

Towards Diffusion of Innovations: Conceptual Commonalities and Contradictions

*Suppakron Pattaratanakun**

บทคัดย่อ

บทความนี้มุ่งเน้นการขยายขอบเขตองค์ความรู้ด้านการแพร่กระจายนวัตกรรมผ่านทฤษฎีสามด้าน คือ ทฤษฎีฐานทรัพยากรขององค์กร มุมมองของลูกค้าที่มีต่อการแพร่กระจายนวัตกรรม และรูปแบบความสัมพันธ์เชิงเหตุผลระหว่างมุมมองทั้งสอง การปริทัศน์วรรณกรรมจากสหสาขาวิชานำมาซึ่งการขยายคุณลักษณะที่ส่งเสริมการแพร่กระจายของนวัตกรรม กล่าวโดยเจาะจงคือ บทความนี้เสนอแนะว่าคุณลักษณะด้านความโดดเด่นกว่าและการแยกส่วนได้ของนวัตกรรมควรปรับเปลี่ยนเป็น



คุณประโยชน์ที่สูงกว่า และการลดความเสี่ยงในการใช้นวัตกรรมซึ่งเข้ากับแนวคิดมุมมองของลูกค้ามากกว่า นอกจากคุณลักษณะของนวัตกรรมแล้ว บทความนี้ยังนำเสนอว่าลักษณะภายในขององค์กรสามด้าน ได้แก่ การดำเนินงานอย่างมีประสิทธิภาพ โครงสร้างและวัฒนธรรมองค์กร และความสามารถขององค์กรในการบูรณาการและแลกเปลี่ยนทรัพยากรก็เป็นปัจจัยนำไปสู่การแพร่กระจายนวัตกรรม นอกจากนี้บทความยังได้นำเสนอโมเดลเชิงแนวคิดจากผลการศึกษาดังกล่าวด้วย

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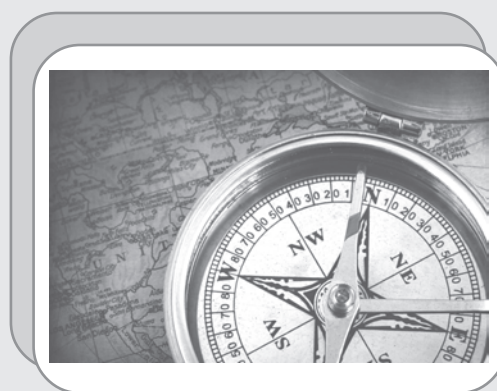
* Lecturer Marketing Department, Chulalongkorn Business School, Chulalongkorn University.

Abstract



This paper aims to expand the diffusion of innovations theory in three theoretical dimensions: resource-based view of a firm, market viewpoint of innovation diffusion, and proposed causal relationship of the two views. The review of literature from interdisciplinary leads to the expansion of characteristics of innovations of which cause diffusion. Specifically, the paper suggests that the relative advantage and divisibility of an innovation should be viewed in terms of advantage superiority and uncertainty marginalization which are more customer-centric.

Further, target customers' affordability and firms' resource compatibility are initiated as the additional key aspects that lead to the diffusion of innovations. Besides the characteristics of an innovation itself, the article proposes three internal characteristics of a firm that facilitates the diffusion operation efficiency, firm structure and culture, and the ability to combine and exchange resources. The article concludes by offering a conceptual model based on the findings.



Keywords : Innovation Diffusion, Innovation, Market Viewpoint, Resource-Based View of a Firm

The vital role of innovation in society and firms can be traced back to 1942 when Schumpeter highlighted the importance of innovations to economic development (Van de Van, 1986: 590). Consequently, management has considered innovation, particularly technological breakthroughs (see Christensen, 1997), as an essential for firms, and has made a strong effort to create innovations in every corner of firms (Prabhu, Chandy, & Ellis, 2005; Frambach, Prabhu & Verhallen, 2003). Christensen (1997) and O'Neill, Poudier, and Buchholtz (1998) cautioned that the thirst for innovations in firms is gross management malpractice because many breakthrough innovations have never been adopted by firms or markets. Consequently, interest in the field of innovation has turned to the diffusion of innovations (DOI), the concept which examines the causes of widespread use and success of innovation (Ardis & Marcolin, 2001). Various management theories and concepts such as resource-based and knowledge-based encourage firms to focus on internal resources in order to acquire a successful innovation (Brown & Eisenhardt, 1995; Verona, 1999). On the other hand, many scholars, such as Rogers (1976; 2003), based their viewpoints on the market adoption as the tipping point of success.

These two views do not necessarily contradict, and can in fact complement each other, because firms operate in a dynamic environment in which competition is disequilibrating an on-going process of constant struggles among firms in their

internal resource capabilities and market positions to yield competitive advantages (Hunt & Lambe, 2000). Nonetheless, the two perspectives internal resources and market positions have rarely been explored mutually, especially in the innovation discipline (Roquebert, Phillips & Westfall, 1996). Although the works proved beneficial, further exploration of the linkage between the two perspectives will expand the knowledge of the discipline.

This article initiates the integration of the internal resources and market perspectives by emphasizing the diffusion of innovations. Following Roger (1976; 2003), the diffusion of an innovation is the process by which an innovation is communicated through certain channels over time among the members. As specified by Ardis and Marcolin (2001) the process is an important indicator of the success of an innovation. Accordingly, the current article aims to enrich the body of knowledge on innovation diffusion in three dimensions: 1) identifying common firm resources that affect innovation, 2) reclassifying ordinary characteristics of diffused innovation from the market's point of view, and 3) combining the two viewpoints and proposing a conceptual model of innovation diffusion. To do so, theories from different disciplines, namely the theory of disruption, the theory of human communication, and theories of customer behaviors, are explored in accordance with various concepts of innovation diffusion. As a result, the fundamental resource-related innovation is defined and the common

characteristics of innovation diffusion in the market are revised. The revision follows the suspicious arguments of such scholars as Downs and Mohr (1976), Lyytinen and Damgaard (2001), and Hughes (1989) which indicate that the common five characteristics of the diffusion of innovations proposed by Roger (1976; 2003) might not be a complete list. To illustrate, Downs and Mohr (1976) cautioned that cultural differences might deviate the characteristics of the diffusion of innovations from Roger's, while Hughes (1989) suggests that the list is not complete because Roger derived the findings from product innovations in certain industries. Furthermore, the framework that links a firm's resources, market positioning, and innovation diffusion is proposed. Further systematic empirical studies will eventually expand the body of knowledge and provide managers with more precise directions to cope with the opportunities and threats of innovations.

Common firm resources

Consideration of the importance of resources is an essential part of resource-based view theory, in which each firm owns a distinctive bundle of resources (Collis & Montgomery, 1995). Accordingly, the RBV suggests firms concentrate on their internal capabilities (Wernerfelt, 1984). Applying the appropriate firms' resources to developing innovation is a key factor of the diffusion of innovations (Bharadwaj & Menon, 2000; Hurley & Hult, 1998). Additionally, firms must possess the ability to transform their resources to valuable

outputs in order to have a successful diffused innovation (Vorhies & Morgan, 2005).

Firms' resources are identified in different ways. For instance, Lee, Lee, and Pennings (2001) and Wernerfelt (1984) suggested that the resources of a firm include its technological knowledge, machinery, people skills, capital items, real estate, and reputation. Further, Daft (2006) identified a firm's resources as comprising all of the internal assets of the firm, such as its capabilities, organizational processes, and knowledge.

According to the objectives of this paper, common firms' resources related to innovations must be identified. In doing so, literature on new product development and firms' resource utilization are explored. As a result, three common categories firm structure and culture, organizational efficiency, and the ability to combine and exchange resources are proposed as the major resources related to innovations. Although each category is not new to the field, the combination of the three is unique to this article.

Firm Structure and Culture

Firm structure has proven to impact on innovations (Acs & Audretsch, 1988). That impact is diverse among the different types of firm structure. For instance, Acs and Audretsch (1988) discovered that a small, less hierarchical firm has a positive effect on innovation. In addition, Cardinal (2001) found that centralization influences radical innovations while Lukas and Menon (2004) discovered that a centralized structure limits incremental innovation.

Later literature has also suggested that firms' cultures, which include but are not limited to shared visions, attitudes, beliefs and values, impact on the firms' innovations. To illustrate, Kuczmarski (1998) found that positive attitudes lead to innovation by firms. Furthermore, Manimal, Jose, and Thomas (2005) discovered that clear strategic visions help development teams to introduce innovation.

Operational Efficiency

Operational efficiency refers to those firm resources that enable efficient innovation processes and the market implementation of innovations (Olson, Walker, Ruekerf & Bonnerd, 2001). Cooper and Kleinschmidt (1994) and Danneels (2002) suggested that firm operational efficiency is essential to innovations. Although scholars have proposed different combinations of operational efficiency, three types of operational efficiency competence in executing predevelopment tasks, technological proficiency, and launch proficiency are mutual.

Competence in performing predevelopment tasks is central in the early stages of innovation development, such as idea generation, idea screening, and feasibility study (Armstrong & Kotler, 2004). Research and development knowledge, activities, and expenditures are critical to this type of operational efficiency (Cooper & Kleinschmidt, 1994). Technology proficiency refers to internal advanced technology and the technological skills of a firm's human resources. Wernerfelt (1984)

suggested that firms with superior technological proficiency are more capable of product innovation development. Launch proficiency is threefold: launch budgeting, launch strategy, and launch tactics (Langerak, Hultink & Robben, 2004). All of those dimensions are interrelated through the marketing budget and activities. For instance, distinctive target marketing and product positioning are considered to be strong launch strategies. Furthermore, having holistic, well thought-out marketing mixes is a robust launch tactic.

Operational efficiency covers an array of firm resources and goes beyond the traditional tangible and intangible resource categorization. Acknowledgement of operational efficiency greatly amplifies the scope of the relationship between firm resources and innovations.

Ability to Combine and Exchange Resources

Hanifan (1916) introduced the concept of social capital in which network, connection, and relationship play a vital role in the value of resources (Field, 2008). Further studies transformed the concept to a theory called the social capital theory in which many scholars (e.g., Adler & Kwon, 2002; Tsai & Ghoshal, 1998; Cohen & Levinthal, 1990) suggested that the exchange of resources and their integration and application are critical factors in innovations. For instance, IMAX 3D cinema emerged and diffused after the Canadian IMAX corporation coupled its technical expertise with its partner relationship management and marketing

capabilities in the 1970's (Mitchel & Coles, 2003; 2004). Based on the social capital theory and empirical evidence, this paper proposes the ability to combine and exchange resources is another common resource that leads to innovation.

To sum up, three common categories of firm resources which are related to innovations are identified. Nonetheless, they are not claimed to be a complete list, but certainly are major groups of resources that demonstrate an impact on firm innovation. The relationship of these three categories will be explored later in this article.

Common characteristics

From the market position perspective, the classical findings of Rogers in 1962 introduced five fundamental characteristics of the diffusion of innovations: relative advantages, compatibility, ease, divisibility, and communicability (Rogers, 2003). These five characteristics have been critiqued by many scholars in various fields (Lyytinen & Damgaard, 2001; Tornatzki & Klein, 1982). Downs and Mohr (1976) dedicated substantial attention to the flaws of the characteristics by focusing on the subjectivity of measurement and differences in cultural perspectives of the ease and communicability aspects. Their fears were later dispelled by Tornatzki and Klein (1982), whose work offers a constructive methodology to understand the characteristics. Hughes (1989) cautioned that the five characteristics might not be a complete list, one reason being that Roger derived the findings from product innovations in certain industries.

Accordingly, there are several gaps in the characteristics of the diffusion of innovations: imprecise definition of some characteristics, and additional characteristics that could make the list more complete. Two sets of literature, namely psychology and marketing, are explored in this section with the expectation that the strong emphasis on the market position perspective of the fields can contribute to the concept of characteristics of the diffusion of innovation.

Definition Revisited

Although there were cautions on the interpretation of all characteristics, it was found that the three characteristics compatibility, ease of use, and communicability have been synchronically defined and adopted (Premkumar, Ramamurthy & Nilakanta, 1994; Rogers, 2003). The only dissimilarity is the interpretation of the relative advantage and divisibility aspects. The following two subsections will present the problems related to the two aspects and suggest some revisions in order to improve the preciseness and applicability of those characteristics.

Relative advantage and fulfilment superiority. According to the original version, relative advantage is about the advancement in product attributes compared to other market offers in the same category (Roger, 2003). Later, some scholars found that relative advantages can go beyond a comparison within the same product categories (e.g., Hitcher, 2006). For instance, facsimiles of the office appliance category became popular because the innovation demonstrates

supremacy over the offers in service categories like express mailing (Schmidt & Werle, 1998). Consequently, a question arises: how to identify the right competitors to acknowledge the relative advantages?

The theory of product levels and a classic concept of marketing myopia (see Levitt, 1983) can lead to a solution. According to the theory of product levels, products are classified into four levels: core product, actual product, augmented product, and potential product. The two most important levels are the core product, the benefits or services that customers are really buying, and the actual product, the tangible parts of the product. Focusing on the actual product leads to marketing myopia in which firms lose their insights about their real opponents. The actual competitors of firms are the other firms which offer the same core product (*ibid.*). Market offerings in a similar category can serve different core customer needs, while the offerings in different categories can fulfil the same core need. To illustrate, a Volvo car meets a safety need, whereas a Bentley car fulfils a social esteem need. Additionally, it was found that average beer sales drop dramatically on the day of an important football match because both products, beer and football, supply a similar need, namely, “happiness of manhood.”

An understanding of the core customer needs contributes to the characteristic of relative advantage in that it demonstrates the set of competitors with which the innovation needs to make comparisons. For instance, besides the

advancement in other transportation modes, the business air travel firms should keep their eyes on the telecommunications industry where technology enables business people to do their business without the need for physical travel. Because of a more distinctive definition, this article will use the term “fulfilment superiority” as an alternative to “relative advantage” to avoid a misunderstanding of the terms.

Proposition 1: the degree to which an innovation can better fulfil similar core needs of target markets increases the likelihood of the diffusion of innovations.

Divisibility and uncertainty avoidance. The intention of Rogers to introduce divisibility was to recognize that it is human nature to adopt after evaluation (Roger, 2003). In other word, the benefits gained from an individual innovation must be evaluated before diffusion of the innovations occurs. Divisibility of innovation makes it less problematic for the market trial and evaluation. (Tornatzkia & Klein, 1982). This argument may appear sound, but some scholars, such as Hai (1998), have countered that divisibility captures only part-of-a-whole. This counter argument against divisibility has built around its own core concept Hai (1998) illustrated that divisibility is only a facet of risk minimization. There are many other ways to reduce risk which will in turn lead to the diffusion of innovation, such as demonstration and satisfaction guarantee. Additionally, focusing on only divisibility might cause the fatal flaw of overlooking the uncertainty avoidance element. For instance,

Premkumar, Ramamurthy and Nilakanta (1994) found that the nature of some products or services, such as an electronic data interchange (EDI) system, limits their divisibility. Therefore, the divisibility aspect was dropped out of their list of common characteristics without acknowledgement of uncertainty of innovation, which plays a vital role in a large, technological system. (Lane & Maxfield, 2005; Pinch & Bijker, 1984)

Consequently, the divisibility element should be redefined to capture the whole picture of uncertainty avoidance. To acknowledge the new definition and avoid misunderstanding, this paper will use the term “uncertainty avoidance” instead of “divisibility”.

Proposition 2: the degree to which an innovation can marginalise the uncertainty of target customers increases the likelihood of the diffusion of innovations.

Additional Common Characteristics

Two additional characteristics are suggested by literature on the costs to customers, theories of communication, and the internal resources of firms: affordability and resources availability. This paper does not claim that the addition of these two extra characteristics captures all possible characteristics, but the expanded list could offer a more complete picture of the diffusion of innovations.

Affordability. To acknowledge the ability of target patrons to obtain innovations, costs of acquiring innovation was accepted by some

scholars as an additional common characteristic of diffused innovations. Rogers (2003) himself stated that the lower the customer cost (market price) of innovation is, the higher the possibility of innovation to diffuse will be. Additionally, George, Works, Watson-Hemphill, and Christensen (2005) suggested that the price of innovation should not be so high that customers can try and evaluate innovations on a limited basis which will in turn increase the adoption rate of innovations. In fact, the price of many diffused innovations is very high. For instance, iPod costs more than five times as much as its direct competitor, a Walkman, but the innovation has diffused in the market and disrupted the incumbent’s innovation. For that anomaly, the low cost is not a precise factor.

The anomaly did falsify the acknowledgement of low cost characteristics, but cost in some specific aspects might still play a vital role in the diffusion of innovations. With a careful exploration of historical data on the diffusion of innovations, the light was shed on affordability of innovation. Affordability, not low costs or price, is presented through the ability of a market to acquire innovations. Affordability is different from low cost in that affordable innovation can come with high costs for the high-end market.

Many disruptive innovations share a main characteristic of affordability. For instance, the mobile phone has dominated the communications industry after the price per call became comparable to a landline phone. In addition, LCD has dominated the monitor market since economies of scale and

scope brought price competitiveness to the innovation (Sood & Tellis, 2005). These examples illustrate that an innovation with the five characteristics of Roger cannot be diffused before it demonstrates the affordability aspect.

Proposition 3: the degree to which an innovation is affordable to target customers increases the likelihood of the diffusion of innovations.

Resources Availability. Resources of a firm consist in all tradable aspects within a firm (Wernerfelt, 1984). With the limitation of an article length, merely one key resource of a firm, namely communication, is revealed here to demonstrate their relationship to the diffusion of innovations. The communication theories support the argument of the characteristics of diffused innovation by stating that the senders cannot convey a message to receivers without communicability of the message itself (Craig, 1999). Work in communication arts later added another fundamental element, the availability of resources, to the communication process. Resources enable a communicable message to be delivered (Littlejohn, 2002). The communication

theory casts doubts that communicability permits innovations to reach the market. The absence of the availability of certain resources limits the potential of diffused innovations. To illustrate, BlackBerry had struggled with low sales volumes for more than 10 year after its inception. In 2002, the firm began to aggressively push its product by tripling its investment in its channels of distribution and human resources development programmes (Ryan, 2004). As a result, the company's global sales increased dramatically.

Proposition 4: the degree to which innovation is supported by firms' resources increases the likelihood of the diffusion of innovations.

Table 1 summarises the revision of the common characteristics of diffused innovation from the market viewpoint. Based on Rogers', two categories are redefined and renamed from relative advantage to fulfilment superiority, and from divisibility to uncertainty avoidance and two new characteristics affordability and resources availability are introduced.

Table 1 Common Characteristics of Diffused Innovation from the Market Viewpoint

Rogers' Common Characteristics	Proposed Characteristics	Exemplary References
• Relative Advantages	• Fulfilment Superiority	• Levitt (1983), Hitcher (2006) & Rogers (2003)
• Divisibility	• Risk Avoidance	• Hai (1998), Lane and Maxfield (2005), Pinch and Bijker (1984) & Premkumar, Ramamurthy and Nilakanta (1994)
• Complexity	• Complexity	• Premkumar, Ramamurthy and Nilakanta (1994) & Rogers, (2003)
• Compatibility	• Compatibility	• Premkumar, Ramamurthy and Nilakanta (1994) & Rogers, (2003)
• Communicability	• Communicability	• Premkumar, Ramamurthy and Nilakanta (1994) & Rogers, (2003)
	• Affordability	• George, Works, Watson-Hemphill, & Christensen (2005) & Rogers (2003)
	• Availability of Resources	• Craig (1999)

Unification of firms' resources and market viewpoints

The relationship between resources and innovation has generally studied by management scholars, such as Silverman (1999) and Subramaniam and Venkatraman (2001), while the studies of market viewpoints of innovation have normally been conducted by marketing scholars, such as Jin, Kim, and Srivastava (1998). Although findings from the two points of view are rigorous, it is proposed that the combination of the two will eventually contribute immensely to the body of knowledge and managerial implications. Based on the three common firm resources and seven common characteristics of innovation explained earlier, this section proposes a conceptual framework which combine firms' resource and market

viewpoint. The model provides a more precise picture of the diffusion of innovations.

Variables Categorization

According to Wernerfelt (1984), resources are the essence of firms' activities, so this paper regards the three categories of firm resources as endogenous variables. Six common characteristics of diffused innovation are believed to have mediating effects and directly link to the diffusion of technology (endogenous variable) (See also Roger, 2003). The characteristic of resource availability is omitted from the list because it has been captured by the exogenous variables.

Causal Relationship and Proposed Model

In order to propose a model that links firms' resources, market position, and the diffusion of

innovations, the related literatures are reviewed and the findings are discussed in this section. The past literature indicates that there are relationships between several firm resources (e.g., firm structure, culture, and operational efficiency) and innovation characteristics from the market viewpoint. Barney (1986; 1991) found that distinctive resources help firms to create a competitive advantage. From the diffusion of innovations viewpoint, some firm resources create superiority in common characteristics. To illustrate, Sheremata (2000) discovered that the speed of innovation decision-making increases in firms with centralised structures. In other words, firm structure¹ leads to the fulfilment superiority characteristic. Furthermore, launch proficiency, which is related to marketing capabilities, decreases in complexity and increases the communicability of innovations (Henard & Szymanski, 2001). In particular, resources in marketing communications (MarComm), such as public relations, advertising, and personal selling, present strategically appropriate communication processes which offer receivers a simple and understandable message. Several marketing communication tools, namely trials, demonstration, and satisfaction guarantee, are able to decrease uncertainty in the market. In addition, the ability to combine and exchange resources offers firms economies of scale and scope, which lead to

compatibility and affordability of innovations (Cohen & Levinthal, 1990).

Proposition 5: Firm structure and culture, operational efficiency, and the ability to combine and exchange resources have positive effects on common characteristics of the diffusion of innovations.

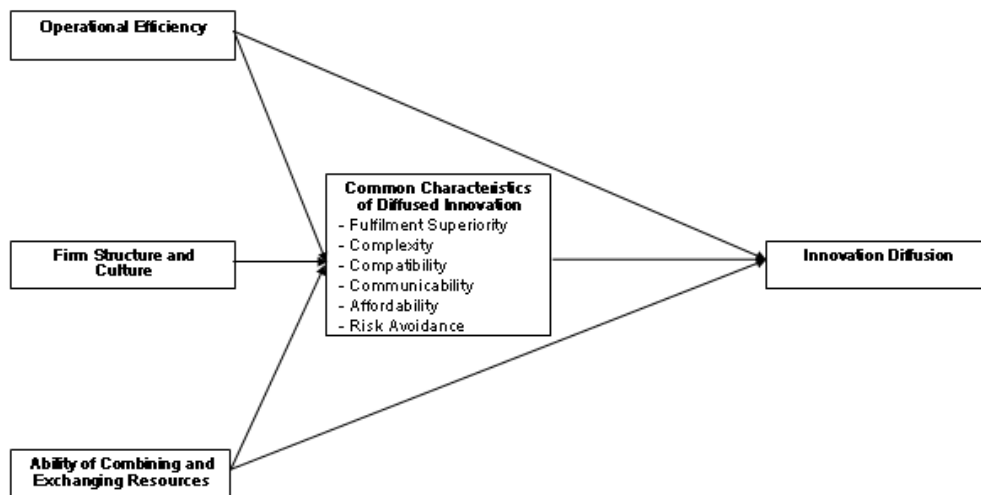
According to the relationship between resource availability and the diffusion of innovations, two resources operational efficiency, and the ability to combine and exchange resources are found to have a direct relationship with the diffusion of innovations. Henard and Szymanski (2001) stated that not only innovation but also innovation implementation benefits from operational efficiency. For instance, financial resources enable innovations with relative advantages, ease, compatibility, communicability, affordability, and risk avoidance to diffuse into a market. The impact of operational efficiency and the ability to combine and exchange resources on the diffusion of innovations aligns with the propositions of such scholars as Danneels (2002) and Eisenhardt and Martin (2000). To illustrate, Danneels (2002) proposed that the dynamics of product innovation is caused by firm operational competencies. Further, Eisenhardt and Martin (2000) argued that innovations have a direct linkage to the ability to alter the resource configuration of the firm.

¹ Organization structure refers to how the organization is built and relations of its constituent parts to each other. Bureaucracies, line and staff organizations and network of organization are parts of firm structure. (Witzel, 2004)

Proposition 6: Operational efficiency and the ability to combine and exchange resources have positive effects on the diffusion of innovations.

By combining all the relationships stated above with the known relationship, common market viewpoint of diffused innovation and the diffusion of innovations, a conceptual model is proposed. (Figure 1)

Figure 1 Proposed Conceptual Model of Firms' Resources, Market Viewpoint of Diffused Innovation, and the Diffusion of Innovations



Conclusion

The perspective presented here emphasizes three potential dimensions to expand the body of knowledge of innovation diffusion: categorising common internal resources, refining common characteristics of diffused innovations, and discovering direct and indirect relationships between internal and market viewpoints. The

proposed characteristic that leads to innovation diffusion offers theoretical contributions and opportunities for future research. To illustrate, an innovation's relative advantage, divisibility, and affordability, and a firm's resource compatibility are more customer-centric and enable the integration of the theory of innovation diffusion and marketing

philosophical orientations. Accordingly, future research on the topic should emphasise more on users as a key of diffusion, not the innovation itself. Further, three internal characteristics operation efficiency, firm structure and culture, and ability to combine and exchange resources address the key issue that has long been omitted from the market viewpoint, namely firms' internal resources. The integration of the resources-based view of a firm to

innovation and marketing enhances a researcher's perspective that might in turn allow for a more precise research frame. Finally, the proposed model at the end of the article offers a research opportunity to verify various causal relationships between innovation, firms' characteristics, and the diffusion of innovations. Nonetheless, the propositions are not claimed to be a complete list and deserve further theoretical and empirical investigation.

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