

A Dynamic Model of Effective Factors on Open Innovation in Manufacturing Small and Medium Sized Companies

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ABSTRACT

Open Innovation is a key to improve SMEs' performance in a dynamic marketplace. This article aims to present a dynamic model based on causal relationships among the most important effective factors on Open Innovation in manufacturing SMEs by using system dynamics modelling approach. To study the most important factors, the data collected by questionnaires filled by 275 experts, and analyzed by SPSS and PLS. Causal relationships among studied factors and efficacy coefficients of each factor were identified by fuzzy DEMATEL technique, the data collected from 12 experts and analyzed by MATLAB and EXCEL. Finally, the dynamic model was plotted by VENSIM. According to the results, only strategy of organization has a single loop of causality and effects on itself directly. Economic factors are the most important causal factor that has the highest influence on the other factors. Strategy of organization takes the highest effect from the system and organizational learning is in the next rank. Besides, partners are the most important effected factor and ecological issues as an effected factor has no influence on the others.

KEYWORDS

Fuzzy DEMATEL Technique, Open Innovation, SMEs, System Dynamics, Vensim

INTRODUCTION

Innovation is an important topic in the study of economics (Bhushan, 2012). It is one of the essential drivers of any sector in the economy (Bajracharya, 2014). There are two kinds of innovation: Closed Innovation (CI) and Open Innovation (OI) (Chesbrough, 2003a, pp. 21-63). This kind of process in which large companies internally explored, developed, and commercialized technologies has been called CI Model (Ibarra et al., 2015; Chesbrough, 2003b). OI introduced as a concept 14 years ago by Henry Chesbrough (Chesbrough, 2017; Chesbrough, 2003a). He defines it as paradigm that assumes that firms can and should use external ideas as well as internal ideas (Hossain, 2013) to accelerate internal innovation and to expand the markets for external use of innovation (Chesbrough et al., 2006, p. 2). Even the largest firms need to open their innovation activities (Hippel, 1988) in order to be update with technological developments (Chen et al., 2011). Studies shows that OI can increase the product success rate up to 50% and research productivity and internal development up

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to 60% (Enkel et al., 2009). Although OI can be applied either in the high-tech or low-tech industries (Chesbrough, 2003b), OI has the lowest rate of adoption in low-tech industries (Chesbrough & Brunswicker, 2013, p. 6). The first step towards OI is the outsourcing of R&D to reduce costs and risks and to use complementary assets to fuel growth (Gassmann et al., 2010). Researches indicate that internal R&D alone cannot fully implement OI, so other parts of the organization such as human resources management must get on board for it to work effectively (Chesbrough & Brunswicker, 2013, p. 37). Small and medium-sized enterprises (SMEs), as the majority of firms in the service and manufacturing sectors, make important contributions to create of innovations (Pervan et al., 2015) and play significant roles in the growth, development, and industrialisation of many economies (Shafiei Nikabadi & Zamani, 2016). However, they face significant challenges in their attempts to innovate due to their small size and limited resources (Robinson & Stubberud, 2011) and only few number of studies have emerged about investigating OI practices in SMEs (Lee et al., 2010; Van de Vrande et al. 2009; Laursen & Salter, 2006). Generally, SMEs have received scant attention in the OI literature (Spithoven et al., 2013). Although near 30% on Iran's economic benefit are created by SMEs and about 75% of manufacturing firms are SMEs (Shafiei Nikabadi & Zamanlo, 2012), there are only few domestic studies about OI implementation in manufacturing SMEs (MSEMs). An examination of the factors that drive OI in SMEs is expected to help SMEs desirous of adopting OI (Kaur et al., 2014). Comprehensive exploring about effective factors OI in MSMEs in terms of different aspects, examining causal relations among studied factors to determine a dynamic model are the contribution of this paper. Thus, in order to help Iranian MSMEs due to successful OI implementation, the paper aims to answer this question "What is the dynamic model of effective factors on OI in MSMEs?" by using System Dynamics approach based on the most vital effective factors on OI and their causal relations in MSMEs in Iran.

LITERATURE REVIEW

OI suggests that the ability to absorb external knowledge has become a major driver for competition (Spithoven et al., 2011). Absorptive capacity means the ability of companies for identifying the value of new external knowledge, absorption and employing them (Cohen, 1990) which is a key precondition to internalize and localize the external knowledge by firms (Spithoven et al., 2011). Many barriers against implementation of OI are cultural barriers that effect on accepting OI inside and outside (Mortara & Minshall, 2011) of SMEs and large organizations (Van de Vrande et al., 2009). SMEs normally consider alliances and networks as ways to extend their technological competencies (Edwards et al., 2005). In a research in South Korea, by considering variables large firms, universities, non-profit research institutions, and other SMEs determined that networking is one of the most effective ways to facilitate open innovation among SMEs companies (Lee et al., 2010). Therefore, SMEs should utilize more of academia links and networks to develop and facilitate innovation capabilities (Adam & Comber, 2013; Lundberg & Andersen, 2012). To move from CI to OI, organizations have begun to involve consumers (Wallin & Von Krogh, 2010; Faems et al., 2010; Tether & Tajar, 2008; Chesbrough & Crowther, 2006; Hippel, 1988) suppliers (Vanhaverbeke et al., 2014; Wallin & Von Krogh, 2010; Faems et al., 2010; Tether & Tajar 2008; Chesbrough & Crowther, 2006; Hippel, 1988), partners (Wallin & Von Krogh, 2010; Chesbrough & Crowther, 2006), competitors (Faems et al., 2010; Tether & Tajar 2008; Hippel, 1988), research institutions, and universities (Mention, 2011; Faems et al., 2010; Tether & Tajar 2008; Chesbrough & Crowther, 2006) in innovation process to improve their innovation performance (Vanhaverbeke et al., 2014). One of the concepts that considered with external resources is the external relationships management (Ibarra et al., 2015) which includes the choice of opportunities to work, its evaluation, recruitment the potential allies, the capture of value by creating knowledge capacity or complementary assets acquisition and finally, the innovative supply market offers (Nakagaki et al., 2012; Idelchik & Kogan, 2012; Huizingh, 2011; Sieg et al., 2010; Kim & Park, 2010). The variety of external sources is called external search breath, whereas

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