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Managerial services and complexity in a firm's expansion process: An empirical study of the impact on the growth of the firm

Thomas Hutzschenreuter *, Julian Horstkotte

Chair of Corporate Strategy and Governance, WHU — Otto Beisheim School of Management, Burgplatz 2, 56179 Vallendar, Germany

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Summary In this study we investigate determinants of parent-firm growth rates. Building on Penrose's theory of the growth of the firm, we argue that factors that influence the availability of managerial services at the upper ranks influence the rate at which a firm is able to establish new subsidiaries. We hypothesize and find that the rate of growth and the common TMT-specific experience of a firm's top management team in one period positively affect the rate of growth of the firm in a subsequent period. We also hypothesize and find that the additional demands put on a firm's management team by increased product scope and cultural distance has a negative effect on the rate of growth of the firm in a subsequent period. We test our hypotheses on cross-sectional time-series data on the 5848 expansion steps taken by 91 German firms from 1985 to 2007.
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Introduction[1]

Corporate growth is a central objective of managers (Brush, Bromiley, & Hendrickx, 2000; Mishina, Pollock, & Porac, 2004). Firm expansion has been identified as an important driver of a firm's value creation (Copeland, Koller, & Murrin, 2000). It has been argued to increase the attractiveness of the firm and thus to be critical for recruiting and retaining talent, and positioning the firm in capital markets and finding investors (Canals, 2001). The question of what factors drive the growth rate of a firm and which slows it down is consequently relevant both for managers and academics.

The seminal work of Penrose (1959), considered by some as 'one of the most influential books of the second half of the twentieth century bridging economics and management' (Kor & Mahoney, 2000, p. 109), informs us about these factors and highlights the crucial role of the management team in the growth process on the firm level. Specifically, Penrose (1959, p. 200) argues that the 'factors determining the availability of managerial services and the need for them in expansion will therefore determine the maximum

* Corresponding author. Tel.: +49 261 6509 200; fax: +49 261 6509 209.
E-mail address: th@whu.edu (T. Hutzschenreuter).

[1] This paper builds upon — and substantially extends — work by (citation withheld to protect the anonymity of the authors during the review process), which has been published in the Journal of Management Studies. While the latter focuses solely on the impact of international expansion, the current study substantially differs by focusing on top management teams and on their crucial role in firms' growth processes. Further, the present study considers firm growth both in terms of expansion into new product markets as well as expansion into new countries. Finally, the dataset itself is different. We have collected new data that substantially extends our original database. We have new data on the top management teams of 91 firms in our sample and lengthened our window of analysis.

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rate of growth of the firm, where rate of growth is defined as the percentage rate at which the size of the firm increases per unit of time'. Taking a dynamic perspective, the so-called 'Penrose effect' suggests that the need for managerial services to grow fast in one period slows down a firm's growth rate in a subsequent period (Mahoney & Pandian, 1992). Conversely, this means that a substantial increase in available managerial services in one period will accelerate the firm's growth rate in a subsequent period.

Many studies build on Penrose's seminal work. In fact, we conducted a literature review using the database 'EBSCO/Business Source Complete'. We used 'Penrose' and 'Penrosean' as search terms and identified 53 studies that build on Edith Penrose's 'Theory of the Growth of the Firm'. Of these, 40 were purely conceptual works and 45 were published within the past 10 years. This indicates the importance of Penrosean thinking in the current literature on strategic management. However, only a limited number of empirical studies have applied such a Penrosean perspective to study growth rates in consecutive time periods at the plant level (Shen, 1970), and within one particular market (Tan, 2003; Tan & Mahoney, 2005, 2007). A fourth study directly followed Penrose and focused on the firm level (Hutzschenreuter, Voll, & Verbeke, 2011). It investigated international expansion on the firm level but did not elaborate on the role of the top management team in coordinating expansion. While these studies have generated important insights, we believe there is need for further empirical research on the determinants of firms' growth rates. In particular, our study contributes to the literature and offers new insights in three important ways. First, we take a firm-level perspective and examine factors that influence the rate at which a parent firm is able to establish new subsidiaries within and across markets. Second, we consider both factors that increase the availability of managerial services and factors that increase the need for them. Third, by considering product and international expansion in our study, we address two important aspects of a firm's overall growth strategy in our analysis. In particular, we contribute by arguing that expansion into new product markets and new international markets are theoretically similar sources of complexity and therefore put a similar strain on a firm's top management. Our results support this reasoning and show that added product scope and added cultural distance indeed exert very similar effects on subsequent firm growth.

Hence, in this study we investigate the additional need for managerial services from coordinating expansion into both new product and international markets. The complexity that the management faces when expanding into new product areas or geographic areas markedly differs from the strain on the management when expanding within a certain market or expanding a plant. Moreover, the management team responsible for coordinating expansion markedly differs. In our study we focus on top management teams while other studies have focused on the role of expatriates in accelerating a subsidiary's growth in a foreign country. Thus, we believe that by focusing on top management teams and on their crucial role in firms' growth processes, we can make a contribution both from a theoretical and empirical perspective.

As a result we contribute to the literature by combing insights from two largely distinct research streams that have investigated these directions of expansion separately and have limited their focus on expansion by only one of these means. In particular, we argue that the more services become available from the top management team that makes and implements corporate expansion decisions, the higher the growth rate of the firm (Verbeke & Yuan, 2007). To this end we take a dynamic approach and examine how the growth rate of the top management team itself and its shared team-specific experience (Kor & Mahoney, 2004; Kor, Mahoney, & Michael, 2007) in one period affect the growth rate of the firm in a subsequent period.

In addition, we analyze how complexity in the expansion process increases the need for top managerial services and thus slows down expansion. Both expansion into new product markets or into new countries are primary sources of complexity, in particular when such markets have little similarity to the markets in which the firm is already active. In both instances this makes the firm an outsider without a strong base (Kay, 2005; Meyer, 2006; Mishina et al., 2004; Verbeke & Yuan, 2007). Accordingly, in this study we examine how adding product scope or adding cultural distance to a firm's existing business portfolio during one period affects its rate of expansion in the subsequent period.

Theoretical background and hypotheses

Availability of managerial services in the expansion process

A resource based view of the firm (RBV) is central to Penrose's theory of the growth of the firm (Penrose, 1959). According to the RBV, firms can be conceptualized as bundles of resources (e.g., Barney, 1991; Peteraf, 1993; Wernerfelt, 1984). A resource can be used in different ways within the firm, i.e., it consists of a variety of potential services that it may provide to the firm. The service or set of services that a resource actually provides depends on its usage or combination with other resources (Penrose, 1959). It is the role of the management to put the resources to use and decide on their combination. As such the management of resources and the services they render is the key to competitive advantage (Kunc & Morecroft, 2010).

Management itself can be considered a resource of the firm. Managerial resources render services in the form of information processing and decision-making (Kor & Mahoney, 2000). As managing the firm in its current state is a complex task these services are at least partly consumed for the administrative coordination of the firm's existing operations within its current scope. Because, firms learn and become more efficient in using their stock of resources, after a certain period of time, they will, ceteris paribus, end up with excess resources (Penrose, 1955; Pitelis, 2007). The potential services available from these unused resources motivate managers to seek opportunities to expand as they want to put these resources to productive use and to exploit economies of scale and scope (Penrose, 1959; Thompson & Wright, 2005). While these resources may also be disposed externally, they often entail a firm-specific component making their internal usage more valuable. Thus, seizing market opportunities by expanding the firm is an important managerial goal (Brush et al., 2000).

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A firm's ability to grow depends on the managerial services available for expansion. Managerial services are required as managing the growth of the firm is even more complex than managing it in its current state. Managers' entrepreneurial imagination is needed to identify new investment opportunities and plan future expansion (Kor et al., 2007). Making and implementing expansion decisions requires information processing as it involves the replication, addition, and recombination of resources and routines (Mishina et al., 2004). In particular, the managerial services of the firm's top management team (TMT) are required. The parent firm's TMT is responsible for coordinating expansion, especially expansion via direct investments as part of the firm's corporate-level strategy. The TMT serves as the firm's internal and external information-processing center and thus is in a unique position to understand, make, and relate complex expansion decisions (Mintzberg, 1971).

Penrose (1959, p. 200) argues that a firm's rate of expansion in one period depends on the rate at which its TMT increased its managerial services available for expansion in the previous period. She writes 'an increased rate of growth can be achieved only if the former [i.e., managerial services available for expansion] are increasing at a rate greater than the latter [i.e., managerial services required per dollar of expansion]'. However, individual TMT members are limited in their ability to absorb, evaluate, and act upon complex information (Cyert & March, 1963). Hence, the ability of existing TMT members to learn and develop new capabilities and thus to become more efficient and increase the managerial services they are able to render per unit of time is limited (Dierickx & Cool, 1989). A substantial increase in managerial services can be accomplished by adding managers to the number of managers that has been managing the firm so far. Additional top managers increase a TMT's managerial services available for expansion by bringing in new knowledge and additional information-processing capacity and thus supporting the identification of growth opportunities and the coordination of expansion. Thus '[n]ew managerial recruits increase the growth potential of the firm' (Mahoney & Pandian, 1992, p. 366). Consequently, the rate at which a TMT grows in one period, ceteris paribus, positively affects the availability of managerial services for expansion and thus the rate at which the firm can grow by making and implementing investment decisions and establishing new subsidiaries in a subsequent period.

Hypothesis 1. Everything else constant, the growth rate of the top management team in one period, will positively affect the rate of growth of the firm in a subsequent period.

The managerial services that a TMT can render are further affected by the common TMT-specific experience of its members (e.g., Kor, 2003; Kor & Mahoney, 2004). Penrose (1955, p. 538) emphasized that when top managers share working experiences 'with a particular group of other men in a firm, they become individually and as a group more valuable to the firm because the range of services they can render is enhanced'. Moreover, common TMT-specific experience may enable managers to better cope with information-processing requirements as a team and hence increase the team's ability to handle its tasks (Hambrick, Finkelstein, & Mooney, 2005). Managers who have served on a specific TMT for a long time and have made extensive experiences in working together have detailed knowledge of the skills, limitations, mental models, and habits of each other. This may lead to better cooperation, information sharing and cross-understanding (Huber & Lewis, 2010). The ability to successfully collaborate is enhanced as managers adapt to each other, learn to get along, and develop decision-making routines. Common TMT-specific experience saves time that might have been spent in coordination and so information processing and decision-making can be done more quickly (Eisenhardt & Schoonhoven, 1990). When managers do not work together well as a team so that information-processing demands surpass the team's abilities, this may negatively affect decision quality and lead to coordination bottlenecks, loss of control, and lower performance (Levitt et al., 1999). Over-extended managers can react by reducing the amount of attention they give to tasks or by focusing on some prioritized tasks and neglecting others (Gary, 2005). As a result, managers may make ill-informed decisions that may prove difficult to reverse (Tan, 2003) and require corrections in a future period that tax managerial resources and hamper further expansion. The information-processing benefits of common TMT-specific experience reduce the likelihood that the challenges that will inevitably arise will unexpectedly exceed a TMT's ability to process information leading to such negative consequences (Teece, 1980).

The benefits of common TMT-specific experience may lead to team members having more time; time which can be devoted to learning and developing new resources sine qua non for expansion in future periods. The integration and development of added TMT members may be facilitated when experienced top managers can transfer the tacit knowledge they have gained on the team. Integrating new members may also be considered a capability that can be learned by frequently adding new members. This would suggest that the more managers have been integrated in the past, the better the team's ability to integrate additional managers. However, adding too many new team members may disrupt team processes since they lack the experience in working together with the other members as a team. Moreover, due to their limited experience these new managers are less capable to integrate even more new managers. According to Penrose (1959, p. 47) when a firm 'expands its operations more rapidly than the individuals in the expanding organization can obtain the experience with each other and with the firm that is necessary for the effective operation of the group [...] a period of 'stagnation' may follow'. Furthermore, integration capabilities may diminish if common TMT-specific experience becomes too high and groupthink tendencies occur (Allison, 1972). Team members may cease to question each other and develop a high group coherence which may hamper the integration of new members into the team. However, in the context of top management teams, we assume that groupthink phenomena and an unwillingness of current team members to integrate new members due to group cohesiveness may be less likely to occur than in most other teams. Top management teams continuously receive outside feedback on their decisions through signals from the market. Moreover, while ordinary board members may not be in such a powerful position as a CEO, they are nevertheless motivated to position themselves within the team. Thus, current TMT members

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are highly motivated to integrate new members to find new allies in the team that may support their position. In addition to these correcting forces from outside the firm and within the TMT, TMT members may also face competition for their jobs from bottom-up.

Taken together, we follow Penrose (1959) and argue that a TMT with high common TMT-specific experience is better able to deal with information-processing demands associated with executive tasks and also to assimilate new managers, leaving more managerial time for learning and developing resources that support growth in a subsequent period. Moreover, such teams have an increased ability to handle complexity, reducing the probability that the top managers will become overstretched, make errors, and so devote valuable time to making corrections, thus hampering growth. Following this logic, we hypothesize:

Hypothesis 2. Everything else constant, more team-specific experience shared among top management team members in one period, will positively affect the rate of growth of the firm in a subsequent period.

Need for managerial services in the expansion process

We have argued that a higher availability of managerial services for expansion in an expansion period may accelerate the rate at which a firm is able to grow in a subsequent period. In turn, a higher need for managerial services in the expansion process may slow down the rate at which a firm is able to make and implement expansion steps. Managing the firm at a point in time is a complex task. Managing its expansion over time even more so (Mishina et al., 2004). Dealing with the complexity added in an expansion period requires managerial services from a firm's top management team to manage the expansion and expanded scope of the firm (Barkema & Shvyrkov, 2007; Vermeulen & Barkema, 2002). This means that there will be, ceteris paribus, fewer managerial services available for further expansion in the following period (Penrose, 1959). While every expansion requires a certain amount of time from top managers during the planning and implementation periods, the amount of complexity associated with different expansion steps varies. Expansions that are within the current scope of a firm may be realized by replication of existing resources and routines (Mishina et al., 2004). A firm expanding in a market in which it is already active often has insider's advantages. It can rely on a trusted business network from within which it is better able to identify growth opportunities and that may help it to acquire or access resources and capabilities necessary for expansion (e.g., Johanson & Vahlne, 2009). Hence, 'expansion in market areas where the firm is already known and established will require less effort than expansion into markets new to the firm'. (Penrose, 1959, p. 209).

Firms expand into new markets by product and/or geographic diversification. Both means of expanding entail additional complexity. For the most part the extant literature focuses on one of these growth dimensions at a time. However, expansion into new product or geographic markets are both part of a firm's overall growth strategy and similar sources of complexity in a firm's expansion path (Kumar, 2009; Meyer, 2006; Nachum, 2004). Direct investments in new product or in new geographic markets entail similar tasks for the TMT. Hence, they put a similar strain on the firm's top management. Expanding a firm's product or geographic scope is challenging as it comes with additional environmental complexity due to the large number of external elements and issues with which top managers must contend (Scott, 1992). A firm's TMT must become familiar with a variety of traits in a newly entered market in order to overcome industry and country outsidership liabilities (Meyer, 2006). Moreover, a firm's resources and routines need to be adapted in order to address the specific requirements of the product or geographic market it is adding to its portfolio (e.g., Lim, Acito, & Rusetski, 2006; Rondinelli, Rosen, & Drori, 2001). Complexity is further driven by the difficulty, and uncertainty, of transferring tacit knowledge that has been gained by the team from past experiences (e.g., Inkpen, 2008; Lippman & Rumelt, 1982; Szulanski, 1996). A new subsidiary must not only be embedded in its external environment, it must also be integrated into the firm's network of already existing subsidiaries. Adjustments in internal structures and systems are required in order to avoid administrative diseconomies (e.g., Calvo & Wellisz, 1978; Singh, Tucker, & House, 1986). Penrose (1959, p. 208) argues that 'in addition to the administrative task of planning the expansion itself, there is the task of maintaining the necessary integration with the rest of the firm and, at the same time, working out flexible administrative arrangements so that the execution of the expanded programme will not be handicapped by bureaucratic bottlenecks'.

The less related the product and the more distant the market entered, the greater the challenge of managing an expansion step. Penrose (1959, p. 134) argues 'the further from its existing area of specialization it [a firm] goes, the greater the effort required of the firm to attain the necessary competence not only in dealing with present production and market conditions, but also in making the adaptations and innovations necessary to keep up with competition'. Thus, expanding into a product market that is less related to a firm's current product portfolio, i.e., that adds more product scope, is associated with greater complexity. The less related the product, the more difficult it is for top managers to familiarize themselves with its industry-specific technologies, success factors, and business logic (Park, 2003). New business-specific knowledge and capabilities need to be developed, existing resources and routines adapted to the new context, and synergetic links to existing businesses managed (e.g., Hill & Hoskisson, 1987; Markides & Williamson, 1996). Likewise, an expansion step that is more distant to a firm's country portfolio comes with more complexity. Culture is a crucial dimension of the distance between geographic markets (Ghemawat, 2001; Gomez-Mejia & Palich, 1997; Tihanyi, Griffith, & Russell, 2005). The greater the cultural distance the more difficult and costly it is to obtain and interpret comprehensive and accurate information about a new environment and to become familiar with it (Roth & O'Donnell, 1996). Cultural ambiguity may further impede the understanding in specific cultural settings (Robertson & Swan, 2003). It is challenging to calibrate a firm to an unfamiliar culture and to recombine existing resources with local resources (Barkema, Bell, & Pennings, 1996). Moreover, the

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extent to which adaptation is needed to fit a local context increases with the degree of cultural difference between a newly entered market and those already served. An expansion step that adds a high degree of product scope or of cultural distance thus entails more complexity than an expansion step within a market where a firm is already established (Verbeke & Yuan, 2007). Yet, the expansion programs of firms often involve multiple steps. Complexity in a given period of expansion is driven by the total amount of added product scope and added cultural distance contributed by all of the expansion steps undertaken in that period.

Dealing with the total amount of complexity in one expansion period consumes managerial time and effort and as a result less of these resources can be devoted to learning from the expansion and developing new capabilities and knowledge, and thus there are time compression diseconomies (Dierickx & Cool, 1989). Consequently, fewer additional services become available for expansion in a subsequent period. Time constraints may also hamper a TMT in its efforts to develop and integrate new managers, thus diminishing the pool of new managerial services available in subsequent periods to manage the firm's increased scope and to expand still further. Furthermore, the additional complexity from product scope and cultural distance added in an expansion process increases the amount of managerial services required to manage the expanded firm scope in a subsequent period. As a result, ceteris paribus, less managerial services in that period will be available for further expansion. For these reasons the rate of growth is likely to decline following a highly complex expansion. Moreover, expansion that adds too much product scope or cultural distance in one period may overwhelm top managers. As we have said, when this happens top managers cope by either parceling out the time they devote to tasks across the board or by concentrating on selected tasks putting aside all others (Gary, 2005). Unfortunately, the first strategy leads to uninformed decision-making and the second one to a backlog that must be handled in a subsequent period, effectively putting the brakes on expansion during that period. In summary, we argue that complexity driven by additional product scope or additional cultural distance in one period has a negative effect on firm growth rate in subsequent periods. Following this logic, we hypothesize:

Hypothesis 3a. Everything else constant, the greater the additional product scope in an expansion period the lower the firm's growth rate in the subsequent period.

Hypothesis 3b. Everything else constant, the greater the additional cultural distance in an expansion period the lower the firm's growth rate in the subsequent period.

Methods

Sample and data

To test our hypotheses we used a sample that was derived from the HDAX index of the German stock exchange. The HDAX is made up of the German companies with the highest market capitalization. The sample was formed by excluding financial institutions, real estate firms, retailers, purely financial holdings, and cross-listed non German firms, and we were left with 135 companies that have been listed on the HDAX since its inception. We build on the dataset of (citation withheld to protect the anonymity of the authors during the review process) and substantially extended it in terms of new variables on top management teams and the length of the window of our analysis. As in this study we analyze the process of firm expansion, only those firms for which we were able to gather data for all our variables over a minimum number of consecutive years are included in the sample. Our final sample includes 91 firms for which we were able to collect data over at least seven consecutive years between 1985 and 2007.

Data were collected by carefully reading the annual reports of the 91 firms in our sample. This review included looking at the list of affiliates found in each report's appendix. When not available from the annual report we obtained more detailed information on these affiliates from public archives and by direct contact with the firms. In this way we were able to gather data on all the expansion steps undertaken by our sample firms during the period of analysis spanning more than two decades. We defined an expansion step as investment of at least a fifty percent stake in a subsidiary in which the parent firm had previously held either a minority stake, or no stake at all. This allowed us to exclude purely financial investments made by the firms. We identified for each firm the subsidiaries at the beginning of our period of analysis and any divestitures year by year. This gave us for each year a firm is in our panel a portfolio of its majority owned subsidiaries. Combined with the collected information in which industry and country each subsidiary is active in, we were able to determine the product and country portfolio of the sample firms for each year.

In addition to building a picture of firm expansion we collected archival data on the top management teams of the firms. Archival data is often collected in management research (e.g., Barkema & Shvyrkov, 2007; Kor, 2006; Tihanyi, Ellstrand, Daily, & Dalton, 2000), as it has the advantage of being clear-cut and objective (Michel & Hambrick, 1992). We did this by gathering data on each firm's 'Vorstand', the management board of German firms. Those who sit on the Vorstand represent the firm and are legally and collectively responsible for managing it. As the CEOs of German firms act as primus inter pares, we include them in our analysis. For our purposes then, the CEO and every member of the Vorstand is a member of the top management team. In many cases we were able to readily get information on the executive directors who served on the Vorstand during our investigative window, including when they joined the Vorstand and when they left. If the information we sought, in particular the date of entry into the TMT, was not given in the annual report of a firm, we turned to sources like Hübner's Who is Who and media archives. If needed, in a later stage we attempted to close remaining gaps in the data set and to test the reliability of already collected data with direct firm contacts. In line with other upper-echelons research (cf. Jensen & Zajac, 2004; Westphal & Zajac, 1997), we excluded firm-year observations if we were not able to gather the TMT data needed on at least three-quarters of the top executives who had served on a respective team during our research window.

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In contrast to other longitudinal studies, we included non-surviving firms in our sample. Furthermore, following Carpenter and Fredrickson (2001) we conducted a means test to compare the firms we included in our analysis to those we excluded based on data from the Thomson Reuters Datastream database. The means test revealed that the firms we included were not significantly different from those we excluded in terms of number of employees, total assets, revenues, and market capitalization. More importantly, firms included did not perform significantly better than firms excluded, indicating that there was no survivorship bias in our results. The structure of our dataset is unbalanced, therefore we applied an additional statistical method to determine if our sample selection might be a problem. According to Wooldridge (2002), sample selection only poses a problem in a fixed effects context when selection is related to the idiosyncratic error term in the model. We applied a test suggested by Nijman and Verbeek (1992) and subsequently used by Berrone and Gomez-Mejia (2009) among others. This test allowed us to confidently confirm the absence of a sample selection bias.

Variables

We aim in our research to empirically confirm the Penrose effect. Consequently, we investigate the effect of TMT characteristics and other determinants of growth in an initial three-year time period, which we call the first period, on the growth of the firm in the subsequent three-year time period, which we call the second period. Studying two consecutive three-year periods, we follow Tan and Mahoney's (2005) approach to investigate the expansion process of Japanese firms in US industries. While the dependent variable of our study reflects the growth rate of the second period, we calculated our independent and control variables as average values over the first period unless specified otherwise.

Dependent variable

The dependent variable in this study is *firm growth rate*. We measured a firm's growth rate by the number of its expansion steps in the second period over the number of its subsidiaries at the beginning of that period. As our dependent variable is positively skewed, we performed a logarithmic transformation (e.g., Chatterji, 2009) which arguably has become the norm in such cases (Russell & Dean, 2000).

Independent variables

We used the variable *TMT growth rate* to measure the rate at which a firm adds managerial resources. German corporate governance legislation does not specify a maximum number of management board members. So we looked at the make up of each firm's TMT and compared how many executives joined the Vorstand and how many stepped down in the first period of analysis. We divided that difference by the number of members on the Vorstand at the beginning of the first period. As already observed by Barkema and Shvyrkov (2007) larger firms usually have larger TMTs in order to handle the complex task of managing larger firms. Thus, the growth rate of the TMT may serve as a proxy for the additional capacity available for coping with complexities of the expansion process.

We also included a variable *common TMT-specific experience*. That variable captures TMT members' cross-understanding, that is, how well team members understand the mental models, skills and knowledge, and limitations and idiosyncratic habits of their fellow members. Following Carroll and Harrison (1998), we calculated for each possible dyadic relationship the years that the two team members of this dyad have spent together on the TMT. Next, we summed up the years across all possible dyads and divided this sum by the number of all possible dyads. Thus, this ratio is independent from the size of the TMT and serves as a proxy for common TMT-specific experience. In this way, we model experiences *specific* to particular TMTs not general TMT or team experience as we investigate TMT joint managerial experience in making and implementing investment decisions together as a team (Kor, 2003). A more detailed explanation of the calculation of *common TMT-specific experience* can be found in the Appendix.

We have argued that one challenge posed to top management teams by international expansion is how to cope with the amount of cultural distance between an existing country portfolio and a newly entered market. We calculated the cultural distance between two countries based on the four original dimensions and scores of Hofstede (1980). Using the formula proposed by Kogut and Singh (1988), we averaged the differences in cultural dimensions between two countries while controlling for the variance in each dimension. This approach has been used extensively in international business research (e.g., Gomez-Mejia & Palich, 1997; Roth & O'Donnell, 1996). To determine the amount of cultural distance added in a given period of time, we first calculated the cultural distance between each country in which the firm was already active before expansion and the country into which the firm expanded. Thus, the number of countries in the firm's country portfolio is equal to the number of cultural distances we computed for each expansion step. The smallest of these distances reflects the cultural distance added by that particular expansion step. Therefore, the amount of cultural distance added in a single expansion step is its distance to the closest existing subsidiary. Next, we summed the added cultural distance of all expansion steps in the relevant period of time in order to measure the level of added cultural distance to which a firm and its management is exposed in that period, hence the variable's name: *added cultural distance per period of time*.

We argue that complexity also arises from expansion into new industries or market segments. Our measure of *added product scope per period of time* builds on the relatedness of industries. The way in which we constructed this variable is analogous to the way we measured added cultural distance. We used four-digit industrial classification WZ codes, i.e., the German classification system for industries analogous to SIC codes, to determine the fit between a newly entered industry and the industries already in a firm's portfolio. Expansion into less related industries is associated with higher complexity. If a firm enters an industry that shares the same four-digit code as an industry in which it is already active indicating that the two industries are relatively closely related, the level of complexity is at its lowest. Assuming a linear relationship in relatedness, and

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hence complexity, over different matches of industry code, we assigned a one for matches at the three-digit level, a two for matches at the two-digit level, a three for matches at the one-digit level, and a four when there was no match at all. In this way we assigned an added complexity score to each individual expansion step. That score reflects the product scope that is actually added by that particular expansion step. Finally, we summed all the scores of all the expansion steps in the first time period. The total reflects the level of added product scope in the respective period.

Control variables

Our variables, added cultural distance and added product scope, capture the complexity with which TMTs must contend when their firm expands into new geographic and product areas. This is not to say that expansion within the same geographic area or industry is without complexity (Mishina et al., 2004). For this reason, we controlled for the total *number of expansion steps* in the first period irrespective of country or industry.

Further, we included another variable, *cultural diversity*. This variable reflects cultural differences between subsidiaries of the same firm at a certain point in time and thus the complexity with which managers must cope when managing a multinational portfolio of activities. We calculated cultural diversity at the beginning of the first time period to ensure that the cultural distance added in the first period has no effect on this variable. Based on the concept of cultural distance as described above, we summed measurements of cultural distance across all dyads of a firm's network of subsidiaries and divided the sum by the total number of pairs. In a parallel fashion, we controlled for a possible effect of *product diversity* at the beginning of the first period (Chatterjee & Wernerfelt, 1991; Palich, Cardinal, & Miller, 2000) as the breadth of the business areas in which a firm is active at a certain point in time increases the complexity with which its managers must cope. We used the entropy measure described by Palepu (1985) and applied by Hitt, Hoskisson, and Kim (1997) based on the number of subsidiaries within different industry codes.

In addition, we controlled for *firm size* using sales and included additional control variables that refer to the expansion undertaken in the first period. We calculated the variable *prior minority* to control for a possible effect of prior minority stakes on taking majority stakes later. We computed this variable as percentage of expansion steps in the first period where the firm already held a minority stake before gaining majority control. We included the variable *acquisitions* to control for investment modes and calculated the percentage of expansion steps in the first period implemented by acquisition. Further, we included a control variable *total ownership*. It may matter whether a firm enters a market by establishing a new subsidiary having full control over it or by engaging in an equity alliance with a partner. We controlled for this effect by including the ratio of fully owned expansion steps over the total number of expansion steps in the first period.

A firm's *profitability* is likely to have an effect on its potential to grow. We controlled for this effect by including return on assets at the beginning of the second period as a control variable. Likewise, we controlled for a firm's *capital structure*, calculated as total liabilities over total assets. Prior research suggests that financial slack may influence growth rate (Weinzimmer, Nystrom, & Freeman, 1998). Accordingly, we entered the variable *slack*. We obtained data from Thomson Reuters Datastream in order to calculate the current ratio as a proxy for financial slack at the beginning of the second period (e.g., Cho & Hambrick, 2006; Herold, Jayaraman, & Narayanaswamy, 2006).

We controlled for an industry effect, i.e., the effect of a firm's portfolio of businesses, by calculating the degree to which a firm is active in the primary, secondary, or tertiary sector of an economy. None of the firms in our sample had a subsidiary in the primary sector in the period of investigation. Thus, we calculated the variable *industry mix* at the beginning of each expansion period as a firm's percentage of business areas in the secondary sector over all business areas.

Analysis

We used a fixed firm effects model to test our hypotheses, confirmed by a Hausman test (Wooldridge, 2002). Fixed effects models are preferred in panel data analysis (Cannella, Park, & Lee, 2008) as they control for constant unobserved heterogeneity across firms (e.g., Greene, 2008). Moreover, they are considered to be conservative as significant effects can only be observed based on changes in independent variables within a particular firm.

Table 1 displays the descriptive statistics. As we use a fixed effects model, we followed the approach of McCann and Vroom (2010) and calculated the within firm correlation coefficients. Table 1 shows that none of the correlation coefficients exceeds the value 0.6 indicating that our results are not driven by multicollinearity (Foo, Sin, & Yiong, 2006; Kennedy, 1979; Tsui, Ashford, St. Clair, & Xin, 1995). As Barkema and Shvyrkov (2007) point out, firm size and TMT size may be highly correlated as larger firms tend to have larger TMTs. Thus, we tested both models including and excluding TMT size. Results were virtually identical.

We also calculated variance inflation factors. They are lower than 2.5 for all of our variables thus considerably smaller than the generally accepted critical value of 10 (Tan & Tan, 2005) so it is reasonable to conclude that multicollinearity is not a problem in our analysis.

A modified Wald statistic for groupwise heteroskedasticity in fixed effects regression models indicated the need for a heteroskedasticity robust estimator (Greene, 2008). Furthermore a test for autocorrelation in panel data (Drukker, 2003; Wooldridge, 2002) suggests that autocorrelation may affect our results. Two viable approaches for dealing with these issues in the specific present panel structure, are discussed in the time-series cross-sectional methodological literature (e.g., Beck & Katz, 1995; Hansen, 2007). First, Certo and Semadeni (2006) suggest the ordinary least squares fixed effects method with Huber—White corrected standard errors (White, 1980) which has been applied in management research by Anderson and Reeb (2004) for example. In contrast, Kristensen and Wawro (2007) consider the Arellano robust estimator in fixed effect models (Arellano, 1987) a preferred estimator. For instance, it has been

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Table 1 Descriptive statistics.

	Mean	s.d.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Firm growth rate in second period[a]	−1.747	0.935	1.00															
2. TMT growth rate	0.043	0.376	0.06	1.00														
3. Common TMT-specific experience[b]	3.515	1.713	0.13	−0.24	1.00													
4. Added product scope	3.498	5.908	−0.05	0.12	−0.05	1.00												
5. Added cultural distance	1.639	2.183	−0.13	−0.04	−0.01	0.17	1.00											
6. Expansion steps	13.663	15.332	−0.14	0.13	−0.11	0.42	0.46	1.00										
7. Cultural diversity	0.673	0.356	−0.21	−0.06	0.03	−0.05	−0.26	−0.11	1.00									
8. Product diversity	1.606	0.780	−0.18	−0.11	0.03	−0.39	0.00	−0.07	0.06	1.00								
9. Minority	0.045	0.120	0.04	−0.08	0.06	−0.07	−0.06	−0.09	0.04	0.01	1.00							
10. Acquisition	0.507	0.309	−0.06	0.03	0.15	0.00	−0.02	0.04	0.06	0.05	0.24	1.00						
11. Total ownership	0.717	0.245	−0.02	0.05	−0.05	0.04	0.06	0.08	−0.01	0.03	−0.29	−0.08	1.00					
12. Firm size[b,c]	7.533	12.767	−0.20	−0.03	−0.07	−0.20	−0.06	−0.06	0.21	0.21	−0.01	0.00	−0.03	1.00				
13. Profitability	0.074	0.090	0.10	0.06	0.09	0.04	−0.08	−0.06	0.05	−0.08	0.01	−0.04	0.05	−0.01	1.00			
14. Capital structure	0.645	0.159	−0.13	−0.03	−0.14	0.01	0.12	0.08	0.01	0.01	0.08	−0.06	−0.03	0.09	−0.19	1.00		
15. Slack	2.161	1.151	0.20	0.04	0.15	0.08	−0.05	−0.12	−0.19	−0.12	−0.02	−0.08	0.02	−0.21	0.19	−0.40	1.00	
16. Industry mix	0.761	0.299	0.08	0.06	0.03	0.07	−0.12	0.15	0.11	−0.17	−0.01	0.02	0.07	−0.05	0.03	−0.05	−0.04	1.00

Correlation coefficients with an absolute value of 0.07 or above are significant at a level of $p < 0.05$.
Correlation coefficients are within firm correlations. Since we use a fixed effects model in the regression, we calculated correlations after subtracting for each variable the mean value of the respective firm from the value of the variable. Mean values and standard deviations are overall values.

[a] Logarithm.
[b] Mean values and standard deviations are average values of the period.
[c] In bn. €

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Table 2 Results of Arellano robust fixed effects regression of firm growth rate.[a]

	Model 1		Model 2		Model 3		Model 4	
	Coeff.	SE	Coeff.	SE	Coeff.	SE	Coeff.	SE
TMT growth rate			0.182	(0.081)*			0.177	(0.082)*
Common TMT-specific experience			0.079	(0.031)**			0.082	(0.031)**
Added product scope					−0.018	(0.006)**	−0.018	(0.007)**
Added cultural distance					−0.046	(0.022)*	−0.047	(0.022)*
Expansion steps	−0.013	(0.004)***	−0.013	(0.004)***	−0.006	(0.004)	−0.006	(0.004)
Cultural diversity	−1.029	(0.549)+	−1.023	(0.533)+	−1.126	(0.544)*	−1.121	(0.526)*
Product diversity	−0.539	(0.362)	−0.532	(0.351)	−0.751	(0.380)*	−0.751	(0.370)*
Minority	0.184	(0.335)	0.215	(0.330)	0.151	(0.332)	0.179	(0.326)
Acquisition	−0.111	(0.138)	−0.196	(0.132)	−0.117	(0.138)	−0.205	(0.131)
Total ownership	−0.086	(0.248)	−0.075	(0.246)	−0.070	(0.250)	−0.057	(0.248)
Firm size[b]	−0.015	(0.008)+	−0.014	(0.008)+	−0.018	(0.008)*	−0.017	(0.008)*
Profitability	0.743	(0.429)+	0.602	(0.393)	0.754	(0.427)+	0.611	(0.382)
Capital structure	−1.119	(0.670)+	−1.041	(0.681)	−1.023	(0.663)	−0.940	(0.675)
Slack	0.015	(0.049)	−0.006	(0.049)	0.026	(0.047)	0.004	(0.048)
Industry mix	2.008	(1.274)	1.873	(1.281)	1.543	(1.273)	1.394	(1.279)
R^2	0.200		0.217		0.216		0.234	
F	10.300***		10.290***		9.840***		10.060***	

$N = 870$.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.
\+ $p < 0.1$.
[a] Model estimated with Arellano robust standard errors. Time dummies are omitted.
[b] Parameter estimates and standard errors are multiplied by 10^6.

applied by Delmas, Russo, and Montes-Sancho (2007) and found to be robust to arbitrary heteroskedasticity and autocorrelation. We estimated our model with both estimators and obtained virtually identical results. In Table 2 we display the more conservative results with Arellano robust standard errors. In addition, we included time dummies to control for contemporaneous correlation (Beck & Katz, 1995; Certo & Semadeni, 2006) and for potential time effects (Greene, 2008).

Results

Table 2 shows the results from the regression analysis used to test our hypotheses. Our dependent variable is firm growth rate in a subsequent period of analysis. Model 1 shows the results of regressing firm growth rate on control variables only. In model 2 we add our top management variables. In model 3, we add further the variables measuring added product scope and added cultural distance. The full model, model 4, is used to test our hypotheses. It includes all control and independent variables and is thus less likely to suffer from omitted variables bias than the other models (Echambadi, Campbell, & Agarwal, 2006).

We posit in Hypothesis 1 that there is a positive relationship between the rate at which managerial resources are added in one period of time and a firm's rate of growth in a subsequent period. We find, consistent with this hypothesis, that the coefficient of the variable TMT growth rate is positive with a coefficient of 0.177 ($p < 0.05$) in model 4. Thus Hypothesis 1 is supported. In Hypothesis 2 we argue that more common TMT-specific experience among top managers in one period will, ceteris paribus, lead to an increase in the firm's rate of growth in a subsequent period. Table 2 shows that the coefficient of the team-specific experience variable is positive and significant in all models in which it was tested. This means that Hypothesis 2 is corroborated. Moreover, it indicates that the positive effects of common TMT-specific experience outweigh potential negative effects that may be associated with common experience. Otherwise, we would have observed an insignificant or even negative coefficient of this variable. Thus, this result supports the reasoning leading up to Hypothesis 2. Consistent with Hypothesis 3a, the added product scope variable is negative and significant with a coefficient of −0.018 ($p < 0.01$) in model 4. Thus, the hypothesized negative influence of the amount of added product scope in one period on a firm's expansion rate in the following period receives support. Our Hypothesis 3b proposes that the amount of additional cultural distance with which a firm's TMT must cope in one period of time will reduce the rate of expansion in a subsequent one. Consistent with this hypothesis, we find that the effect of the added cultural distance variable is highly significant in all models in which it is included, i.e., in models 3 and 4. The coefficient of −0.047 in the full model implies that increasing additional cultural distance by one unit reduces the average firm's growth rate by 0.047 in the subsequent period.

In addition to the complexity arising from entering new geographic and product areas, we also tested the effect of expansion in general, i.e., without considering the

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specific kind of expansion. To that end, we included the number of expansion steps undertaken by firms in the first period as control variable. Interestingly, in model 1 the variable is negative and highly significant indicating that the complexity of expansion has a negative effect on subsequent expansions. However, when controlling for additional product scope and then additional cultural distance as done in models 3 and 4, the effect is no longer significant. This supports our assumption that additional cultural distance and additional product scope are the main drivers of complexity in the expansion process.

Managing a firm in its current state is itself a complex task that requires managerial services. The level of complexity of this task increases with the diversity of a firm's subsidiaries, and the higher the level of subsidiary diversity, the greater the strain on top managers and so the lower their ability to plan further expansion projects. In line with this logic, we find that cultural diversity and product diversity at the beginning of a three-year period negatively influence the expansion rate in a subsequent period.

Discussion

Our study empirically investigates the dynamics of firm growth rates in the context of parent firms expanding within and across product markets as well as international markets. We build on Penrose's theory of the growth of the firm which emphasizes the role of management and its limitations for firm growth. We too seek to draw attention to the role that top management teams play in the process of corporate expansion by integrating prior research on firm growth and top management teams. In so doing we attempt to empirically inform the debate on the Penrose effect. In line with Penrose's theory, we argue that 'management [is] both the accelerator and brake for the growth process' (Starbuck, 1965, p. 490). Studying two subsequent periods of time, we argue that an increased amount of available managerial services accelerates firm growth, whereas the need for managerial services from highly complex expansion in one period slows down firm growth in the subsequent period. Specifically, our empirical study shows the positive effect of the rate of growth of a firm's top management team and the team's shared experiences on the rate of growth of the firm. It further highlights the negative effect of complexity associated with an increase in product scope or in international scope in one period on firm growth in a subsequent period.

The finding that increasing the size of its TMT in one period enables a firm to grow faster in a subsequent period provides important support for a key argument in Penrose's theory of the growth of the firm. At the same time, this study offers insights into the crucial role of top managerial experience in firm expansion. Tan (2003) demonstrated that a subsidiary's growth after entry was positively influenced by the use of experienced expatriates. Our research focuses on the corporate level and suggests that common TMT-specific experience increases its ability to process information and thus fosters corporate firm growth. In a like vein, Kor (2006) finds that TMTs with a high level of shared team-specific experience cope well with uncertainty and thus invest more intensely in R&D than teams without such experience. Likewise, we show that common TMT-specific experiences may spur investments in uncertain expansion projects and accelerate a firm's growth rate. Furthermore, Kor (2003) argues that shared team-specific experience may increase entrepreneurial firms' sales growth within an industry. Our research adds to her study by finding support for a direct relationship between common TMT-specific experience and the rate of growth of large German firms on the corporate level and by focusing on expansion steps undertaken in already familiar as well as into new product and international markets.

We believe that our study has important implications for researchers investigating both the level of product or geographic diversification at any point of time, or its increase over time. We contribute by showing that expansion into new product markets and new international markets, both being part of a firm's overall growth strategy, are similar sources of complexity and put a similar strain on a firm's management. Thus, they affect a firm's growth rate in a similar way. In their seminal paper on international expansion, Vermeulen and Barkema (2002) found that, along with other factors, the diversity of industries and countries entered negatively affected firm profitability. We focus in this study on additional product scope and cultural distance as sources of complexity. We specifically argue that it is not the relatedness and distance to the core industry or home country that is relevant but that to the closest product or country in a firm's existing portfolio. We argue that expansion steps into unrelated products or culturally distant markets lead to more complexity and that they put more strain on managerial resources than steps into familiar industries and settings. Our results support this logic. We find that it is not simply the number of expansion steps that matter, but that it is the amount of product scope or cultural distance added in a certain, limited period of time that leads to lower growth rates. In addition, our study may contribute to the body of research on the effects of product and cultural diversity on performance. A broad range of empirical studies have found a variety of relationships between diversity and performance (for overviews see Contractor, Kundu, & Chin-Chun, 2003; Palich et al., 2000). The results of our study show that it is not only the level of diversity at a certain point in time that affects growth but also how much firm scope is added over a period of time. Moreover, as we jointly study dimensions of both product and geographic diversification and diversity, we bring together research that has hitherto for the most part been in two separate research streams, one focusing on diversification through increasing product scope and the other focusing on international expansion (Meyer, 2006; Tallman & Li, 1996). Yet, both dimensions are part of a firm's overall growth strategy and our research supports this argument by suggesting that the complexity associated with product and international expansion comes with similar challenges for the firm and by empirically showing that added product scope and added cultural distance exert a similar influence on firm growth.

The managerial relevance of this study lies in our identification of the possibilities to increase managerial services that a TMT can render. Thus, it is directly relevant for CEOs or supervisory boards that nominate, or decide on, top managers. Our results show that adding top managerial resources and ensuring that the team shares a high level of

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TMT-specific experiences are important drivers of future growth. Our study also can inform TMT decisions on the timing of expansion projects. By identifying sources of complexity in an expansion period, a TMT can gauge the amount of complexity they are likely to face and so better assess the probable level of managerial services that will be needed. As a result, a TMT can better estimate what level of product scope and/or cultural distance might be taken on in a given period of time and what level might hamper further firm growth unless spread over a longer period of time. Moreover, our study emphasizes the importance of preparing for future growth by developing top managers and allowing the TMT sufficient time to develop into an effective team.

Limitations & further research

A central decision that researchers investigating top management teams must make is the operational definition of a top management team. Prior studies have, for example, asked CEOs to identify the TMT members of their firms (e.g., Bantel & Jackson, 1989), or included all of a firm's managers above the vice-presidential level (e.g., Michel & Hambrick, 1992). Thus, each study that includes TMTs is limited in some way or another by its underlying definition of who makes up the team. In our analysis, we decided to include all members of the Vorstand, the management board of German corporations. This definition has two advantages. First, a complete list of Vorstand members is available in the respective annual reports of all German firms. Second, the members of a firm's Vorstand are legally and collectively responsible for the management of that firm, and as such the management board of German firms closely resembles the definition of a TMT as a group with 'the overall responsibility for the organization' (Mintzberg, 1979).

We examine the Penrose effect in the context of German firms. Societal differences affect the influence that top managers are able to exert (e.g., Hambrick, 2007). For example, the CEOs of American firms arguably have a stronger impact than the CEOs of German or Japanese firms do (Crossland & Hambrick, 2007). Researchers may want to test our hypotheses in other national contexts or across national contexts. Since our longitudinal research design let us rely on archival TMT data we are not able to control for the existence of harmful team effects such as for example groupthink. We assume that such phenomena are less relevant in TMT contexts for the reasons given above. However, empirical support for such an assumption is up to further research.

We distinguished between expansion steps that increase product scope and those that increase cultural distance over the existing business portfolio of a firm arguing that the complexity inherent in this added product scope or cultural distance puts a strain on managerial services. We believe that it would be worthwhile to further explore this by having managerial services as a dependent variable. In the future researchers might analyze the impact of other factors, such as environmental turbulence (Luo & Peng, 1999), or use other measures for product relatedness, perhaps focusing on customer or managerial knowledge (Tanriverdi & Venkatraman, 2005), and for geographic diversity, for example geographic, economic or institutional differences (e.g., Estrin, Baghdasaryan, & Meyer, 2009; Ghemawat, 2001; Meyer, Estrin, Bhaumik, & Peng, 2009; Slangen & Beugelsdijk, 2010).

One limitation of our study has to do with the timing of expansion steps. We were able to determine the year of each step from annual reports, but it was not always possible to determine exact dates. Thus, we could not track of the precise sequence of expansion steps within a particular year. While firms may be able to learn from previous expansions, they also require a certain amount of time to learn from an expansion step and to make use of that knowledge to plan subsequent steps. Moreover, we do not measure the size of each expansion step. While larger expansion steps may be associated with higher complexity and require more managerial attention, every expansion step, independent of its size, needs to be initiated, planned, and implemented and thus consumes managerial services.

In this study, we bring together research on expansion processes and research on top management teams. We focused on the growth rate of the TMT and used overlaps in the tenure of TMT members as proxy for experiences that members had as a team, elements central to Penrose's theory of the growth of the firm (Penrose, 1959). We see great potential for future research in further integrating these two hitherto mainly distinct research streams. For example, future research might study how managerial characteristics other than shared experiences, for example TMT diversity (Cannella et al., 2008), affect a firm's growth rate. We believe that the result could be a better and more complete understanding of the crucial ways in which managers affect expansion processes. We relied on observable characteristics of TMTs as indicators of their information-processing capabilities (Hambrick & Mason, 1984). While observable data based on archival sources have the advantage of being reliable and objective, we believe that further research may complement our approach by using research methods that more directly observe the creation and use of managerial services.

Appendix. Calculation of common TMT-specific experience

When calculating the variable *common TMT-specific experience*, we weight each dyadic relationship with the number of years that the two members have served together on the team. Next, we sum up these weights/years and divide the sum by the number of all possible dyadic relationships in the team. Since we sum up the years that two members have served together on the team for all possible dyadic relationship and divide the sum by the number of possible dyadic relationships, the measuring unit of our variable is years per dyadic relationship and the variable is independent from the size of the team.

To better illustrate the calculation of the variable, we provide two construed examples below. Example 1 shows a three member team. In example 2, the team is exactly the same except that it has an additional fourth team member who has served on the team for three years.

These two examples illustrate that the variable *common TMT-specific experience* is independent from a team's

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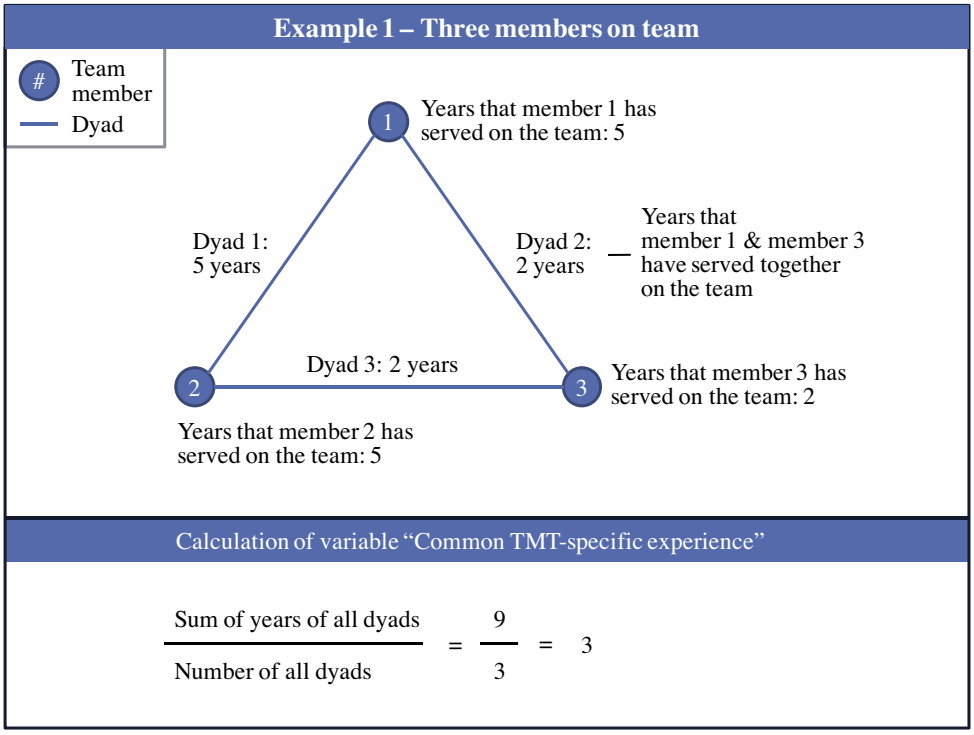

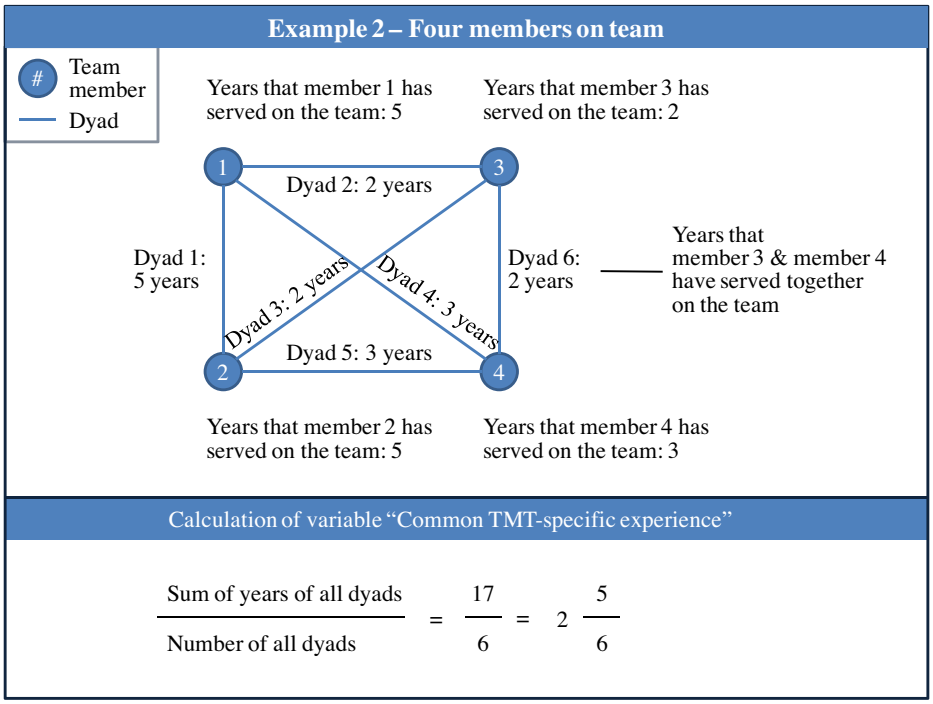

size. While the team size increases from example 1 to example 2, the value of the variable slightly decreases. The reason for this is that the average common experience of Team member 4, who has been added in example 2, with the other team members is below the average common TMT-specific experience of the rest of the team. Team member 4 has served for three years together with Team members 1 and 2 and two years with Team member 3. Thus, his/her average common experience with the other members is $(3 + 3 + 2)/3 = 2.6666$. This is below 3, the value of the common experience of the rest of the team as calculated in example 1.

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THOMAS HUTZSCHENREUTER, Chair of Corporate Strategy and Governance, WHU — Otto-Beisheim-School of Management, Burgplatz 2, 56179 Vallendar, Germany. Dr. Thomas Hutzschenreuter is a Professor of Strategic Management at the WHU — Otto-Beisheim-School of Management. His research is centered on corporate strategy and specifically investigates how companies change and develop their strategies over time. Current focus topics cover projects related to growth strategy, internationalization strategies and strategy processes.

JULIAN HORSTKOTTE received his PhD from WHU — Otto-Beisheim-School of Management. His research focuses on growth strategies including product diversification and internationalization strategies, and role of top management teams.