idea, behaviour, or product in question must initially strike the individual as novel or pioneering in order for them to adopt it. This allows for the possibility of diffusion to take place (Choe, M.J. and Noh, G.Y., 2018).

The process by which some people are more likely to accept a new concept, behaviour, or product (also known as "innovation") does not occur instantaneously in a social system; rather, it is a process by which some people are more likely to adopt the innovation than others (Jamshidi, D. and Kazemi, F., 2020). The traits of people who accept a new technology quickly have been found to be distinct from those of those who adopt a new technology more slowly, according to research. When trying to convince a certain group of people to accept a new invention, it is critical to have a solid understanding of the features of the target audience and how those traits will either facilitate or impede adoption of the innovation (Cheng, H.H., 2017). There are five known adopter types, and while though the vast majority of people in the general public tend to fall somewhere in the middle of these categories, it is still vital to understand the characteristics of the population you are trying to reach (Marak, Z.R., *et al* 2019). When it comes to marketing an innovation, there are a variety of approaches that may be used to appeal to the various kinds of early adopters (Hosseini, M., *el al* 2016). Rogers believed that innovativeness was helpful in identifying the main and desired behaviour that occurred during the innovation decision-making process (Earl, M., 2018). Therefore, he classifies the adopters in accordance with their degree of inventiveness (Batte, M.T. and Johnson, R., 2019). The distribution of adopters can be represented by a normal distribution, as can be shown in Figure 1.1

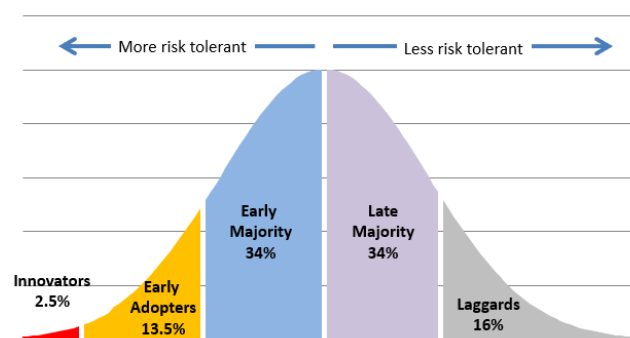


Fig 1.1: Adopter Categorization on the Basis of technology adoption lifecycle Innovativeness (Source: Diffusion of Innovations, fifth edition by Everett M. Rogers. Copyright (c) 2003 by the Free Press)

In addition, Rogers (2003) made the observation that non-adoption and partial adoption do not constitute this adopter type. This curve is only generated over time by early adopters of successful innovations (Kapoor, K.K., *et al* 2015). The

definition of each category in this normal distribution is based on a standardised percentage of the total number of respondents. For instance, the region that lies beneath the left side of the curve and two standard deviations below the mean contains innovators who adopt an invention as the first 2.5% of the individuals in a system (McPhee, C., *et al* 2018).

1.2.1 Innovators

According to Rogers (2003), innovators were open to the possibility of trying out new concepts. As a result, they must be ready to deal with inventions that are not profitable and that are unsuccessful, in addition to a certain level of ambiguity regarding the innovation (Batte, M.T. and Johnson, R., 2019). Additionally, Rogers stated that innovators play the role of gatekeepers, bringing innovation from outside the system into the organisation (McPhee, C., *et al* 2018). Because of their daring and the intimate relationships they have with people from outside the social system, it is possible that other members of the social system do not appreciate them. Because of their adventurous nature, innovators are expected to have extensive technical expertise (Kapoor, K.K., *et al* 2015).

1.2.2 Early adopters

Early adopters are more constrained by the constraints of the social system as opposed to innovators, who are more likely to push such boundaries (Barua, A. and Mani, D., 2018). According to Rogers (2003), early adopters are more likely to have leadership roles in the social system (Batte, M.T. and Johnson, R., 2019). As a result, other members of the social system go to early adopters to receive guidance or information about innovations (Barua, A. and Mani, D., 2018). In point of fact, according to Light (1998), "leaders play a central role at virtually every stage of the innovation process, from initiation to implementation, particularly in deploying the resources that carry innovation forward" (p. 19) (Batte, M.T. and Johnson, R., 2019). Therefore, the attitudes that early adopters have towards innovations are more essential since they serve as role models (McPhee, C., *et al* 2018). Through their interpersonal connections, their personal opinions and judgements regarding the innovation are communicated to other participants in the social system. During the process of innovation dissemination, the level of ambiguity regarding the innovation is reduced when early adopters take the lead in implementing the innovation (Earl, M., 2018). The final point is that "early adopters put their stamp of approval on a new idea by adopting it" (Rogers, 2003, page 283).

1.2.3 Early Majority

According to Rogers (2003), early adopters, although having a good relationship with other members of the social system, have the leadership role (Batte, M.T. and Johnson, R., 2019). Early majority members, on the other hand, do not have this leadership function. However, the importance of their interpersonal networks cannot be overstated when discussing the process of invention diffusion (Barua, A. and Mani, D., 2018). As can be seen in Figure 2.3, the early majority adopts the innovation right around the time that the other half of their peers does the same thing. According to Rogers, they take careful consideration before implementing a new technology, and they are neither the pioneers nor the trailblazers in this field (Barua, A. and Mani, D., 2018). As a result, the decision-making process around their innovative endeavors

typically takes longer than that of innovators and early adopters (Earl, M., 2018). After the Late Majority a third of all members of the social system make up the late majority, which is comparable to the early majority in that these individuals wait until the bulk of their contemporaries accept the innovation (McPhee, C., *et al* 2018). There is a possibility that they will adopt the innovation despite their reservations regarding it and the results it would produce due to the combination of economic need and the influence of their peers (Batte, M.T. and Johnson, R., 2019). Interpersonal networks made up of close contemporaries should urge the late majority to adopt the innovation so that the level of uncertainty associated with it can be reduced. After that, "the late majority feels that it is safe to adopt" (Rogers, 2003, p. 284) felt that it was okay to adopt (McNutt, J., *et al* 2018).

1.2.4 Laggards

According to Rogers (2003), laggards adhere to the old viewpoint, and they have a greater degree of skepticism in comparison to late majority members about innovations and change agents (McPhee, C., *et al* 2018). Their interpersonal networks are primarily composed of other members of the social system that fall into the same category since they are the most locally concentrated group inside the social system (Earl, M., 2018). In addition to this, they are not in a position of leadership. Because they have limited resources and a lack of awareness and expertise about innovations, they want to ensure that an invention is successful before adopting it (Batte, M.T. and Johnson, R., 2019). As a result, laggards have a tendency to make decisions after considering whether or not other participants in the social system have successfully accepted the innovation in the past (Barua, A. and Mani, D., 2018). The duration of time that it takes for laggards to make decisions regarding new technologies is typically somewhat extended (McNutt, J., *et al* 2018). Rogers (2003) further detailed his five kinds of adopters by dividing them into two primary groups: earlier adopters and later adopters (McPhee, C., *et al* 2018). These five categories of adopters are included in this description as well. Innovators, early adopters, and the early majority are all examples of early adopters. Later adopters, on the other hand, include the late majority and laggards. Rogers emphasises the distinctions between these two groups with regard to socioeconomic level, personality factors, and communication behaviours, all of which are typically associated in a good manner with innovativeness (McNutt, J., *et al* 2018). For instance, "the individuals or other units in a system who most need the benefits of a new idea (the less educated, less wealthy, and the like), are generally the last to adopt an innovation" (Rogers, 2003, p. 295) (Earl, M., 2018). This is because "the individuals or other units in a system who most need the benefits of a new idea (the less educated, less wealthy, and the like)" According to Rogers, there was no statistically significant difference in age between those who adopted earlier and those who adopted later; however, the categorization of later adopters and the characteristics of that group are beyond the scope of this study (McPhee, C., *et al* 2018).

1.2.5 The Innovation-Decision Process

Rogers (2003) defined the process of deciding whether or not to implement an innovation as "an activity of information-seeking and information-processing, where an individual is motivated to reduce uncertainty about the advantages and

disadvantages of an innovation" (p. 172). Rogers (2003) identifies the following five stages as constituting the innovation-decision process: (1) awareness, (2) wisdom persuasion, (3) decision, (4) implementation, and (5)

confirmation (Kreps, G.L., 2017). These stages will normally occur in the sequence listed above, in chronological order. Figure 2.2 depicts this procedure in its entirety (Mahata, N., *et al* 2022).

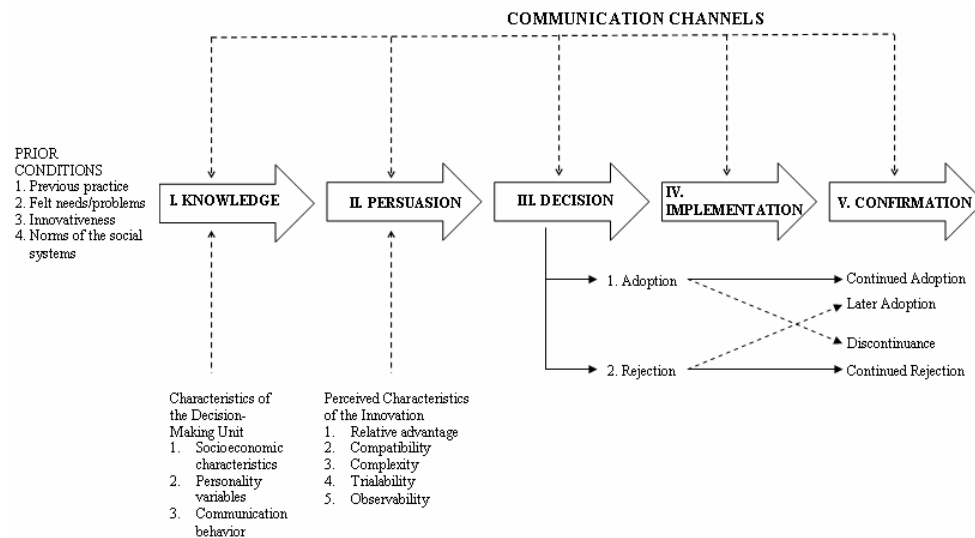


Fig 1.2: A Model of Five Stages in the Innovation-Decision Process (Source: Diffusion of Innovations, Fifth Edition by Everett M. Rogers. Copyright (c) 2003 by The Free Press.

1.2.6 The Knowledge Stage

The knowledge stage of the innovation decision process is where things get started (García-Avilés, J.A., 2020). An individual becomes aware of the existence of innovation and begins searching for information regarding the invention during this stage of the process (Kreps, G.L., 2017). The questions "what?," "how?," and "why?" are the most important ones to ask in the knowledge phase. During this phase, the individual makes an effort to comprehend "what the innovation is and how and why it works" (Rogers, 2003, page 21). Rogers identifies the following categories of knowledge as being formed through the questions: (1) the knowledge of consciousness, (2) the knowledge of how to, and (3) the knowledge of principles (Mahata, N., *et al* 2022).

1.2.7 Awareness-knowledge

The awareness-knowledge that an innovation already exists is the same thing as the knowledge that it does exist (Mahata, N., *et al* 2022). This kind of information has the potential to inspire the individual to learn more about the invention and, ultimately, to incorporate it into their lives (Karnowski, V. and Kümpel, A.S., 2016). In addition to this, it has the potential to inspire a person to increase their understanding of the other two categories of information (Aizstrauta, D., *et al* 2015). Know-how about how to know: The other kind of knowledge is called how-to knowledge, and it consists of information about how to make appropriate use of an innovation (Mahata, N., *et al* 2022). According to Wetzel (1993), even faculty members with technical skills may be unable to make effective use of technology in the classroom if they are not familiar with the proper procedures for doing so (Aizstrauta, D., *et al* 2015). Therefore, technology is not employed at the level that would be expected because students require assistance in learning how to make efficient use of technology in the classroom (Aizstrauta, D., *et al* 2015). Rogers considered this knowledge to be an important factor in the decision-making process about innovative

practices. Before trying out a new innovation, a person should have a sufficient level of understanding about how to use it, as this will improve the likelihood that others will embrace the innovation after it has been tested. As a result, having this information becomes even more essential for innovations that are rather difficult (Karnowski, V. and Kümpel, A.S., 2016).

- *Principles-knowledge:* The final category of knowledge is known as principles-based knowledge (Mahata, N., *et al* 2022). This knowledge encompasses the operating principles that explain how and why an innovation functions in the way that it does. It is possible for a new idea to be implemented without this information being known, but its abuse could result in the innovation being abandoned (Aizstrauta, D., *et al* 2015). According to Sprague *et al.* (1999), the most significant obstacle to the use of technology by faculty members in the classroom is that teachers do not have a clear understanding of why or how to incorporate technological elements into their lessons (Aizstrauta, D., *et al* 2015). Technology education and practise should provide not only a "how to" experience but also a "know why" experience in order to foster the creation of new knowledge (Seemann, 2003). In point of fact, an individual may possess all of the essential knowledge; yet, this does not necessarily guarantee that the individual will embrace the innovation because an individual's attitudes also play a role in determining whether or not an invention is accepted or rejected (Aizstrauta, D., *et al* 2015).

1.2.8 The Persuasion Stage

The Stage of Convincing Others When an individual has a favourable or unfavourable attitude towards an innovation; the persuasion phase comes into play. However, "the formation of a favourable or unfavourable attitude towards an innovation does not always lead directly or indirectly to an adoption or rejection" (Rogers, 2003, p. 176) (Miller, R.L., 2015). As a result of the fact that an individual doesn't form their attitude until after they have gained knowledge about an

innovation, the stage of persuasion comes after the stage of knowledge in the process of deciding whether or not to adopt an innovation. In addition, according to Rogers, the knowledge stage has a greater emphasis on cognitive (or knowing) centering, whereas the persuasive stage places a greater emphasis on emotive (or feeling) centering (Kreps, G.L., 2017). Consequently, the individual gets involved with the innovation on a more sensitive level at the period of persuasion (Ramos, F.L., *et al* 2015). Opinions and beliefs of an individual are impacted, both positively and negatively, by the degree of unpredictability around the operation of the invention, as well as by the social reinforcement received from others (such as coworkers, peers, etc.) (Karnowski, V. and Kumpel, A.S., 2016). Evaluations of the innovation made by the individual's close peers that are more likely to be credible because they lessen the amount of uncertainty surrounding the outcomes of the innovation: "While information about a new innovation is usually available from outside experts and scientific evaluations, teachers typically seek it out from trusted friends and colleagues whose subjective opinions of a new innovation are most convincing" (Sherry, 1997, p. 70) (Değerli A, *et al* 2015). During the stage of decision making, people will continue their searches for information and messages pertaining to innovation appraisal (Miller, R.L., 2015).

1.2.9 The Decision Stage

The Phase of Decision Making The individual makes the decision during the decision stage of the innovation-decision process as to whether or not they will adopt the innovation (Miller, R.L., 2015). Adoption is defined as "full use of an innovation as the best course of action available," whereas rejection is defined as "not to adopt an innovation" (Rogers, 2003, page 177). Because the majority of people want to test out an invention in their own circumstances before deciding whether or not to accept it, innovations that allow for partial trials are typically adopted more rapidly than those that do not (Nilsson, M., 2015). The process of making decisions about innovative ideas can be sped up through the use of vicarious testing (Miller, R.L., 2015). Despite this, it is always possible for an innovation's decision to be rejected at any step of the process. Rogers demonstrated both an active and a passive form of rejection in his statements (García-Avilés, J.A., 2020). An human engages in an activity known as active rejection when they experiment with a new idea, give it some serious consideration, and then ultimately choose not to embrace it. It's possible to classify a decision to stop using an innovation after having previously embraced it as an active kind of rejection (Kreps, G.L., 2017). This is known as a discontinuance decision. In the posture of passive rejection, also known as non-adoption, the individual does not give any consideration to the possibility of accepting the innovation (García-Avilés, J.A., 2020). According to Rogers, the two different sorts of rejection that might occur in diffusion studies have not been differentiated and explored sufficiently in the past Nilsson, M., 2015. The steps of knowledge, persuasion, and choice can, in some circumstances, occur in the reverse order of knowledge, decision, and persuasion (Kreps, G.L., 2017). This order occurs, especially in collectivistic cultures like those seen in Eastern countries, where social influence on acceptance of an innovation can change a person's personal innovation decision into a community's collective innovation decision. (Rogers, 2003). In any event, the stage of implementation

comes after the phase during which decisions are made (Nilsson, M., 2015).

1.2.10 The Implementation Stage

The stage known as "Implementation" is putting an innovation into action. An innovation, on the other hand, introduces something new, which means that "some degree of uncertainty is involved in diffusion" (p. 6) (Peixoto, M., Castro, A.C. and Nascimento, P.P., 2015). At this point in the process, there is still the potential for confusion over the results of the innovation. As a result, the implementer may require the technical assistance of change agents and other individuals in order to cut down on the amount of uncertainty surrounding the implications. In addition, the process of innovation and decision-making will come to an end since, according to Rogers (2003), "the innovation loses its distinctive quality as the separate identity of the new idea disappears" (p. 180) (Miller, R.L., 2015).

1.2.11 The Confirmation Stage

During the confirmation stage, the individual looks for support for his or her choice from others (Nilsson, M., 2015). Rogers (2003) suggests that an individual's decision can be changed if they are "exposed to conflicting messages about the innovation" (p. 189). On the other hand, the individual has a propensity to avoid unfavorable messages and instead searches for supportive messages that reinforce his or her choice (Onayemi, K.K., *et al* 2022). As a result, attitudes take on an increasingly significant role during the confirmation stage. During this stage, later adoption or discontinuance of the invention takes place depending on factors such as the support for adoption of the innovation and the mindset of the individual (Ramdhani, M.A., *et al* 2021). During this period, there are two different ways that discontinuance could take place (Onayemi, K.K., *et al* 2022). At first, the person resists the innovation in order to provide room for a superior innovation to take its place. The choice to discontinue something in place of something else is known as replacement discontinuance (Miller, R.L., 2015).

1.3 Theory of Technology Acceptance (TAT), and Technology Acceptance Model. (TAM)/TAM2/TAM3

According to the TAM, the acceptance of technology is a three-stage process. First, external factors (features of the system design) trigger cognitive responses (perceived ease of use and perceived usefulness). Next, these cognitive responses form an affective response (attitude towards using technology/intention), which in turn influences use behaviour. TAM is an acronym that stands for "total apparent behaviour," which is the outcome that is predicted by "perceived ease of use," "perceived usefulness," and "behavioural intention." Both the expectation of favourable behavioural effects and the idea that the behaviour will not be labor-intensive can be represented by the concepts of perceived ease of use and perceived usefulness, respectively. The more intense the mental reaction, the greater the probability that the behaviour will be exhibited. It is possible for perceived usefulness to have a direct effect on actual use, which highlights the significance of the variable in terms of its ability to predict behaviour. The effect of perceived usefulness is underpinned by the effect of perceived ease of use, despite the fact that perceived ease of use does not directly affect use behaviour. According to the model, the likelihood that an application will be considered valuable for

the user and that this will drive the acceptance of technology increases in direct proportion to the ease with which the programme is anticipated to be utilised by the user. TAM operates under the assumption that an individual's

acceptance of information systems is determined by the stated four primary factors of perceived usefulness, perceived ease of use, behavioral intention to use and actual use of a system (Venkatesh, V. and Bala, H., 2008).

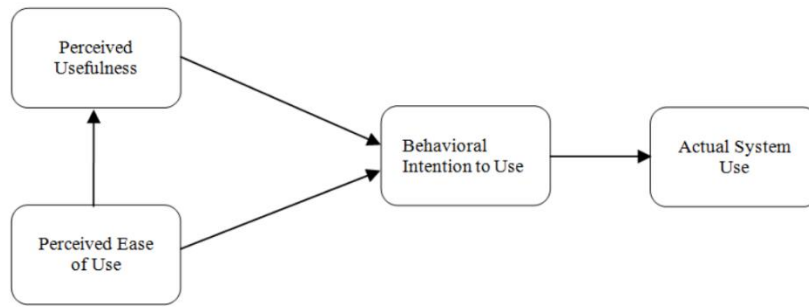


Fig 1.3: Acceptance of innovation model (adapted from Venkatesh, Morris, Davis, and Davis, 2003)

Theoretical Extensions of Theory TAM2

After the establishment of the initial TAM, the investigation of technology acceptance remained at the centre of the research agenda. This is due to the fact that there is a proven link between the adoption of technology in organisations and the productivity of organisations.

The developers of the model wanted to make it even more accurate at predicting the future, despite the fact that widespread use of TAM proved that the theory was sound (it explained approximately 40% of the average variation in technological acceptance), but they also wanted to make it even more accurate. The poor understanding of the conditions that underpin consumers' experience of technology usage was the driving force behind the decision to broaden the model. According to Venkatesh and Davis's research from 2000, perceived usefulness was shown to be the factor that best predicts a person's inclination to utilise a product or service, with an effect size of 0.6 on average. Nevertheless, there was a paucity of evidence about the components that underpin the impression of the usefulness of technology in the existing research. The investigation of the antecedents of usefulness perception was required in order to comprehend acceptance, as well as to provide advice on the construction of systems that go beyond the suggestion that users' perceptions of usefulness and ease of use reflect intention (for example, see (Venkatesh & Davis, 1996)). The analysis of major antecedents of perceived usefulness had the goal of providing a complete framework for explaining and forecasting the acceptance of technology in organisational contexts. This was accomplished through the study of key antecedents of perceived usefulness. (2000), by Venkatesh and Davis.

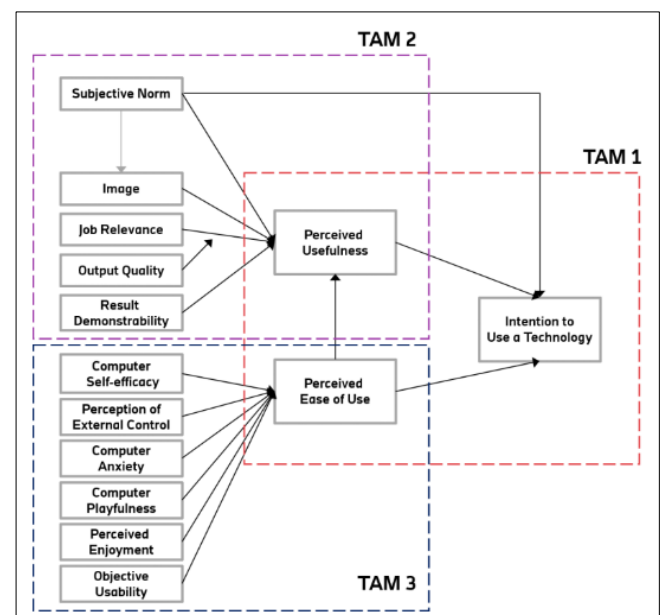
The suggested addition, which was given the name TAM2, comprised of two moderators and five exogenous variables in addition to the original set. Subjective norm, image, job relevance, output quality, outcome demonstrability, experience, and voluntariness were the new constructs and moderators that were included in TAM2's iteration.

According to the TAM2 theory, there is a positive association between image and subjective norm. The link was backed by previous research that confirmed that image has a large effect on conduct if individuals follow the advise of their peers to maintain the individual's standing in the group (Pfeffer, 1992; Chassin, Presson, and Sherman 1990). These studies confirmed that the image of an individual has a considerable effect on the individual's behaviour. In addition, the TAM2 theory proposes a positive link between an image and how useful it is evaluated to be. An individual "achieves

membership and the social support that such membership affords as well as possible goal attainment which can occur only through group action or group membership" (Pfeffer, 1992) by showing the conduct that is endorsed by group norms. This is because goal attainment can only occur through group action or group membership. According to the TAM2 theory, which was proposed by Venkatesh and Davis in the year 2000, the possibility of a good view of technological productivity can be increased if there is a favourable image among the members of the social group.

Theoretical extension of Extensions of Theory TAM3

In response to growing criticism levelled at the TAM, it was modified to incorporate new characteristics, including as social influence, age, and gender, all of which play a role in determining how one intends to behave. The TAM2 model is an extension of the original Technology Acceptance Model that was developed by Venkatesh and Davis in 2000. It takes into account both internal and external social elements that have an effect on a person's behavioural intention to adopt new technology. In 2008, Venkatesh and Bala made some additional improvements and extensions to the model.



Simplified TAM 1, 2 & 3 omitting moderators, Davis(1989) Venkatesh and Davis (2000) Venkatesh & Bala (2008) and as adapted from acceptancelab.com.

Davis (1989); Venkatesh and Davis (2000); Venkatesh and Davis (1996); TAM3, TAM, and TAM2; and evidence from other studies had offered detailed explanations concerning major factors of use intention. Despite this, there had only been a small amount of research done on interventions that could be implemented to speed up the rate at which people adopted new technologies (Venkatesh & Speier, 1999). Venkatesh and Bala (Venkatesh and Bala, 2008) combined the antecedents of perceived usefulness and perceived ease of use in a single model and investigated the relationship between antecedents and perception variables in order to exclude cross-over effects. This was done because TAM was criticised for providing few actionable guidelines to practitioners (Lee, Kozar, and Larsen, 2003). An example of such an approach would be to supply a nomological network as a means of providing an all-encompassing explanation of how technology got adopted. The literature has been inconsistent in terms of the predictors of the two perception elements (Agarwal & Karahanna, 2000; Venkatesh & Davis, 2000). The purpose of theorising different effects of variables on perceived usefulness and perceived ease of use was to bring clarity to this area of study (Agarwal & Karahanna, 2000; Venkatesh & Davis, 2000). According to Venkatesh and Davis (2000), the factors that determine perceived usefulness include the subjective norm, image, job relevance, output quality, and the ability to demonstrate results. These factors have not altered since TAM2. Direct determinants of perceived ease of use were introduced in this model (Venkatesh & Bala, 2008). These direct predictors include computer self-efficacy, perception of external control, computer anxiety, computer playfulness, perceived enjoyment, and objective usability. Evidence on human decision making provided the inspiration for the reasoning behind the choice to incorporate these antecedents. The antecedents of the perception of ease of use can be broken down into two categories: anchoring factors and adjustment factors. According to Venkatesh (2000), individuals' first judgements of the perceived ease of use are driven by anchoring variables. However, once individuals gain direct experience with information systems, adjustment factors come into play.

1.4 Theory of Reasoned Action (TRA)

According to Ajzen and Fishbein's theory of reasoned action (TRA; 1980), behaviour can be predicted by the agent's volition as well as their intentions. According to the theory of planned behaviour (TPB), people are more likely to engage in a behaviour if they have a higher intention (motivation) to do so and if they believe that other people want them to engage in the behaviour (subjective norm). Attitude and subjective norm are two components of the theory of planned behaviour. Numerous researches (Sheppard *et al.*, 1998) have shown that there is a strong connection between behavioural intention and behaviour itself, as well as between attitudes and subjective norms. However, the findings of a few research point to a shortcoming of this hypothesis, which is that the intention to behave in a certain way does not automatically translate into that behaviour (Wickramanayake, N.N., 2019). The theory of planned behaviour is a model that takes into account the influence that non-volitional elements have on behaviour (Bosnjak, Michael, *et al* 2020). This model came forth as a response to the widespread belief that there is a strong relationship between behavioural intention and actual behaviour

(Morchid, N., 2020).

Explicating and predicting behaviour on the basis of attitudes, norms, and intentions is the purpose of the Theory of Reasoned Action (TRA) (Conner, M. and Armitage, C.J., 1998). Behavioural beliefs, evaluations of behavioural results that lead to attitude, normative beliefs, and motivation to comply are the components that make up the construct of TRA (Wickramanayake, N.N., 2019). Subjective norms are the end result of this chain of events. Both the attitude and the subjective norm contribute to the formation of the intention to carry out the behaviour, which in turn leads to the manifestation of the behaviour (Conner, M. and Armitage, C.J., 1998). The Theory of Reasoned Action (TRA) does not take into consideration people's perceptions of the amount of control they have over their behaviours (Michael, *et al* 2020). Control beliefs, perceived power, which leads to perceived control, then purpose to conduct the behaviour, and then the behaviour itself are all introduced by the Theory of Planned Behaviour at this point (Morchid, N., 2020).

Behavioral belief: Beliefs about behaviour can induce either a positive or negative attitude in the host towards the behaviour in question (Rhodes, R.E. and Conner, M., 2010). A man who has survived Ebola might be interested in engaging in sexual activity, but he is now debating whether or not to use a condom. The values that are associated to the outcome or behaviour, as well as the favourable or negative judgement that a host has, are what constitute the evaluation of behavioural beliefs (Rhodes, R.E. and Conner, M., 2010). Take, for instance, a consideration of whether or not to make use of a condom. The inclination of a host to behave in a particular manner is referred to as their attitude. Because the host has developed immunity to the agent, he might decide that he no longer needs to use a condom (Lam, T., Cho, V. and Qu, H., 2007). When those who are close to the host either agree or disagree about his behaviour, this is an example of normative belief.

The motivation to comply comes from wanting to concur with what the friends and family of the host believe to be the appropriate behaviour. That is, he uses the condom to protect himself and the people around him (Lam, T., Cho, V. and Qu, H., 2007). Subjective norms are the host's view of social norms or what his peers' beliefs are regarding the behaviour (Conner, M., 2020). Subjective norms can also be thought of as the beliefs of the host's peers (Nugroho, A., *et al* 2018). It's possible that he'll remark that he wishes to shield himself from harm since the people who are significant to him are concerned about his behaviour (Conner, M. and Armitage, C.J., 1998). After that, there is a chance that he will agree to use condoms. Behaviours can also be influenced by extrinsic factors such as demographics variables, attitudes towards targets, personality traits, and other individual difference variables (Dippel, E.A., *et al* 2017).

TRA does not take into account people's perceptions of the amount of control they have over their behaviours, as was noted earlier (McEachan, R., *et al* 2016). The theory of planned behaviour (TPB) enters the picture here with its control beliefs, which are beliefs about things that either help or hinder the performance of the host behaviour. The performance of the behaviour might be helped or hindered by various factors, including perceived power (Montano, D.E. and Kasprzyk, D., 2015). The host has complete control over his behaviour; nonetheless, the host's conviction that he has been cured may encourage him to engage in sexual behaviour (McEachan, R., *et al* 2016). Therefore, there is no reason to

be concerned about anything (Michael, *et al* 2020). The degree to which an individual believes they have command over their own actions is known as perceived control (Nugroho, A., *et al* 2018). The host has the ability to determine whether or not to carry out the behaviour when they have perceived control over it.

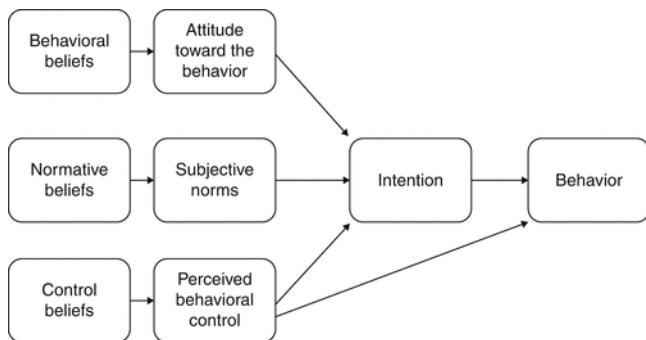


Fig 2.6: Theory of reasoned action (TRA) (Adapted from Nugroho, A., *et al* 2018)

1.5 Unified Theory of Acceptance and Use of Technology (UTAUT)

UTAUT was developed in 2003 by Venkatesh, Morris, Davis, and Davis after they investigated eight of the most prevalent theoretical frameworks and chose the most significant constructs from among them (Venkatesh, Morris, Davis, and Davis, 2003). According to Rondan-Catalua *et al.* (2015), the intention behind the development of UTAUT was to produce a coherent picture in light of the widespread and unstructured use as well as extensions of earlier models. According to Google Scholar, the original paper has been referenced or cited more than 17,000 times since it was published. (Venkatesh *et al.*, 2003) explored eight different prolific models when attempting to synthesise UTAUT. These models included TRA, TAM, TPB, IDT, and social cognitive theory (Aljohani, A., *et al* 2018). According to Venkatesh *et al.* (2016), the model identified four factors that determine usage intention and five factors that moderate usage intention. Gender, age, amount of prior experience, and whether or not the use was voluntarily undertaken all played a role (Venkatesh, V. and Bala, H., 2008). The following is a definition of each of the four determinants, with the degrees of influence associated with each factor shown in brackets:

- Performance Expectancy (PE) is the belief that the technology will be able to assist in the accomplishment of the mission.
- Effort Expectation (EE) refers to the amount of work that users believe is required to use a piece of technology.
- Social Influence (SI) is the term used to describe the social pressure to utilise a technology.
- Facilitating Conditions (FC) refers to the perception of the availability of resources and assistance for the application of the technology

According to (Venkatesh *et al.*, 2016) found that UTAUT explained 77% of the variation in behavioural intention and 52% of the variation in actual usage in longitudinal field investigations. UTAUT, which was created for organisational contexts with largely utilitarian usage (Rondan-Catalua *et al.*, 2015), is comparable to TAM and IDT in that regard. In 2012, Venkatesh *et al.* came up with the idea for UTAUT2 in order to directly address the consumer context in their study. UTAUT2 included hedonic motivation (also known as

enjoyment), prices or price value (PV), which enhance the time/effort resource components of the basic model, and habit as an alternative mediating mechanism to behavioural intention. These additions were made so that consumer-specific characteristics could be accounted for. In addition, voluntariness was removed from the UTAUT model because Slade *et al.* (2013) made the assumption that consumer behaviour was voluntarily chosen by the individual (Venkatesh, V. and Bala, H., 2008).

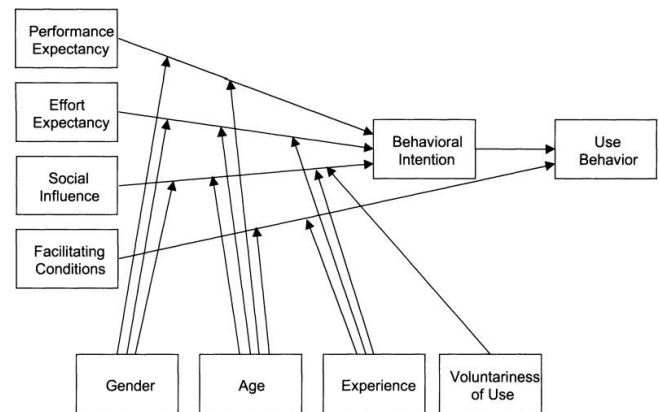


Fig 1.5: UTAUT from (Venkatesh, Thong, & Xu, 2012).

1.6 Theory of Planned Behaviour (TPB)

A psychological theory known as the Theory of Planned Behaviour (TPB) establishes a connection between an individual's ideas and their actions (Nugroho, A., *et al* 2018). According to this theory, an individual's behavioural intentions are shaped collectively by three fundamental aspects: an individual's attitude, the subjective norms that they are subject to, and their level of perceived behavioural control (Dippel, E.A., *et al* 2017). As a corollary, one of the core beliefs of TPB is that behavioural intention is the most proximal factor in determining human social behaviour. Icek Ajzen is credited with developing the theory with the intention of enhancing the capacity of the theory of reasoned action (TRA) to make accurate predictions (Montano, D.E. and Kasprzyk, D., 2015). The concept of incorporating perceived behavioural control into TPB was originally conceived by Ajzen. The TRA did not include a measure of perceived behavioural control over participants (McEachan, R., *et al* 2016). Studies have been conducted using TPB to investigate the connections between beliefs, attitudes, behavioural intentions, and behaviours in a variety of human contexts (Dippel, E.A., *et al* 2017). These fields may include, but are not restricted to, areas such as advertising, public relations, advertising campaigns, healthcare management, sport management, and sustainability.

Extension from the theory of reasoned action

Icek Ajzen (1985) first put up the TPB in his chapter titled "From intentions to actions: A theory of planned behaviour. TPB originated from the idea known as TRA, which was initially presented by Martin Fishbein and Ajzen in the year 1980 (Nugroho, A., *et al* 2018). In turn, TRA was grounded in a variety of theories that pertain to attitude and attitude change. These theories include learning theories, expectancy-value theories, attribution theory, and consistency theories (such as Heider's balance theory, Osgood and Tannenbaum's congruity theory, and Festinger's dissonance theory (Michael, *et al* 2020). These ideas were used to examine how attitudes

are formed and how they might change. According to the transtheoretical model of attitude change (TRA), if an individual considers a suggested behaviour to be beneficial (attitude), and if the individual believes significant others want the person to perform the behaviour (subjective norm), then the individual will have a greater intention (motivation) to perform the behaviour, and the individual will also be more likely to perform the behaviour (Nugroho, A., *et al* 2018). Attitudes and subjective norms have a strong relationship with a person's behavioural intention, and behavioural intention has a relationship with the individual's actual behaviour (McEachan, R., *et al* 2016).

However, research demonstrates that the intention to behave in a certain way does not always translate into that behaviour. Because behavioural intention cannot be the only driver of behaviour in situations in which an individual's control over the behaviour is only partial, Ajzen came up with the idea for TPB by adding the component "perceived behavioural control" to TRA. This was done for this reason. He expanded TRA in this way so that it could more accurately anticipate actual behaviour (Dippel, E.A., *et al* 2017).

The degree to which a person believes that they are able to carry out a specific behaviour is referred to as their perceived behavioural control over that behaviour (Montano, D.E. and Kasprzyk, D., 2015). The individual's sense of his or her own capacity to carry out the behaviour is an important component of perceived behavioural control (Nugroho, A., *et al* 2018). In other words, one's behaviour or their goals determine how much control they feel they have over their behaviour. This perspective shifts depending on the surrounding conditions as well as the actions that are taken (Nugroho, A., *et al* 2018). According to the theory of planned behaviour, people are considerably more likely to intend to enact particular behaviours when they feel that they can enact them successfully (McEachan, R., *et al* 2016). The theory has thus improved upon TRA since it says that people are much more likely to intend to do certain behaviours when they believe that they can enact them successfully (Montano, D.E. and Kasprzyk, D., 2015).

Extension of self-efficacy

TPB adds the concept of perceived behavioural control, which originated from the self-efficacy theory (SET), to the mix of attitudes and subjective norms that are already included in TRA. SET is one of the three components that make up TRA. Bandura first put up the idea of the self-efficacy construct in connection to social cognitive theory in the year 1977 (Montano, D.E. and Kasprzyk, D., 2015). The term "self-efficacy" refers to a person's expectation or belief that he or she can master behaviour or accomplish a goal; the degree to which an individual believes he or she is capable of mastering behaviour or achieving a goal varies depending on the behaviour or objective in question (Montano, D.E. and Kasprzyk, D., 2015). Bandura defined two different kinds of expectations related to achieving a goal: self-efficacy expectations and outcome expectations (McEachan, R., *et al* 2016). He defined self-efficacy as the belief that an individual is capable of successfully carrying out the actions necessary to generate the outcome that is in question (Dippel, E.A., *et al* 2017). The term "outcome expectancy" describes a person's estimation that a particular action will result in a particular set of consequences. Bandura established the concept that self-efficacy is the most crucial precondition for behavioural change since it is essential to the beginning of

coping behaviours (McEachan, R., *et al* 2016). He said this because self-efficacy is the key to initiating coping behaviours (Montano, D.E. and Kasprzyk, D., 2015).

Previous research has demonstrated that an individual's confidence in his or her ability to conduct certain behaviour has a significant impact on that individual's propensity to engage in that behaviour. Because self-efficacy contributes to explanations of various relationships among beliefs, attitudes, intentions, and behaviour, TPB has been widely applied in fields related to health, such as encouraging adults and pre-adolescents to engage in more physical activity in order to improve their mental health and encouraging pre-adolescents to participate in more physical activity in order to improve their mental health (Dippel, E.A., *et al* 2017).

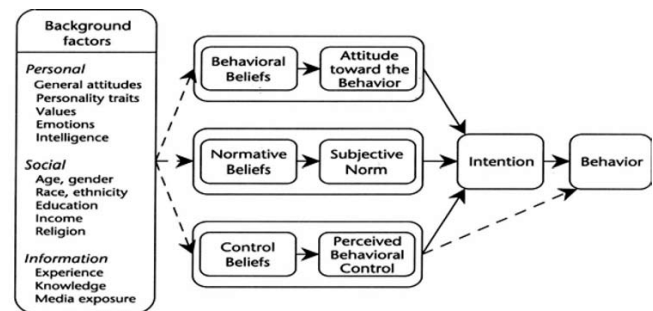


Fig 1.7: Theory of Planned Behavior (TPB)

2. Conclusion

The discussions, concepts, and applications presented above, as well as the development of technology adoption models and theories based on the literature review, are open to a variety of interpretations and points of view. The literature reviews discuss the various models and theories of technology adoption, each of which have their own unique theoretical insights, research issues, variable sets, and measurement scales. Both the theoretical and practical aspects of the various models and concepts about the adoption of technology. In this body of work, we aimed to identify characteristics that would boost the likelihood of a technological innovation being accepted and utilised on an ongoing basis, such as the digital currency bitcoin acceptance. More specifically, Rogers' Innovation Diffusion Theory (IDT), Theory of Technology Acceptance (TAT), and Technology Acceptance Model (TAM)/TAM2/TAM3, Theory of Reasoned Action (TRA), Unified Theory of Acceptance and Use of Technology (UTAUT), and Theory of Planned Behaviour (TPB) were key outstanding theories that were applicable to the transfer and adoption of new technologies by members of the public in this case MSMEs.

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