Competence of IT Professionals in E-Business Venture Teams: The Effect of Experience and Expertise on Preference Structure

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Abstract: The ascension of e-business has significantly changed competence requirements of information technology (IT) professionals. In this paper, we derive a competence set that addresses these changes and investigate individual preferences for specific competence components within e-business teams. We connect these preferences and competence valuation with personal characteristics of team members that were found to influence the perception of competence requirements in previous research. To empirically address this issue, we apply a Web-based questionnaire with adaptive conjoint measurement. By cluster analysis, we identify four competence profiles preferred by team members. Data from 176 respondents suggest that experience is related to the preferred profile, whereas expertise is related to overall competence valuation. Our research suggests that immature teams should consider that preferences regarding IT professionals may change with venture maturation, whereas

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interdisciplinary teams should discuss each member's value contribution. Considering our results, these suggestions could optimize the process of team composition.

KEY WORDS AND PHRASES: competence of IT professionals, competence profile, competence valuation, conjoint analysis, e-business, team composition.

WITH THE PROLIFERATION OF THE INTERNET, new possibilities of developing innovative business concepts have appeared [4, 58, 98]. Consequently, new ventures have emerged to capture the economic value that is created within this rapidly evolving e-business environment [61]. These ventures are mostly run by interdisciplinary teams that have expertise in both the areas of business and information technology (IT) as e-business projects make high demands for diverse competencies [69]. For these teams, the competence of IT professionals is vital because IT is used to conceptualize and implement new electronic products [51]. Product development in e-business varies from traditional software development due to the technological dynamism, short time-to-market, and continuous product adaptations [28, 36, 43, 59]. Accordingly, recent research findings indicate that the increase of e-business has notably altered competence requirements of IT professionals [21].

Information systems (IS) research has widely elaborated on IT/IS-related competence concepts, including the skills and knowledge required by IS professionals [54, 87], the business competence of IT professionals [10], the IT competence of business managers [11, 12], and the competence of chief information officers [30]. However, there is a persisting lack of research that empirically investigates the role and competencies of IT professionals in e-business teams [69, 70, 81], particularly in nascent Internet-based firms [61]. Furthermore, current literature has not paid much attention to the perception of competence requirements from a team member's perspective. This study will address this gap by investigating individual preferences for the competence profile of IT professionals in e-business teams. From a practical point of view, understanding these preferences is essential as they represent an indicator for the role expectation that is assigned to IT professionals in e-business ventures. Furthermore, understanding these preferences will shed light on the perceived value that IT professionals contribute to the team. Thus, findings of our study will illuminate aspects of team composition in e-business environments, and, more specifically, the choice of partners in the context of founding Internet-based firms.

In our study, we theoretically derive the constitutive dimensions and components of an IT professional's competence required in e-business venture teams from the IS literature. On the basis of this competence set, we empirically analyze individual preferences for specific components and check for patterns in these preferences. Thereupon, we investigate the relationship between these patterns and personal characteristics of members of e-business venture teams and examine the value that they attribute to different competence profiles.

Theoretical Foundation

WE DEFINE AN E-BUSINESS VENTURE as a young firm that primarily generates revenue and profits through a Web-based platform, independent of a physical value chain [4, 58, 94]. E-business ventures are typically run by entrepreneurial teams [20, 51]. These teams consist of at least two individuals who bring in equity capital and take an active part in the development of a young firm [48]. As e-business requires knowledge and skills from both the areas of business and IT [21], e-business venture teams usually comprise partners with expertise in either one or both of these two fields.

The choice of a potential partner in the context of starting a new venture is one of the most challenging decisions related with human resources [48, 49]. The success or failure of the venture depends to a great extent on the commitment and competence of the single team members [22, 23]. This decision hence provides a meaningful context for studying preferences, as they mainly manifest themselves in crucial decision-making situations [91]. Preference structures with respect to competence should thus become particularly evident in the decision to partner with a potential cofounder. Therefore, the study of entrepreneurial team composition in an e-business context will provide a deeper understanding of preferences related to the competence of IT professionals.

IT Professionals in E-Business Venture Teams

With respect to e-business, IT-related issues of strategy are elevated from inward-focused support functions to critical success factors [13]. As the Web-based platforms of e-business ventures are complex software applications that implement the primary value-creation activities of the firm [51], the role of IT professionals becomes crucial. Instead of designing the firm-wide IT infrastructure and delivering internal IT services to established organizations [33], IT professionals in e-business ventures are responsible for designing, implementing, and maintaining the technological basis of the firm's value proposition. These activities are subject to high levels of technological complexity [76] and volatility [77]. In particular, the turbulence of e-business environments leads to the fact that electronic products are characterized by a very short time-to-market [21, 77]. Design and development activities continue to occur after the initial launch of a product [43], resulting in long-lived, adaptable software applications with an incremental development life cycle that includes corrections, adaptations, and enhancements of the product [9].

In the light of continuously changing requirements, flexibility and rapid response are the keys to success in e-business [82, 84]. This calls for IT professionals who understand the interdependencies between market and technology and thus are able to anticipate upcoming requirements and transfer them into new products and functionalities. Thus, the competence of IT professionals is critical with respect to enforcing fast and flexible processes and at the same time to developing adaptable products of high quality.

Definitions and Dimensions of Competence

Competence can be seen as a combination of an individual's knowledge and task requirements [52]; a good fit indicates higher levels of competence. Competence can be seen as specific for different disciplines, jobs, or functions [71]. With respect to IT professionals, scholars agree that specialized IT knowledge must be accompanied by competencies that are not directly related to IT or computer science [10, 86, 87]. In particular, these non-IT competencies include knowledge on the potential problem-solving areas and business knowledge because the development of IT/IS always has to meet economic requirements [10]. Thus, competence of IT professionals may be conceptualized as a dualism of IT and business knowledge [10]. However, it may be argued that many problems that IT professionals are confronted with cannot be solved by the mere existence of functional or disciplinary (i.e., IT or business) knowledge. These problems may be referred to as transdisciplinary, meaning that solving these problems requires knowledge on how to *integrate* disciplinary knowledge [45]. Using this definition, it can be argued that transdisciplinary knowledge enables IT professionals to combine their functional knowledge on instruments and methods as it is required in the respective context, facilitating a "higher-order thinking about technical and managerial issues in a holistic manner" [27, p. 26].

Numerous researchers underline the interplay of specialized IT knowledge and general business knowledge. In a previous study, Nelson studied the knowledge and abilities required from IT personnel [68]. He not only identified six dimensions of competence that describe both organizational and IT knowledge but also highlighted the transdisciplinary ability to sense the potential of IT in an organizational context. In a study surveying business managers, IT managers, and IT consultants, Lee et al. [54] found that IT professionals need to understand the business context and to possess interpersonal and management knowledge/skills. Similarly, Fang et al. [32] found that entry-level IS professionals need to possess both technically oriented and business-oriented knowledge and skills, whereas the latter particularly include knowledge and visions on how to use technology trends in a competitive environment. In a survey of job advertisements for programmers, system analysts, and IS managers, Todd et al. [87] ascertained that all of these job profiles require technical knowledge, systems knowledge, and business knowledge. In their study on the effect of e-business on the role of IT professionals, Cash et al. [21] explored technical, business, relationship, and conceptual competence domains. The business competence of IT professionals was investigated in detail by Bassellier and Benbasat [10], who differentiated between interpersonal/management and organization-specific knowledge which includes knowledge of IT-business integration that enables IT professionals to understand synergies and interdependencies between IT and business activities. In line with this survey on the business competence of IT professionals, Bassellier et al. [12] explored the IT competence of business managers, comprising five areas of explicit IT knowledge, as well as tacit knowledge such as experience in IT projects and vision for the role of IT.

Synthesis of the Competence Set

For validity and simplicity, the majority of competence sets in IS literature are developed by semantically classifying a critical set of competencies using studies that have identified and verified the respective dimensions [54]. Our study is focused on the preferences of IT professionals' competence components in e-business venture teams. The components of competence that are relevant for this context have, to our knowledge, not yet been identified in previous research. We will therefore derive our competence set for the e-business context by integrating and reorganizing recommendations of prior studies [10]. We will adapt and extend existing components and dimensions, building on previous work which has revealed that the competence of IT professionals invariably covers a technical/methodical and a business/social dimension. Moreover, literature highlights the importance of transdisciplinary knowledge that enables IT professionals to integrate the technical/methodical and business/social competence dimensions—that is, effectively applying specialized knowledge in a higher-order business context. In particular, the exploration and assessment of e-business ideas is a truly transdisciplinary activity [7]. Consequently, the competence of IT professionals can be conceptually classified into three dimensions of IT competence, business competence, and transdisciplinary competence. As depicted in Table 1, literature suggests that these dimensions may be further subdivided into eight components that capture the particular competence requirements within e-business venture teams. The final competence set will be further discussed in the following paragraphs.

Technology Knowledge

Technology knowledge concerns current and emerging technologies that can be valuable for the organization [12], including specific languages, applications, platforms, and tools [26, 41, 56]. In particular, the implementation of e-business applications demands knowledge of the underlying client-side and server-side technologies [66]. These include, but are not limited to, Internet technologies, Web standards, programming and markup languages, application server software, database systems and query languages, application frameworks, reusable components, and development tools [95]. Due to the rapid changes of the technological environment, IT professionals are challenged by an ever-increasing amount of new technology knowledge [54].

Conceptual Knowledge

In addition to knowledge on the related technology, the development of Web applications demands a strong theoretical background [95]. In line with that requirement, the conceptual knowledge component of IT competence concerns formal methods, theories, and abstract concepts of computer science. Thus, conceptual knowledge is independent of concrete tools or technologies and can be repetitively used to solve

Table 1. Integration and Reorganization of Competence Components Proposed in Literature

	IT competence			Business competence			Transdisciplinary competence	
	Technology knowledge	Conceptual knowledge	Realization competence	Business management knowledge	Entrepreneurial competence	Interpersonal competence	E-business competence	IT/business vision
Bassellier et al. [12]	Technology; applications		Systems development; access to IT knowledge					Cognition
Bassellier et al. [11]				Organizational overview	Organizational responsibility	Interpersonal communication; leadership		IT/business integration
Cash et al. [21]	Technical	Conceptual		Business		Relationship		
Chandler and Hanks [22]; Chandler and Jansen [23]					Entrepreneurial competence	Managerial/ human competence		
Couger et al. [26]	IT and tools	Systems theory and concepts	Problem solving; systems development methodologies					

Fusilier and Durlabhji [35]	Technical			Business		E-business-technical/ nontechnical	
Heckman [41]	Technology	Conceptual			Social	Marketplace	
Lee et al. [54]				Business functional	Interpersonal and management		Technology management
Leitheiser [56]	Computer language; specific application; platform	Programming; analysis and design		Business	Interpersonal		
Mirza and Chan [63]	Tools and technology; systems	Architecture	Projects				
Moshkovich et al. [66]	Web development; telecommunication and networking					E-commerce	
Todd et al. [87]	Hardware; software		Problem solving; development methodology	Business	Management; social		

sets of recurring problems [41]. Among others, this includes knowledge on algorithms, data structures, object-oriented concepts, structured design, design patterns, software architectures, data design, and human–computer interaction [56, 63, 95]. Conceptual knowledge is crucial when it comes to structured architectural design efforts and thus ensures the maintainability and adaptability of Internet-based software [59]. Consequently, it is one of the key factors for long-term, successful e-business activities [21].

Realization Competence

While both technology and conceptual knowledge are rather explicit forms of knowledge, realization competence is linked with practical experience to a great extent. Realization competence can be understood as knowledge as well as experience in analysis and design [56], in creatively solving business problems [26, 87], and in using external knowledge such as knowledgeable people or Web resources [12]. Furthermore, realization competence covers software project management practices [12, 63] and the ability to select and use appropriate development methodologies [12, 26, 87]. In particular, the volatility of e-business projects may demand the ability to integrate traditional plan-driven approaches and agile methods in such a way as to take advantage of their strengths while avoiding their weaknesses [17].

Business Management Knowledge

To actively participate in formulating strategy and processes and to collaboratively work with their business partners, IT professionals are required to have a sound understanding of the general business domain [10]. This is particularly true for IT professionals in e-business venture teams because e-business projects engage an organization at a high-strategic level [21]. Business management knowledge is a prerequisite to understand the business environment, to interpret managerial problems, and to develop appropriate technical solutions that match both operational use cases and economic requirements [54]. It includes knowledge in strategic management, finance, marketing, organization, business ethics, and customer management [21, 56, 87].

Entrepreneurial Competence

With respect to an organization's IT-driven value efforts, IT professionals need to feel responsible for the overall processes and outcomes of the business [10]. Applying this idea to the special case of entrepreneurship in the e-business environment, IT professionals are required to possess skills and abilities that are relevant to the challenge of new venture creation. Literature suggests that entrepreneurial competence is a twofold phenomenon because it concerns both recognizing and envisioning new business opportunities [22, 23] as well as combining and organizing resources for the venture [3]. Among others, an important component of entrepreneurial competence is prior experience of how to create and develop new routines [8].

Interpersonal Competence

To be effective team players, IT professionals need to possess strong interpersonal skills that include communication, leadership, and knowledge networking [10]. More specifically, interpersonal competence covers the abilities to manage and lead projects, as well as to understand, motivate, and persuade others [54, 56, 87]. Interpersonal competence is critical in such a way that frictions within e-business teams oftentimes result from a lack of leadership and unrealistic expectations [77]. Due to the high complexity of technical solutions, IT professionals need to be able to explain technical issues to their partners and become expert knowledge providers to their team [21]. This demands the ability to create a "common ground" [24, p. 92] between IT and business experts.

E-Business Competence

In the broadest sense, IT and business competence need to be accompanied by marketplace skills that enable IT professionals to operate effectively in the marketplace in which their firm competes [41]. The ascension of e-business entails a demand for novel knowledge and skills that are specific to the e-business marketplace. Among others, these include knowledge on e-business platforms and concepts, online marketing, search engines, Web security, payment systems, and legal and ethical issues in e-business [35, 66, 95]. Hence, e-business competence can be seen as transdisciplinary because it concerns both technical and nontechnical issues that are largely interweaved with each other.

IT/Business Vision

The continuous change of the IT and business environment is one of the basic challenges that IT professionals are confronted with. As they are the technology experts within their team, they are responsible for anticipating the implications of this change [54]. Consequently, literature suggests that IT professionals need to interpret technological trends, understand the interdependencies between IT and business, and envision business processes that technology can enable in the future [12, 54]. As e-business venture teams are small, IT professionals particularly are demanded to maintain a cohesive team and project vision and to holistically observe the potential of future strategies [21], focusing on technology as a means and not as an end [54, 77].

Perception of Utility

Although the preceding section proposed a competence set capturing the requirements of IT professionals in e-business venture teams, the model does not make any assumptions on the individual relevance that is attributed to each of the components—that is, whether a single component is preferred more than another. In this study, we aim to analyze this issue from the perspective of an individual team member and simultaneously examine the overall value that venture team members attribute to resulting competence profiles.

In line with microeconomic theory, individual preference structures may be mathematically depicted using utility functions, where utility is a measure of the relative satisfaction from or desire for the consumption of goods [91]. According to multiattribute utility theory, the utility of a specific good can be explained by summing up the utility functions of the attributes inherent to this good [96]. This concept may be applied to our problem of analyzing preferences for single competence components by considering an individual competence profile as a good with a specific value to the team members. More precisely, the eight components that were described above can be considered as attributes inherent to the competence of an IT professional. For each component, different levels of competence can result in different utilities, and each component is linked to a utility function. The sum of these functions results in an overall function that describes how an individual team member perceives the utility or value of competence.

To quantify the value of competence and to allow for comparisons between evaluating individuals, a common unit of measurement is required. Regarding goods, absolute comparability can be obtained by approximating utility by the consumer's reservation price [46]. The reservation price represents a consumer's willingness to pay and can thus be used as a measure for the customer's perceived utility of a good [91]. Applying human capital theory [14, 62], the concept of willingness to pay can be transferred to the evaluation of human resources. Human capital theory suggests that the potential value contribution of an individual to the firm depends on his or her competence to solve the tasks and problems that are connected with his or her job profile [97]. Thus, reservation price is similar to the cash compensation that a firm is willing to pay to its employee. In the context of venture formation, the founders' competence to meet the challenges connected to founding and running a business provides economic value to their firms. However, in case of nascent firms, founding team members are compensated by founder shares (i.e., equity control) rather than by a regular income [93]. Therefore, the amount of equity that is held by a team member (or granted to a team member in the process of team composition) has been considered to be related to the perceived value that he or she potentially contributes to the firm [19].

In the process of venture creation, the distribution of equity is a central issue [48]. Granting equity to a cofounder is connected to a loss of profit and control [17], but only by finding other complementary and competent team members can the new venture profit from a larger pool of skills and knowledge [90]. The dilution of personal ownership is hence offset if equity is granted to a cofounder who is vital for the company's growth [17]. Therefore, we use in our study the proportion of equity that is granted to an IT professional as an indicator for his or her value contribution. This makes it possible to measure the value that venture team members attribute to different competence profiles in our research model.

Research Model and Hypotheses

Economic value is not a purely objective attribute of goods, but it is grounded in the subjective perception of human beings [91]. Similarly, the evaluation or ratings

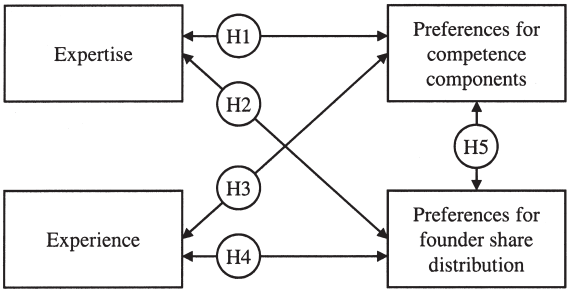

Figure 1. Research Model

concerning other persons are often influenced by the rater's subjective perception and individual characteristics [53, 89]. Venture team members will also differ in individual characteristics and are likely to have different knowledge bases and models of the world [3]. These differences may influence their perception of competence value. Previous work in the field of IS suggests that experience and expertise have a major effect on the perception of competence requirements [15, 32, 54]. In this study, we analyze the interrelation between these two characteristics of founders and their preference structures with respect to prospective cofounding IT professionals. We want to make connections between the own area of competence of the founders and their valuation of different competence components as well as the financial appreciation of a potential IT professional in their venture team. In this section, we present our research model (Figure 1) and our hypotheses connected to these two factors.

Expertise

As described above, e-business venture teams usually comprise partners with expertise in either or both of the fields of business and IT. The relationship between these two domains has long been of major interest in the IS literature [75, 85]. One important issue of this debate is the influence that the field of expertise has on the perception of resource requirements. For instance, Moløkken-Østvold and Jørgensen [64] observed differences in the estimation of Web-development projects between technical and non-technical employees. Tan and Gallupe [85] concluded that differences in business and IT managers lead to different knowledge, assumptions, and expectations concerning IT problems. Moreover, scholars debate on the influence that the field of expertise has on the perception of critical competencies [15, 54, 55, 68]. In particular, Benbasat et al. [15] found that managerial skills are perceived to be more useful to IS managers than to system analysts, whereas technical skills are perceived to be more useful to analysts than to managers. Similarly, Lee et al. [54] assumed that the perception of skills and knowledge requirements of IS professionals differed between IS managers, business managers, and IS consultants. Differences with respect to IT-related competencies are reasonable because managers define these requirements, whereas IT professionals rather have to conform to them. Along with the differences in the

perception of requirements, there will also be differences in the value attributed to the competencies. Some components of competence will be perceived as more important and thus will be more useful than others.

In our study, we analyze the perception of utility of different competence components of IT professionals in venture teams. In line with existing literature, we postulate an influence of the founders' expertise in the fields of business and IT on his or her preferred competence profile. Second, we postulate differences in the value attributed to human IT resources. Therefore, there will be variations in the preferences regarding the distribution of founder shares (i.e., the willingness to distribute equity to cofounding IT professionals) depending on the founders' own field of expertise.

Hypothesis 1: There is a relationship between a venture team member's expertise and the perceived gain in utility that results from higher levels of specific competence components of the cofounding IT professional.

Hypothesis 2: There is a relationship between a venture team member's expertise and the perceived loss of utility that results from granting equity to the cofounding IT professional.

Experience

While the protagonist's expertise reflects the professional orientation, experience represents professional maturity. We record experience as the duration of direct participation in the creation and growth of new e-business ventures. This understanding of experience comprises industry-specific start-up and management experience that has been subsumed as entrepreneurial career experiences in the literature [73]. Over the years, beliefs, attitudes, and expectations are likely to change so that experience can affect the understanding of IT and business problems [85]. In line with that, prior experience is found to have an effect on the process of venture creation [8]. Experienced protagonists have been exposed to specific problems, which they might again encounter in a new venture team. In contrast, nonexperienced protagonists cannot resort to familiar situations to base their decisions on [47]. Among others, these decisions can concern aspects of personnel recruitment. For instance, Benbasat et al. [15] found that managerial skills of IT professionals are perceived to be more important to managers of more mature organizations than of less mature organizations. Moreover, it can be expected that experience will positively influence the understanding of the specific value contribution of IT and business experts within the team [75].

Analogically to our hypotheses on expertise, we postulate an influence of the founders' experience in the context of e-business venture creation on his or her preferred competence profile. Moreover, we expect experience to be related to the value that is attributed to IT professionals in e-business venture teams. In consequence, we postulate variations in the willingness to distribute founder shares to partners with IT expertise depending on different levels of experience.

Hypothesis 3: There is a relationship between a venture team member's e-business venture experience and the perceived gain in utility that results from higher levels of specific competence components of the cofounding IT professional.

Hypothesis 4: There is a relationship between a venture team member's e-business venture experience and the perceived loss of utility that results from granting equity to the cofounding IT professional.

Preference Structure and Equity

As mentioned above, we expect differences in the utility values that individuals attribute to the specific components of our competence set. Considered conjointly, these utility values make up a founder's preferred competence profile. As competence contributes to venture success [22, 23], each founder associates a specific potential value contribution with his or her preferred competence profile. In line with human capital theory [97], this contribution may be approximated by the amount of shares that a venture team member is willing to distribute to that profile [19]. We assume that similarity in the preference structure is associated with a similar valuation of competence, whereas dissimilarities in the preferred competence profiles go hand in hand with differences in the perception of value. Approximating this value by equity ownership, we hypothesize:

Hypothesis 5: There is a relationship between a venture team member's preferred competence profile and the perceived loss of utility that results from granting equity to the cofounding IT professional.

Method

Prior to our empirical study, we used expert judgments (six academics, five practitioners) to ensure the content validity of our competence set. This procedure is suggested in the literature to assess the validity of multicomponential dimensions [44, 57, 78]. The judges confirmed our components to be comprehensible, separable, and complete.

To address our research question, we applied a Web-based questionnaire with an adaptive conjoint analysis (ACA) [39, 40]. Conjoint analysis is a technique that requires respondents to judge a series of profiles consisting of several attributes from which their decision processes can be decomposed into their underlying preference structure [83]. In the profiles, each attribute is described by one of its levels. In ACA, utility values for more important attributes are estimated through a series of graded paired comparisons [39]. The technique is adaptive in the sense that each paired comparison is constructed so as to profit from the information obtained in the preceding judgments of the respondent [40]. The main advantage of this technique is that the relevant attributes (i.e., the components of competence) are judged as a whole, whereas the technique still allows deriving utility values for the single attributes. Moreover, conjoint analysis is an accepted method to estimate a consumer's willingness to pay

[46, 50]. Following this approach, it is possible to estimate utility values for different equity ratios, which, at the same time, allows calculating the loss of utility that results from granting more or less equity to a potential cofounder.

Conjoint analysis has been proposed for researching decision-making processes as it is a real-time method that is not influenced by recall and post hoc rationalization biases [29, 83]. Conjoint frameworks can overcome the limitations of self-reported ratings, especially when concerning the assessment of another person's characteristics [67]. Furthermore, it was found that results obtained by conjoint analysis are comparable with those of traditional surveys [65] while at the same time possessing advantages in terms of validity [80].

Sample

Our sample was recruited from a Web database that consists of the major recent Internet start-ups in Germany (388 at the time of survey). This database is published and maintained by a German company with the goal of providing a comprehensive overview of entrepreneurial activities in the e-business sector in Germany. It collects data such as names of the founders, founding year, and location from ventures with Internet-based business concepts all over the country. One hundred fifty-nine of these ventures declined to take part in our study because they were not interested or too busy. Forty-seven respondents terminated the questionnaire prematurely and did not provide answers to the conjoint analytic part. Hence, they were excluded from the sample.[1] In total, the Web-based questionnaire was completed by 182 respondents resulting in a response rate of 47 percent. Due to low reliability values in the R^2 of the final regression that ACA makes available for every data set of the sample [42], another six respondents were excluded. Our final sample consists of 176 respondents from different e-business venture teams. On average, the respondents' ventures are 3.02 years old (standard deviation [SD] = 3.04) and are managed by entrepreneurial teams with an average size of 2.76 members (SD = 1.24).[2]

We checked for nonresponse bias by comparing early versus late respondents because late respondents are supposed to be more similar to nonrespondents than are early ones [5]. *t*-tests between the first and last quartile according to response time indicated no statistically significant differences in the responses for all included variables. This gives evidence that nonresponse bias is of minor concern in our data set.

As we use self-reported responses, common method variance bias could be a concern of our study. However, this concern is alleviated as Harman's single-factor test [72] did result in more than one factor, with the first extracted factor only accounting for 13 percent of the variance. This indicates that common method variance is not the main origin of our results.

Design and Measures

Our questionnaire consisted of a preexperimental part to record respondents' demographics, expertise, and experience. Subsequently, we conducted an adaptive conjoint

analysis to determine utility values for different levels of the competence components and different equity ratios.

Preexperimental Questionnaire

To record a respondent's expertise, we asked the respondents for a self-assessment for their expertise in the fields of IT based on Couger et al. [26] and Leitheiser [56] and business based on Cash et al. [21], Chandler and Jansen [23], and Couger et al. [26] by three items each. Internal consistencies (Cronbach's α) were satisfying for both IT ($\alpha = 0.82$) and business expertise ($\alpha = 0.73$).[3]

To place our respondents on a continuum from IT experts with low business expertise to business experts with low IT expertise, we computed the quotient of the two values, resulting in a new variable that can be used as an indicator of the respondents' field of expertise. Values less than 1 indicate that business competence outweighs IT competence (approximately two-thirds of our respondents), whereas values greater than 1 indicate that the respondent's expertise is in the field of IT rather than in the field of business (approximately one-third of our respondents). This new variable is referred to as *competence focus* in this paper. It can be seen as an indicator for our respondents' background and specialization in their team.

Besides expertise, the preexperimental questionnaire recorded the respondents' experience. To consider an all-embracing understanding of entrepreneurial career experience as suggested in the literature [73], we asked the respondents for the length of time they have spent as entrepreneurs in the e-business field. This measure reflects the total magnitude of experience that respondents have made in creating and running Web-based ventures, including both current and previous start-up projects. On average, the respondents have 4.75 years of experience (SD = 3.85), with more than a fourth ($n = 46$) being in their first year as entrepreneurs in e-business ventures.

Conjoint Analysis

In the experimental part of our questionnaire, we asked the participants to imagine that a team consisting of a business manager and an IT professional thinks about starting an e-business venture. The respondents were confronted with paired comparisons, each consisting of alternative competence profiles of the IT professional and equity ratios (see Figure 2 for an example). For each comparison, they were asked to decide which profile of a potential cofounder should be preferred from a founder's perspective. The respondents were requested to base all of their decisions solely on the competence of the IT professional and the division of founder shares, disregarding any other concomitant factors related to the decision of venture creation. We are aware that this procedure highly simplifies reality and does not take into account a crucial aspect of the definition of entrepreneurial teams—the fact that all members are to bring in equity capital to some extent. However, as we wanted to analyze the perception of competence with all other circumstances being equal, we had to focus on this component of the decision. The procedure of creating a common context among respondents to keep the factors not

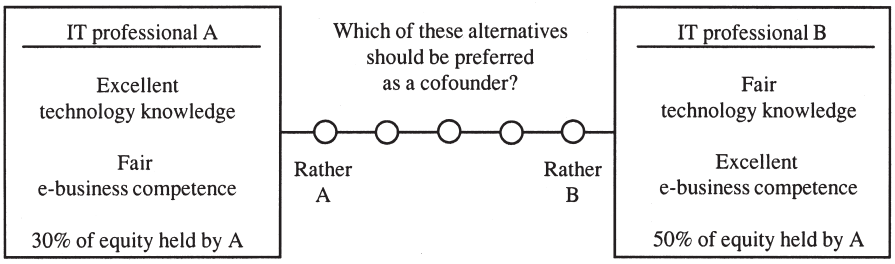

Figure 2. Example for a Paired Comparison in Conjoint Analysis

being investigated constant is well established in conjoint studies [83]. In the literature on conjoint analysis, it has been argued "that even in the most artificial situations conjoint analyses significantly reflect the decision policies actually used" [18, p. 232].

The attributes used in the experiment consisted of eight components of the competence set described above and the amount of equity granted to the IT professional. Detailed descriptions of these attributes were available to the respondents during the whole experiment. For each of the competence components, we specified two levels as this minimizes the number of pair comparisons. We labeled these levels "fair" and "excellent" (cf. for the use of these labels [67]) as "low" levels could represent exclusion criteria, which would contradict the additive compensatory model implied by conjoint analysis [38]. For the amount of equity, we differentiated between four alternative share distributions that differ with respect to the different team members' bargaining power (10 percent, 30 percent, 50 percent, and 70 percent of equity held by the IT professional). The conjoint analysis consisted of three phases [39, 40, 42]: a compositional part with ratings of each attribute, a total of ten paired comparisons, and a final calibration phase with four profiles in which the respondent was asked to provide a recommendation whether a founder should rather accept or reject the presented IT professional as cofounder. A description of each of the eight components of competence was made available to the respondents during the whole experiment.

This procedure resulted in part worth utilities for each level of each attribute (i.e., a total of 20 utility values for each respondent). For further analysis, we normalized the utility scale for each respondent such that the least preferred level of each attribute has a utility equal to zero, and utilities are interpersonally comparable. The use of these normalized utilities has the advantage that the maximum utility of each attribute corresponds to its relative importance with respect to a change in preference [42]. In the context of our study, a high relative importance of an attribute indicates that excellent levels of it are considered crucial for the decision to accept or reject a specific IT professional, whereas a low relative importance indicates that this attribute does not play a role in team composition.

Data Analysis and Results

In an initiatory step, we inspected the mean utilities of the "excellent" level of each competence component (as the utilities of the "fair" levels are to be zero due to nor-

malization and thus may be neglected). With respect to the importance of the single components, the following order resulted: realization competence (mean [M] = 0.15, SD = 0.05), technology knowledge (M = 0.14, SD = 0.07), conceptual knowledge (M = 0.11, SD = 0.06), e-business competence (M = 0.11, SD = 0.05), IT/business vision (M = 0.11, SD = 0.05), interpersonal competence (M = 0.09, SD = 0.06), entrepreneurial competence (M = 0.08, SD = 0.06), and business management knowledge (M = 0.05, SD = 0.05). The mean relative importance of the share distribution compared with competence is M = 0.15 (SD = 0.06). However, this aggregated preference structure may be linked to a loss of information when individual preference structures are heterogeneous. Therefore, we classified the data into smaller groups of respondents with homogeneous preference structures.

Cluster Analysis

Cluster analysis is a collection of statistical methods that aim at gaining knowledge about a population by reducing the data into homogeneous groups and interpreting the characteristics of the group members [74]. Within a conjoint framework, the most common approach to segmentation is the use of the part worth utilities to cluster respondents [37]. As we look for patterns in the respondents' preferred competence profiles, we used the part worth utilities of our competence components, leading to $8 \times 2 = 16$ cluster variables.

In a first step, the sample was cleaned from outliers (five in total) with the single-linkage algorithm. Subsequently, we used Ward's hierarchical clustering procedure [92] to determine the optimal number of clusters and calculated the cluster centers. Using the elbow criterion [2], the procedure resulted in a four-cluster solution. Finally, the initial cluster centers were used as starting points for nonhierarchical *k*-means clustering, as hierarchical procedures can result in nonoptimal solutions because clusters that are fused in one step remain together in all later steps (see [6] for the consecutive use of clustering methods). This last step resulted in four clusters with a size of 38 to 50 respondents. The descriptive statistics of the clusters are listed in Table 2. A discriminant analysis was performed to validate the clustering solution, as this method can be used for the confirmation of the classification of cases [16]. Overall, 98 percent of the cases were classified correctly.

Testing of Hypotheses

To test our hypotheses, we analyzed correlations and differences between the four groups identified in cluster analysis.

Expertise

To test Hypothesis 1, we first analyzed the correlations of the respondents' self-assessed IT competence, business competence, and competence focus with the part worth utility of the "excellent" level of each competence component. We found a significant positive correlation of both IT competence ($r = 0.17$, $p < 0.05$) and competence

Table 2. Descriptives of the Cluster Solution

	Cluster 1 (n = 43) Mean (standard deviation)	Cluster 2 (n = 40) Mean (standard deviation)	Cluster 3 (n = 50) Mean (standard deviation)	Cluster 4 (n = 38) Mean (standard deviation)
Technology knowledge	0.09 (0.04)	0.11 (0.05)	0.19 (0.05)	0.18 (0.05)
Conceptual knowledge	0.12 (0.04)	0.08 (0.05)	0.16 (0.04)	0.08 (0.05)
Realization competence	0.15 (0.04)	0.16 (0.05)	0.17 (0.05)	0.12 (0.06)
Business management knowledge	0.05 (0.04)	0.06 (0.04)	0.02 (0.03)	0.07 (0.06)
Entrepreneurial competence	0.07 (0.04)	0.16 (0.04)	0.05 (0.04)	0.05 (0.03)
Interpersonal competence	0.15 (0.05)	0.09 (0.04)	0.07 (0.04)	0.06 (0.04)
E-business competence	0.10 (0.05)	0.09 (0.05)	0.10 (0.04)	0.14 (0.03)
IT/business vision	0.12 (0.06)	0.09 (0.05)	0.09 (0.04)	0.14 (0.05)

focus ($r = 0.16$, $p < 0.05$) with the part worth utility of the interpersonal competence component. Second, we applied a univariate analysis of variance to test for differences between the clusters with regard to the self-assessed competence. We found no significant effect for IT competence ($F(3,167) = 0.47$, nonsignificant [n.s.]), business competence ($F(3,167) = 0.40$, n.s.), and competence focus ($F(3,167) = 0.77$, n.s.), with the exception of interpersonal competence, which has a higher utility for respondents who have their expertise in the field of IT rather than in the field of business. Therefore, Hypothesis 1 is largely not supported.

In Hypothesis 2, we postulate a relationship between a respondent's expertise and the perceived loss of utility resulting from granting equity to the IT professional. As this loss of utility corresponds to the relative importance of the share distribution compared with competence, we computed the correlations of this variable with the variables describing the respondents' self-assessed competence. The correlations were significantly negative for IT competence ($r = –0.15$, $p < 0.05$) and competence focus ($r = –0.15$, $p < 0.05$). This means that loss in utility is lower for those respondents whose field of expertise is in IT rather than in business and vice versa. Therefore, our data largely support Hypothesis 2.

Experience

To test Hypothesis 3, we first analyzed the correlations of the respondents' self-assessed experience with the part worth utility of the "excellent" level of each competence component. We found three significant correlations: a negative correlation for technology knowledge ($r = –0.19$, $p < 0.05$) and for conceptual knowledge ($r = –0.23$, $p < 0.01$) and a positive correlation for interpersonal competence ($r = 0.22$, $p < 0.01$). We then applied a univariate analysis of variance to test for differences between the clusters, which resulted in a significant effect: $F(3,167) = 5.18$, $p < 0.01$, $f = 0.31$. To determine the significant differences between the groups, a Scheffé post hoc test was conducted. The test indicated differences between cluster 3 (M = 3.16, SD = 2.73) and cluster 1 (M = 5.72, SD = 4.11, $p < 0.05$) and between cluster 3 and cluster 2 (M = 5.63, SD = 4.42, $p < 0.05$). Therefore, our data clearly support Hypothesis 3.

In line with the testing of Hypothesis 2, we tested Hypothesis 4 by analyzing the correlation between the respondent's experience and his or her perceived relative importance of the share distribution. As we found no significant effect for this correlation ($r = –0.02$, n.s.), Hypothesis 4 is not supported.

Preference Structure and Equity

Hypothesis 5 assumes a relationship between a respondent's preferred competence profile and the perceived loss of utility resulting from granting equity to the cofounding IT professional. To test this assumption, we applied a univariate analysis of variance to compare the respondents in our four clusters regarding their perception of the relative importance of equity. The analysis resulted in a significant effect: $F(3,167) = 3.22$, $p < 0.05$, $f = 0.25$. To determine the significant differences between the groups, again

a Scheffé post hoc test was conducted. It indicated a difference between cluster 2 (M = 0.16, SD = 0.06) and cluster 3 (M = 0.13, SD = 0.05, $p < 0.05$). Therefore, Hypothesis 5 is clearly supported by our data.

Discussion

IN THIS STUDY, WE ANALYZED THE EFFECT of personal characteristics (i.e., field of expertise and experience) on the perception of the value of the IT professional's competence in e-business venture teams. We checked both relationships between personal characteristics and the perceived values of single components of competence, as well as differences between groups of respondents with homogeneous preference structures. These groups were identified by cluster analysis. The mean utilities connected to each component of competence can be used to visualize the preferred competence profiles of the single groups (Figure 3), resulting in four prototypes of IT professionals, which are discussed in this section. We then discuss the results of our data analysis for each of our hypotheses.

Prototypes of IT Professionals

Respondents in cluster 1 prefer profiles with high levels of realization competence and interpersonal competence, whereas the remaining components of business competence have rather average mean utilities in this cluster. Supposedly, this competence profile corresponds to an *IT manager*—that is, an executive position focused on technical issues. This cofounder prototype might be capable of designing e-business architectures, managing development processes, and overseeing technical staff. Cluster 2 is characterized by high utilities in realization and entrepreneurial competence, whereas the utilities of all other components are well balanced. This profile might correspond to an *e-entrepreneur,* who is capable of both developing ideas and realizing them in a new e-business venture. Respondents in cluster 3 stand out against the others as they prefer profiles with high levels of all three components of IT competence, whereas the components of business competence have very low mean utilities. The corresponding cofounder prototype could be referred to as a *Web developer*—that is, a specialist position focused on Web applications. Finally, cluster 4 features high utilities of technology knowledge, e-business competence, and IT/business vision. This might correspond to an *e-business expert* who is proficient in both the technical and the nontechnical aspects of e-business.

Discussion of Hypotheses

Figure 4 gives an overview of the supported and rejected hypotheses and of the results of our study. In our data, we did not find a relationship between the respondents' expertise and their preferred competence profile (which was postulated in Hypothesis 1). However, we did find one single interrelation between expertise and preference: with rising IT competence, respondents preferred a higher level of interpersonal competence.

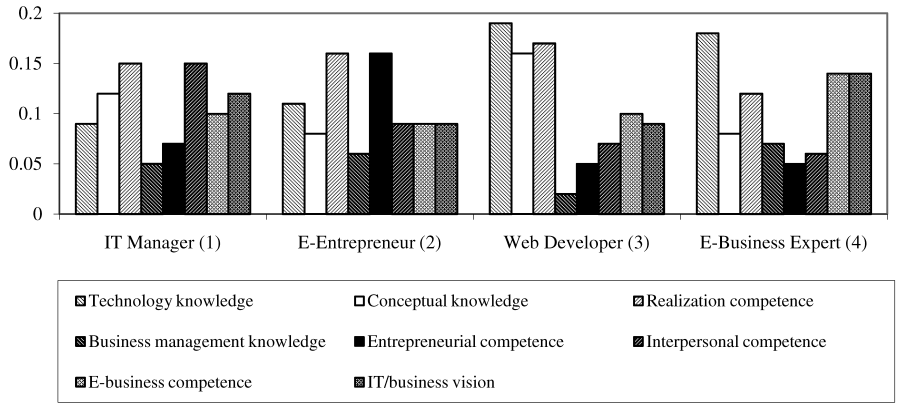

Figure 3. Cluster Solution: Mean Utilities of the Competence Components

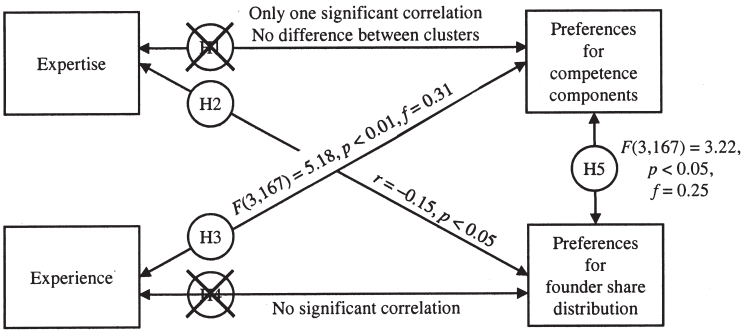

Figure 4. Overview of the Results of Our Study

This is interesting, as it emphasizes the importance of communication in e-business software development processes from an IT expert's perspective. Apparently, business experts do not assess communication as important as their IT partners do. However, generally, preference structures regarding the competence profile of a cofounding IT professional appear independent of a respondent's own competence. In other words, IT and business experts in e-business venture teams have similar beliefs as to what IT professionals should be capable of. This result is rather surprising as the mutual perceptions of IT and business experts are often influenced by stereotypical images [31]. Probably e-business venture team members, despite having complementary fields of expertise, are not as distant from each other as IT and business experts in traditional enterprises, because they are more familiar with each other's contribution to team.

Although the field of expertise is obviously not related to the perceived gain in utility resulting from higher levels of specific competence components, there was a significant relationship with the relative importance of share distribution (which was postulated in Hypothesis 2). The higher a respondent's self-assessed IT competence, the lower is the perceived loss of utility resulting from distributing equity to a cofounder. In

other words, IT experts perceive competence in relation to equity more important than business experts. This reflects findings that IT workers are above all motivated by their work itself [25] and rather seek appreciation of their contributions [31].

Correlation analysis revealed an interrelation between experience and some of the competence components (what we postulated in Hypothesis 3): experienced respondents have a preference for a high level of interpersonal competence, whereas less-experienced respondents prefer the technology/conceptual knowledge components. Similar results became apparent when analyzing differences between the clusters. Respondents who prefer the *Web developer* prototype (which is characterized by excellent levels of IT competence) turned out to be less experienced than respondents who prefer the *IT manager* prototype (high levels of interpersonal competence) or the *e-entrepreneur* prototype (high level of entrepreneurial competence). One possible explanation for this is that less-experienced respondents are still unable to estimate the requirements that a cofounding IT professional will be confronted with. In contrast to their experienced counterparts, they probably cannot identify the components that will be of critical importance in the long term. It is also possible that the requirements differ with respect to a venture's maturity [60, 79], indicating that new ventures require a different competence profile than more mature ones. In that sense, IT professionals in younger venture teams are expected to be *Web developers,* whereas IT professionals in more mature teams are expected to develop ideas, design architectures, manage development processes, and oversee technical staff.

Although experience is related to the preferred competence profile, our data suggest that it is not related to the importance of share distribution—that is, the perceived overall *value* of competence (contrary to Hypothesis 4). This may result from different *kinds* of experiences that respondents have made with respect to their collaboration with IT professionals, which will affect their perception of competence value or with respect to different equity control, which will affect their willingness to distribute shares to a cofounder.

Hypothesis 5 concerns differences in value attribution between the different clusters measured by perceived loss of utility resulting from granting equity to the IT professional. Apparently, respondents who prefer the *Web developer* prototype perceive the IT professional's competence as more valuable than respondents who prefer the *e-entrepreneur* prototype. One reason for the difference in value perception might be that usually the *Web developer's* IT competence cannot be provided by business experts, whereas the *e-entrepreneur's* entrepreneurial competence can. IT competence is genuine to the IT professional and thus makes him or her more valuable and irreplaceable for the team.

Implications and Limitations

Our study shows a relationship between personal characteristics of members of e-business venture teams and their preferences regarding both the competence profile of a cofounding IT professional and the distribution of founder shares. This implies that team members, depending on their experience and expertise, will make different

decisions in the process of team composition. Our findings have important implications for e-business venture teams. In particular, these implications concern interdisciplinary and immature teams.

In interdisciplinary teams, tensions can arise resulting from different perceptions of business and IT experts as they have different knowledge, assumptions, and expectations concerning IT [54, 64, 85]. Our study reveals that these different perceptions of IT professionals concern to a lesser extent preferences for different competence components but rather the overall value attributed to the competence of IT professionals. Thus, we suggest that during the process of venture creation, team members should deliberately bring up questions of each other's value contribution and related issues of equity control. This is important especially from the perspective of IT professionals, who should pay attention to emphasizing the unique contribution of their competence to the team.

There are further implications for immature teams as our study reveals that a team member's experience is related to his or her preferences for different competence profiles. This suggests that immature teams may have difficulties in identifying the critical components of competence. In addition, it is possible that the importance of specific components changes over time, as the problems that venture teams are confronted with may evolve with the growth of the firm [79]. This might be particularly true for cofounding IT professionals, as their role is likely to develop from a developer-like specialist to a manager-like generalist. Inexperienced founders probably misjudge or fail to notice these transformations and will therefore rather choose a partner who fits the requirements in early stages of venture growth. Independent of their origin, these misjudgments might result in suboptimal choices of cofounding partners. Thus, it might be advantageous for inexperienced founders to obtain information about actual and future requirements regarding the competence of IT professionals. As this competence is critical to succeed in the e-business environment [21], founders should reflect upon how to embed it into the firm, that is, decide whether to employ an IT professional or to take him or her into the team as a cofounder. IT professionals with both high levels of IT competence and the potential to mature from a *Web developer* to an *IT manager* appear to be particularly suitable as cofounders.

As with all empirical research, our study is subject to limitations. One limitation is that we assessed the participants' own competence by self-ratings only. These self-ratings could be distorted (e.g., by a self-serving bias) and thus a more objective assessment would have been desirable. Still, it was shown in the literature that self-assessed competence is highly correlated with objective outcome measures [23].

Furthermore, our sampling did not allow selecting pure IT experts or pure business experts within the teams, so our sample may contain founders with very different backgrounds. But as we wanted to relate differences in the preference structure with the founders' expertise, we sampled founders from the two different fields of expertise relevant for an e-business context [51] and computed the ratio of IT and business expertise to determine each respondent's specialization.

Another limitation is that our experimental framework highly simplifies reality. In particular, it is unlikely that partner recruitment decisions are solely based on questions

of competence [48]. The willingness to distribute equity to a partner also depends on a number of additional factors such as external investors, availability of equity, or negotiating skills. As we discussed above, for our research, we had to instruct our respondents to focus on questions of competence and to neglect any other factors that would influence their decisions during conjoint analysis. The respondents could hence concentrate on the central factors of our study whereas this controlled setting would not have been realizable in a field study where processes are confounded by uncontrollable factors external to the research questions [34]. Furthermore, hypothetical situations run the risk of not being fully understood by the respondents. But in our study, respondents have already created an e-business venture and thus have experienced similar situations before. Therefore, we assume that they have been able to relate their experimental decision to decisions they would make in the real world. This is in line with evidence that even in artificial situations conjoint analysis significantly reflects the actual decision-making process [29].

Even if conjoint analysis can be considered as a valid method to derive preference structures and decision-making policies [83], it does not provide information on the quality of these preferences and decisions or on how they are related to success. Future research could complement our work and relate the different competence components to firm performance so that the actual value of the different components for venture success can be assessed.

Another limitation of our study is that we used a cross-sectional design. Thus, we could not take into account the course of development of the participants' ventures and the connected changes in their preference structures. As we found differences between more- and less-experienced founders, a longitudinal design might provide additional insights in the development of preference structures. Furthermore, a cross-sectional design can only reflect a single point of time. A longitudinal design would have the additional benefit that successful ventures could be differentiated from unsuccessful ones. All of our participants were founders of Internet-based ventures and have, at least in a first step, successfully founded a business. On one hand, this makes the hypothetical situation more realistic to them and could improve validity due to higher representativeness [1]. On the other hand, respondents who have not yet made the decision to start a venture and have not already completed this action will probably be more appropriate because our hypothetical situation takes place right at the moment of venture foundation. For future research, it could be insightful to survey students that have not yet founded their own venture as a very inexperienced control group and compare these results with the ones obtained in our study.[4]

Despite its limitations, our approach is innovative in the way that it combines human capital theory with a utility-theoretical perspective. Therefore, we suggest applying adaptive conjoint analysis when it comes to the valuation of personal characteristics of IT professionals, such as personnel recruitment decisions and the composition of software development teams. For the special case of IT professionals in Internet-based venture teams, we presented an integrative and comprehensive competence set that can be further applied and researched in the e-business context. Furthermore, our framework and method could be further refined to elucidate the requests and require-

ments that IT professionals encounter in their working life. As a gap has been stated between the academic preparation and job requirements [54, 68, 88], this information is needed to reveal the diverse and broad expectations that IT professionals will be confronted with. Thus, data obtained by this technique could contribute to existing efforts [32, 54, 55, 86] to improve IT education.

Notes

1. Before we excluded the 47 dropouts of our sample, we compared their answers (as far as they were available) with the participants who terminated the questionnaire. We conducted *t*-tests and found no differences for the respondents' experience ($t(214) = -1.56$, n.s.), their IT expertise ($t(209) = -0.31$, n.s.), their business expertise ($t(209) = 0.06$, n.s.), and their competence focus (see below the description of this variable) ($t(209) = -0.27$, n.s.). This indicates that the dropouts did not differ significantly from the participants.

2. We checked if team size had a significant effect on any variable recorded in our study and found no correlations or differences with respect to the size of the respondents' venture teams.

3. The items for IT expertise were "How would you rate your technology knowledge, i.e., your knowledge about specific languages, applications, platforms, and tools?" "How would you rate your conceptual knowledge, i.e., your knowledge about formal methods, systems theory and concepts?" and "How would you rate your realization competence, i.e., your knowledge about development methodology and problem solving?"

The items for business expertise were "How would you rate your business management knowledge, i.e., your knowledge about business principles and operations, strategic management, finance, marketing, and customer management?" "How would you rate your entrepreneurial competence, i.e., your capability to recognize and envision new business opportunities?" and "How would you rate your interpersonal competence, i.e., your capability to communicate effectively, to motivate and influence others?"

4. We thank an anonymous referee for this suggestion.

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