

## **Diffusion of Innovation: A reflection from a retrospective and prospective outlook**

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### **A brief historical background:**

The spread of ideas from people to people lies at the heart of human ingenuity that have its origin on innovation and creation. Endowed with the gifted capacity, among all other living species, for cumulative accumulation of knowledge across generations, has indeed enabled and shaped the current human society in what we are today. The metamorphosis of human civilization from its primitive society to its modern welfare state became possible through our continual and never-ending quest for intellectual enrichment and the ability to disseminate perceived useful ideas and thoughts among the members of our species. The diffusion of innovation by E.M. Rogers (1962) is one such well-known theory that deals extensively with diffusion (spread) of ideas or innovation among humans.

Going back to its historical records, we could trace diffusion research starting from Europe as early as the beginning of the 20<sup>th</sup> century. Gabriel Tarde, a French lawyer and judge was the first to mention “the laws of imitation” now-a-days re-labeled as “adoption” (Rogers, 2003). Tarde was also the first to realize the rate of adoption pattern followed an S-shaped curve over time which was later confirmed by Ryan and Ross (1943) and by E. M. Rogers (1962) himself in the ensuing 4 decades that followed during his diffusion research, giving further credence and acknowledging Tarde as the founding father of diffusion theory. In the early years of 1900s and soon after, other researchers such as Georg Simmel from Germany and a combination of German-Austrian and British anthropologists gave their varying perspectives on diffusion as a means of social change, which piqued the interest of US scholars first in the 1920s and then in 1940s, who began to investigate the diffusion of innovations in a methodical and empirical way.

One such major contribution in the diffusion of innovation research came from the rural sociology field in the form of hybrid seed corn (maize) research by Bryce Ryan, then professor at Iowa State University (ISU) and his fellow student Neal Gross in 1943. Soon after the two researchers get their research work published, the 2<sup>nd</sup> World War erupted in 1945 stymying further development of this emerging concept of diffusion research, until some years later when Rogers first realized the idea of the diffusion model while working as an undergraduate student at ISU in the early 1950s when he came across the classical published research paper of Ryan and Gross, related to the adoption of hybrid corn among Iowa community farmers. The hybrid corn was introduced, following years of research by plant breeders and agronomists, because it was drought-tolerant, have sturdier stalks and would yield 20% more than traditional corn varieties that farmers have been using. Among the 259 farmers that were interviewed and included in the original research analysis, the two researchers found that it took 13 years to reach 100% adoption rate among farmers of the two Iowa communities to replace their existing open-pollinated corn with the new hybrid ones in their farms. On average, it took about 7 years for farmers to adopt the new hybrid corn, often considered a promising variety ensuring high economic returns to farmers, which then puzzled the two researchers among others. Having

come from a farm-family background, often helping his father in farm related activities in his home community near Carroll, about 70 miles from ISU, Rogers was intrigued to find in the research paper of Ryan and Gross that their findings resonated with his own personal experience with his family farm and other neighboring farms in his home county concerning reluctance of farmers to adopt new innovation in their farms despite its proven intended benefits. This led Rogers to further delve into the diffusion of innovation research, which earned him a Ph.D. in 1957 from ISU, which continued further down the road culminating in 5 editions of his "Diffusion of Innovations" book till 2003, while holding faculty positions in different universities across the country, while bringing about further revisions and subsequent expansion of the diffusion literature once in nearly every decade, until his untimely death in October 2004.

According to Rogers (1962), "an innovation is an idea, practice, or object that is perceived as new by an individual, organization, or other unit of adoption." In his seminal book, "The Diffusion of Innovation" first published in 1962, Rogers proposes that **four** main elements influence the spread of a new idea in his diffusion model: the **innovation** itself, **communication channels**, **time**, and a **social system**. This process relies heavily on human capital. So far, this is the most widely accepted and key foundational theory on the adoption and spread of innovation, spurring a vast array of research spanning across various development sectors such as agriculture, health, education, sociology, anthropology, technology, and so forth. Each element of the diffusion model is expanded by later researchers to further elucidate the core component with its own set of concepts and approaches. Rogers upheld the same four elements of the diffusion model throughout the 5 different editions of his book, but has modified his earlier classic linear or top-down approach of adoption decision by adding either adoption or rejection decision of innovation and a feedback loop, giving more weight to a two-way communication process among innovators of ideas and its final adopters, based on new findings from research studies in the intervening years since the hybrid seed corn study of Ryan and Gross. Nevertheless, Rogers postulate the theory of a general diffusion model even in the final edition of his book and strongly argues that the diffusion process follows certain common patterns and regularizes across a range of conditions, innovations and cultures.

### **Overview of the theory's components:**

#### **Innovation**

According to the definition of innovation provided by Rogers in the brief background section above, an innovation usually have two parts: a hardware component, in its material or physical form which is usually the product or representation of a practice or idea; and a software component which is the idea itself or information base, which together influence the characteristics of the innovation. As identified by Rogers, there are 5 characteristics of innovations that helps to explain the different rate of adoption of different innovations. They are: **relative advantage**, the "degree to which an innovation is perceived as better than the

idea it supersedes”; **compatibility**, the “degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters”; **complexity**, the “degree to which an innovation is perceived as difficult to understand and use”; **trialability**, the “degree to which an innovation may be experimented with on a limited basis”; and finally **observability**, the “degree to which the results of an innovation are visible to others” (Rogers, 1995, 2003). Rogers maintained that successful innovations do possess all the five characteristics.

### **Communication Channels:**

According to Rogers (1962), “the essence of the diffusion process is the information exchange through which one individual communicates a new idea to one or several others.” Rogers identified two types of communication channels: mass media channels, such as newspapers, radio, television for reaching a wide audience followed by interpersonal communication channels for exchanging face-to-face dialogue between two or more individual or groups of people. The latter one could be most effective in convincing a potential adopter, since people are keen to know the perspective from earlier adopters regarding the real value or usefulness of an innovation. Dearing (2018) further stressed the importance of interpersonal relationships that functioned as effective filters and gatekeepers by helping potential adopters to weed out worthless innovations and selectively picking up the good ones.

Rogers also used the terms “homophily”, which connotes similarity between interacting individuals and “heterophily” meaning dissimilarity between individuals who interact, based on their education level, socio-economic status, language, culture or other comparative attribute. In the last edition (2003) of his book, Rogers also recognized the importance of Internet, by providing user statistics trend, in fostering diffusion of information in a completely revolutionary and different way than the earlier established communication channels. As a further elaboration, he also talks about Re-invention, “the degree to which an innovation is changed or modified during the process of its diffusion”; Digital divide, “the gap that exists between individuals advantaged by the Internet and those relatively disadvantaged by the Internet”; Telecentres, “usually provided by government for individuals who do not own or have access to computers.” (Rogers, 2003).

### **Time:**

The significance of the time element in diffusion research (Rogers, 1995, 2003) is evidenced in three ways. First, all innovation-decision process that an individual goes through must pass through a process and it takes time to reach that decision point. Second, the rate of adoption of an innovation depends on how much length of time it took to spread the novel idea in a contextual system which has its own peculiar attributes such as established norms, culture, and values. Finally, the innovativeness of an individual or group is found to be determined by the time element over a certain period.

### **Social System:**

According to Rogers (1995), a social system “is a set of interrelated units that are engaged in joint problem-solving to accomplish a common goal.” Some examples of social systems or now-a-days referred to as social networks are families, work organizations (offices), community or recreation centers and so forth. A social system helps individuals to form social ties or social bonds by providing a platform to exchange information and ideas. As such, it delineates a boundary within which an innovation can diffuse (Miller, 2015). The concept of social structure, opinion leaders, personal and social norms, change agents, types of innovation-decisions and consequences of innovation are all subsumed and understood within a social system (Miller, 2015).

### **Review of Related concepts tied to Diffusion of Innovation:**

Most of the research work in the diffusion of innovation theory over the last half century revolved around the four core components as discussed above. The connecting link between the diffusion of innovation theory and other technology adoption models, such as Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTUAT) among others, lies at the individual adoption level. These are the innovation-decision process, the innovativeness level of an adopter and the types of Innovation-decisions. (Miller, 2015).

### **Innovation-Decision Process:**

This process consists of five identified functions that usually occur sequentially. The first is the **knowledge function**. At this critical stage, the individual becomes aware of the innovation and tries to understand in depth about its functioning. The second stage is the **persuasion function** where the individual seeks interpersonal channels of communications in order to get more convincing viewpoints or thoughts about the innovation from network of friends and peers which could ultimately help him/her to form a favorable or unfavorable attitude about the innovation. In the third stage comes the **decision function**, where the individual decides whether to adopt or reject the innovation. The fourth stage is the **implementation function** where the individual finally actually puts the innovation to use. In doing so, the individual may re-invent the innovation through slight modification to suit his/her needs. Finally, the last stage is the **confirmation function**, where the individual re-affirms his/her earlier decision which may lead to either adoption (if the earlier decision was to reject) or discontinuance (if the earlier decision was to adopt). The five stages need to pass through time, and the time required for this process to happen is called innovation-decision period (Rogers, 2003).

### **Adopter’s Innovativeness level:**

According to Rogers (1995, 2003) Innovativeness of an adopter is measured as the degree that an individual is “relatively earlier in adopting new ideas than the other members of a system.” This definition encapsulates both the innovation decision period at the individual level, and the

rate of adoption at the social system level. Rogers (1962) have classified individuals into one of **five adopter categories** forming a normal bell-shaped curve when the distribution of adopters is plotted over time. The distribution makes up **Innovators** (2.5%), **Early Adopters** (13.5%), **Early Majority** (34%), **Late Majority** (34%) and **Laggards** (16%). Such categorization based on innovativeness serves two purpose: First, it provides a useful measurement of the distribution of individuals within a social system over time. Second, it helps to segregate individual categories who makes the adoption decision (Miller, 2015)

### **Types of Innovation-Decisions:**

The social system plays a defining role in the type of innovation-decisions that is made in society. The classic diffusion model is more focused and based on optional innovation-decisions where an individual makes the final choice, being “independent of the decisions of other members of the system” (Rogers, 1995). Although, arguably, such individual decisions are still influenced by the existing social norms, traditions and interpersonal networks (Miller, 2015). In recent years as more research work began to surface with a focus on the system level, two other types of innovation-decisions were developed. They are: **collective innovation-decisions**, where the choices to adopt or reject and innovation is made “by consensus among the members of a system,” and **authority innovation-decisions**, where the choices are made “by a relatively few individuals in a system who posses power, status, or technical expertise” (Rogers, 1995, pp 28-29). As a further elaboration in either of the two scenarios, contingent innovation-decisions are choices that can be made “only after a prior innovation-decision” (Rogers, 1995, p 30) which is relatively most common within an organizational setting. In short, an innovation-decision continuum is evident from optional to collective to authority decisions where the prevailing social system plays the important role of a catalyst.

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