

External Venturing Activities and the Influence of the Chief Technology Officer

Author Information:

Authors: Niklas J. A. Hunsdiek^{1,*}, Constanze Chwallek²

Affiliations:

¹ Innovation and Entrepreneurship Group (WIN) – TIME Research Area, RWTH Aachen University, Kackerstr. 7, 52072 Aachen, Germany

² FH Aachen University of Applied Sciences, Eupener Str. 70, 52066 Aachen, Germany

* Corresponding author: E-Mail: hunsdiek@time.rwth-aachen.de

Introduction and theoretical foundation

Today companies act in a complex environment characterized by uncertainty, rapid technological change, intense global competition and shorter product life cycles (Edler, Meyer-Krahmer, & Reger, 2002; Euchner, 2011) forcing them to innovate faster and to properly manage their existing technology portfolio. However, innovative technologies are often not found within the traditional boundaries of companies such as the R&D portfolio but rather in young ventures. Therefore, technology insourcing becomes more important for large companies (van de Vrande, Vanhaverbeke, & Duysters, 2009). It can be achieved through different external corporate venturing (ECV) modes such as corporate venture capital (CVC), alliances, or acquisitions (van de Vrande, 2013). CVC and alliances (presuming partial ownership) show a positive impact on creating pioneering technologies (van de Vrande, Vanhaverbeke, & Duysters, 2011) with CVC being the preferred option for sourcing distant technologies (Dushnitsky, 2004), whereas acquisitions (presuming majority ownership), are linked to other advantages, e.g. improving the market position or realizing economies of scale and scope (van de Vrande et al., 2011).

Drawing on the upper echelons perspective, which states that firm's strategic choices are a reflection of their executives (Hambrick, 2007; Hambrick & Mason, 1984), top management teams (TMT) play a key role as they decide on the overall strategic direction, the corresponding project portfolio, and the allocation of resources to innovation projects (Talke, Salomo, & Kock, 2011). Because R&D and innovation are critical performance drivers, many firms have installed Chief Technology Officers (CTO) within their TMTs (Menz, 2012; Smith, 2003) resulting in a higher number of CTOs and an increased relative power within the TMT (Medcof & Lee, 2017). Main responsibilities of CTOs can be described as aligning technology strategy with corporate strategy, managing the R&D organization and filling the projected funnel (Medcof & Lee, 2017). This given, it is surprising that scholars have paid little attention to the CTO as key influencing factor for ECV activities, being an important driver for technology insourcing. Even though the CTO received recognition since the 1990s, it represents a niche in upper echelons literature (Cetindamar & Pala, 2011). Early studies mostly focus on roles and have exploratory character (e.g. Medcof, 2008; Smith, 2003), while recent ones focus on outcomes finding positive relationships with innovation performance or R&D commitment (Chung & Kang, 2018; Garms & Engelen, 2018) and financial performance (Cetindamar & Pala, 2011; Hartley, 2011).

Thus, we aim to answer the following research questions: (1) Does the functional presence of a CTO influence the ECV mode choice of a firm? (2) Do CTO characteristics such as industry,

functional or educational background influence the ECV mode choice? (3) How does exogenous uncertainty, like technological dynamism moderate these relationships?

Hypotheses

Building on the concept of bounded rationality, the upper echelons perspective suggests an existence of direct relationships between presence as well as characteristics of functional TMT members and outcomes to their respective fields (Menz, 2012). Combining this with the argumentation that ECV modes play an important role in the creation of pioneering technologies and by using the real options theory, which is well suited to investigate exogenous uncertainty (Tong & Li, 2011), we hypothesize that:

- H1: CTO presence has a positive relationship with relative use of CVC in the portfolio of ECV investments
- H2a: CTO's diverse industry background exhibits a positive curvilinear relationship with relative use of CVC
- H2b: CTO's diverse functional background is positively associated with relative use of CVC
- H2c: High level of educational background is positively related to relative use of CVC
- H3: Technological dynamism is moderating these effects: The higher the technological dynamisms, the stronger the effects.

Methodology and data

This study's sample consists of secondary data of large publicly traded firms in the U.S. from multiple sources. All companies that have been listed in the Standard & Poor's (S&P) 500 index over a 13-year period from 2005 to 2017 constitute the basis of this study's sample. The financial information of these companies stated in their annual reports were obtained from S&P's Compustat database. Following prior upper echelon research on TMTs in large firms (Hambrick & Cannella, 2004), the TMT is operationalized as the executive officers listed by firms in their annual Form 10-Ks or proxy statements that are filed with the Securities Exchange Commission. Thus, the data regarding a firm's TMT was manually collected from the 10-Ks and proxy statements, which are publicly available on www.sec.gov. In case of any missing information data was enhanced with information from the company websites and professional profiles of the TMT executives. The total sample consists of 804 firms, 15,748 unique

executives and 58,967 firm-year-executive-observations. It has to be noted that not all of the 804 companies were listed in the S&P 500 over the full 13-year period. This unique TMT dataset will be matched with data on acquisitions, CVC and alliances of those 804 firms over the same period. Alliance data come from the Thomson Reuters SDC Platinum database, while acquisition and CVC data were extracted from Thomson Reuters EIKON.

Results

Data collection is done and databases will have to be merged. Results are expected well before the G-Forum will take place.

Implications for research and practice

This study has important implications and contributes to literature in three ways. First, this study extends recent CTO literature on innovation outcomes by investigating other sources of technology sourcing than R&D (compare Garms & Engelen, 2018). Second, by examining the relative use of CVC compared to two other ECV modes, it contributes to ECV literature as most studies investigating antecedents examine only one mode or a combination of two modes (Titus, House, & Covin, 2017), which is not a proper reflection reality because most companies pursue multiple ECV modes simultaneously (MacMillan, Roberts, Livada, & Wang, 2008). Third, this study informs the broader research on functional TMT members on specific outcomes and moves CTO literature from conceptual and descriptive studies to empirical research. Finally, we contribute to practice providing insights on the increasingly important position of the CTO and show which characteristics influence key responsibilities.

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