Journal of Business Research 68 (2015) 1388–1394

Contents lists available at ScienceDirect

Journal of Business Research

Strategic embeddedness of modularity in alliances: Innovation and performance implications

Ricarda B. Bouncken [a,*], Robin Pesch [a], Siegfried P. Gudergan [b]

[a] Bayreuth University, Bayreuth, Germany
[b] Newcastle Business School, University of Newcastle, Newcastle, Australia

ARTICLE INFO

Article history:
Received February 2014
Received in revised form November 2014
Accepted January 2015
Available online 10 February 2015

Keywords:
Modularity
Performance
Innovation alliances
PLS-SEM

ABSTRACT

This paper examines modular product structures in alliances. Results from a survey of 225 alliances show that modular product structures within alliances affect alliance firms' competitive performance. Product innovation performance, assessed as both speed to market and radical innovations and contingent on the employed innovation strategy, partially mediates this effect. Modular product structures exert curvilinear effects on product innovation performance and linear effects on competitive performance. Although the interaction of modular product structures with an innovation strategy increases product innovation performance, this contingency also reduces the positive effect of the innovation strategy on competitive performance.

1. Introduction

Firms form alliances to increase access to resources and improve innovation and competitive performance (Das & Teng, 2000; Lyles & Gudergan, 2006; Pitsis & Gudergan, 2010). Although alliances can advance product innovation performance (de Faria, Lima, & Santos, 2010), alliances often fail to meet their targets (Park & Ungson, 2001), due to high uncertainty, complexity, misunderstandings, opportunism risks, and potential goal incongruence among allying firms (Das & Rahman, 2001).

This paper examines whether modular product structures within alliances might moderate the weak spots that characterize alliances and thereby improve product innovation and competitive performance. An innovation strategy sets strategic targets and helps streamline activities within the firm; modular product structures specify products as bundles of components that offer recombination potential for leveraging distributed, ongoing product innovation (Sanchez, 1995). Prior research in operations management and new product development highlights the advantages of modular product structures for alliance firms, including facilitating parallel, decentralized product innovation processes (Galunic & Eisenhardt, 2001) and component recombinations that generate new outputs without needing new component designs (Sanchez & Mahoney, 1996).

Yet extant literature offers little insight about modularity within alliances (Lau, Tang, & Yam, 2010), even though product innovation performance requires coordinated innovation activities across firms (Howard & Squire, 2007). By drawing on modularity conceptualizations, the present study investigates how modular product structures improve firms' speed to market, radical innovation, and competitive performance. After establishing the role of a firm's innovation strategy, this study considers the moderating effect of that innovation strategy on the relationship between modular product structures in the alliance and performance.

2. Theory

Alliances, as "voluntary cooperative inter-firm agreements" (Das & Teng, 2000, p. 33), strengthen partners' competitive advantages and can leverage complementary resources (Grant & Baden-Fuller, 2004). Yet firms in alliances also face misunderstandings and opportunism risk, because each member tends to pursue its own interests; potentially at the expense of partners (Das & Teng, 2000). Jacobs, Vickery, and Droge (2007) find that modular product structures simplify communication among allied firms by reducing ambiguity and opportunism risks. Such modular structures result from decomposing a product design into independent elements, according to interrelated components and their interfaces (Baldwin & Clarke, 2000). Modular product structures support unit-level combinations to fulfill customers' needs (Jarvenpaa & Ives, 1994). Firms use modular structures internally to increase production flexibility (Sanchez & Mahoney, 1996) and enhance innovation through changes to coordinated patterns or modules (Henderson & Clark, 1990). Modular product structures also enhance coordination among firms, by improving

* Corresponding author at: University of Bayreuth, Prieserstr. 2, 95444 Bayreuth, Germany. Tel.: +49 921554840; fax: +49 921554841.
E-mail addresses: bouncken@uni-bayreuth.de (R.B. Bouncken), robin.pesch@uni-bayreuth.de (R. Pesch), siggi.gudergan@newcastle.edu.au (S.P. Gudergan).

http://dx.doi.org/10.1016/j.jbusres.2015.01.020
0148-2963/

product innovation and competitive performance while reducing opportunism risks.

Speed to market is the time elapsed between an initial product idea and market launch (McNally, Akdeniz, & Calantone, 2011), which affects product innovation performance (Wang, Yeung, & Zhang, 2011). Modular product structures reduce development time, allowing alliance firms to work in parallel. Each partner thus can focus on certain components or interfaces and allocate resources to activities accordingly (Lau et al., 2010). Speed to market improves when firms use pre-developed product modules and apply them to alternative new product configurations. Decomposing complex new product development into less intricate components supports faster development and reduces time-consuming, repetitive communication and coordination (Lau, Yam, & Tang, 2011).

Hypothesis 1. Greater modular product structures increase speed to market in alliances.

Radicalness describes an innovation's novelty and departure from existing solutions (Azadegan, Dooley, Carter, & Carter, 2008). Prior studies outline modular product structures' advantages for incremental innovations (Grunwald & Kieser, 2007); the effect on radical innovations is unclear, however. On the one hand, modular product structures can constrain innovations' radicalness (Prencipe, Davies, & Hobday, 2003), because radicalness requires changes to both the component and the interfaces, which firms rarely consider when implementing modular structures. Worren, Moore, and Cardona (2002) assume that the architecture behind modular product structures implies fixed higher-level elements (e.g., interface specifications). Modular product structures require formalization, constrain creativity, and trap firms in certain designs (Pil & Cohen, 2006), which reduce both radical innovation (Prencipe et al., 2003) and the chances of serendipitous discoveries (Schilling, 2000). On the other hand, modular product structures can support creativity and foster radical innovation, because designers and engineers who concentrate on distinct modules experience greater autonomy and can dedicate their skills and resources to new ideas (Lau et al., 2010). Lau et al. (2011) suggest an inverted U-shaped relationship between modular product structures and product innovativeness within firms: Modular product structures might assist radical innovations in alliances to a certain extent, but an excessive focus on modularity lessens radicalness.

Hypothesis 2. The relationship between modular product structures and radical innovation follows an inverted U-shape.

Competitive performance reflects a firm's relative performance compared with that of others in the industry (Deshpandé, Farley, & Webster, 1993). Sanchez (1995) postulates that modular structures have first- and second-order benefits for competitive performance. First-order benefits result from greater product variations, novel combinations, reduced costs, and shorter switching times. Second-order benefits reflect parallel processes that support innovations by separating component-level and architectural learning processes and facilitating interactive, real-time research into market needs (Garud & Kumaraswamy, 1995). Related learning processes support continuous quality improvements, component exploitation, and cost reductions and improve market positions. Modular structures also directly increase responsiveness to market changes, economies of scale, learning curve effects, rationalization through reduced inventory (Jacobs et al., 2007), returns on investment, and consistency in organizational focus (Mikkola, 2006). Firms can design more flexible organizational and technological systems with modular product structures (Pil & Cohen, 2006), which help restrict imitation (Worren et al., 2002).

Hypothesis 3a. Greater modular product structures increase competitive performance.

Modular product structures yield indirect competitive performance effects through radical innovations and quicker market entry (Powell, 1992). Adapting more quickly to changing environments by launching new products faster triggers competitive performance (Teece, 2007). Firms that achieve radical innovations can establish better competitive positions (McDermott & O'Connor, 2002).

Hypothesis 3. Firms' (b) speed to market and (c) radical innovation performance in alliances increase competitive performance.

An innovation strategy describes a firm's strategic new product and market position (Dyer & Song, 1998) and specifies the resources allocated to achieve specific goals and streamline activities within and among firms (Ramanujam & Mensch, 1985). An innovation strategy specifies explicit and implicit goals, assumptions, and innovation efforts. The deployment of an innovation strategy includes considerations for monitoring competitors' actions, obtaining customer market intelligence, and investing in R&D and thus increases innovation and performance (Oke, Walumbwa, & Myer, 2012).

Firms integrate considerations of modular product structures into innovation strategies (Chen & Paulraj, 2004). Without a clear innovation strategy, firms can lose sight of their own targets when working within alliances and follow less efficient modular structures. Greater alignment with an innovation strategy enables firms to leverage modularity better and reach markets faster, with more radical innovations. The joint deployment of modular product structures

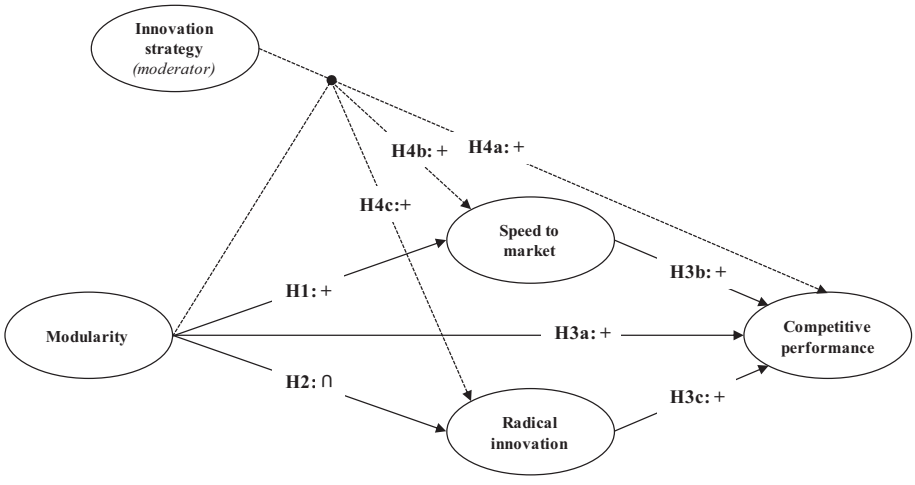

Fig. 1. Proposed model.