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Nicola Berg, Dirk Holtbrügge

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Global teams: a network analysis

Global teams: a
network analysis

Nicola Berg

University of Hamburg, Hamburg, Germany, and

Dirk Holtbrügge

*Department of International Management, University of Erlangen-Nuremberg,
Nuremberg, Germany*

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Abstract

Purpose – In the last few years, several empirical studies about the determinants and success factors of global teams have been published. While these studies show many interesting results, they are often focused on single variables such as cultural homogeneity, cooperation length, or task complexity, but rarely analyze the complex relationships between these concepts. The aim of this paper is to explore how members of global teams consider the relevance of different determinants of their cooperation, how these determinants are interrelated, and how they influence team performance.

Design/methodology/approach – In this paper, a network study of global teams in the automotive and airline industries is presented. Based on interviews with the members of nine teams in three companies the software programs NVivo and UCINET were applied for a construct causal network analysis of the relationships between various team characteristics and their impact on team performance.

Findings – The study shows that the interaction of team members from different cultures does not directly impact the productivity and creativity of teams. This relationship is rather influenced by various determinants such as task complexity, language skills, communication media and intercultural training.

Research limitations/implications – A restriction of this study is its regional concentration on teams with members from European cultures. Future research should broaden this perspective and focus on global teams with a more diverse composition in terms of culture. For example, it would be interesting to know whether for global teams in Asia, South America or Asia similar or different determinants are relevant.

Originality/value – The study enhances the knowledge of the complex interrelationships between various determinants of global teams and their impact on team performance. A major methodological contribution is the analysis of real teams, enabling a far more realistic picture than previous experimental studies conducted in this area that deal with simulated teams, whose members do not have a shared past nor a shared future.

Keywords Globalization, Team working, Networking, Team performance, Cross-cultural management

Paper type Research paper

Problem and objectives

In many organizations, global teams, i.e. the institutionalized interaction of persons from different cultural backgrounds, have great practical relevance (for an overview, see Canney Davison and Ward, 1999; Marquard and Horvath, 2001; Earley and Gibson, 2002; Shapiro *et al.*, 2005; Halverson and Tirmizi, 2008). One reason for their introduction is to better fulfill customer demands through the internalization of diversity within organizations. Moreover, the institutionalized communication of employees with different national and cultural backgrounds should promote creativity and the adaptation of innovations. In multinational corporations, they are also often used to improve the worldwide coordination of value-chain activities conducted in different countries.

In practice, the realization of these aims is confronted by several problems. As the members of the global teams come from different cultures, they are inevitably shaped by different, often conflicting views of management practices (e.g. Gabriëlsson *et al.*, 2009). For example, empirical studies find that Americans put more emphasis on quick results, while Chinese typically have a much longer time-perspective. Cooperation in global teams may also be challenged by differences in power distance, masculinity, uncertainty avoidance, and individualism (Hofstede, 2001). Additionally, different native languages can lead to communication problems and misunderstandings (e.g. Chen *et al.*, 2006). For example, team members with a preference for low-context communication may find team members with a high-context communication style reserved and ambiguous, while the latter may perceive the others as offensive and rude (Hall, 1976).

The great practical relevance of global teams has prompted a multitude of theoretical and empirical studies. Up to now, however, a comprehensive model of their determinants and performance impact has been missing. The current studies are mostly concentrated on single variables such as cultural homogeneity, cooperation length, or the complexity of tasks, but rarely analyze the complex interrelationships between different determinants. For this reason, the aim of this article is to investigate how members of global teams consider the relevance of different determinants of their cooperation, how these determinants are interrelated, and how they influence team performance. The remaining part of the paper is organized as follows. In the following section, the existing empirical studies of global teams will be critically analyzed. Based on this literature review, important determinants will be isolated and their relationships will be explored in a network study of nine global teams in the automotive and airline industries. In the main section, the findings of this study are presented and discussed. The paper ends with a summary of its main contributions and implications for future studies.

Review of existing studies

In order to explore the current state of knowledge of global teams, existing empirical studies relevant to the underlying research question published in highly reputable academic journals were analyzed (Berg, 2006a). In particular we looked for publications that had a combination of the terms “group(s)” or “team(s)” as well as “international”, “intercultural”, “multinational”, “global” or “transnational” in their titles or abstracts. We restricted our search to articles which were published in highly reputable academic journals, i.e. journals in the categories A + , A and B in the JOURQUAL 2 ranking of the German Academic Association of Business Research (http://pbwi2www.uni-paderborn.de/WWW/VHB/VHB-Online.nsf/id/DE_Jourqual_2). The search took place in December 2007 and resulted in 62 hits. A closer analysis revealed that 16 of these 62 contributions lacked an empirical basis (e.g. Hambrick *et al.*, 1998; Shapiro *et al.*, 2002), and 25 were not actually relevant to the topic and were as a result, excluded from the study. There were three reasons in particular for the exclusion. First, some of the articles did not deal with any international aspects. They examined firms, for example, that were active in various countries without referring explicitly to groups composed of members with different nationalities (e.g. Montoya-Weiss *et al.*, 2001; Goodall and Roberts, 2003). Second, some articles were concerned with comparisons of teams in different cultures and not with teams that consist of members from different cultures

(e.g. Mueller, 1992; Earley, 1999; Gibson and Zellmer-Bruhn, 2001). Third, in some articles, the term “team” or “group” was merely used metaphorically for a large number of people, without considering the interaction of individuals with different cultural backgrounds (e.g. Mendez, 2003). Altogether, 21 relevant studies were identified (Table I). In the following, these studies will be analyzed and implications for our own study will be derived.

Determinants of global team performance

One of the most intensively researched topics in existing studies of global teams is the influence of cultural compositions on team efficiency. The results are, however, conflicting. While Thomas *et al.* (1996) found a negative relationship between cultural diversity and team performance, Cox *et al.* (1991) and Gibson (1999, 2nd sub study) reveal a positive effect, and Earley and Mosakowski (2000) found a curvilinear relationship. Kilduff *et al.* (2000) and Gibson (1999, 1st sub-study) could not verify any influence of team composition in terms of culture at all.

The different results can be attributed to several causes. For instance, Kilduff *et al.* (2000) measure a team member’s cultural background with nationality, whereas other studies take on a more complex conceptualization. Earley and Mosakowski (2000) use self-assessments, while Cox *et al.* (1991) and Gibson (1999) refer to the data from Hofstede (1980). They discriminate between homogenous and heterogeneous teams, however, on account of a single dimension only – namely that of individualism and collectivism. In contrast, Thomas *et al.* (1996) refer to Hofstede’s four dimensions, i.e. power distance, individualism, masculinity, and uncertainty avoidance, and develop an index of global team homogeneity on the basis of the index of Kogut and Singh (1988).

Journal	Study
<i>Academy of Management Journal</i>	Cox <i>et al.</i> (1991) Gibson (1999) Earley and Mosakowski (2000) Salk and Brannen (2000)
<i>Journal of International Business Studies</i>	Athanassiou and Nigh (2000) Reuber and Fischer (1997)
<i>Journal of International Management</i>	van Ryssen and Godar (2000)
<i>Journal of World Business</i>	Joshi <i>et al.</i> (2002) Chevrier (2003) Lagerström and Anderson (2003) Lunnan and Barth (2003) Schweiger <i>et al.</i> (2003)
<i>Management International Review</i>	Athanassiou and Nigh (2002)
<i>Organization Science</i>	Jarvenpaa and Leidner (1999) Kilduff <i>et al.</i> (2000) Maznevski and Chudoba (2000)
<i>Research in the Sociology of Organizations</i>	Thomas <i>et al.</i> (1996)
<i>Sloan Management Review</i>	Govindarajan and Gupta (2001)
<i>Strategic Management Journal</i>	Sambharya (1996) Athanassiou and Nigh (1999) Subramaniam and Venkatraman (2001)

Table I.
Empirical studies of
global teams

This index calculates the cultural distance along Hofstede's four dimensions of each individual in a group from all other group members and takes the arithmetic average.

Another reason for the contradictory results might be different methods of data collection. Earley and Mosakowski (2000) revert to a mix of methods for data collection – from the analysis of secondary data and the written survey about personal interviews to participatory observation. The other studies are based on experiments. Cox *et al.* (1991), Thomas *et al.* (1996), and Gibson (1999) conducted these with students, while managers participated in the experiment of Kilduff *et al.* (2000). In all four cases the global teams were composed *ad hoc* for the reason of the study. Only Earley and Mosakowski (2000) observe global teams that had already been working together for a longer period of time.

Additionally, differences in the investigated countries and cultures could also be responsible for the contradictory results. Cox *et al.* (1991) observe ethnically diverse monocultural teams that consist of member with different ethnic backgrounds. Gibson (1999) examines teams with members from Hong Kong, Indonesia, and USA, whereas the participants in the study of Earley and Mosakowski's (2000) come from Australia, Great Britain, Hong Kong, Indonesia, Malaysia, USA, and Vietnam. The cultural background of the team members is not mentioned in Thomas *et al.* (1996) and Kilduff *et al.* (2000).

Another group of studies focuses on the influence of the length of teamwork on team efficiency. Thomas *et al.* (1996) and Earley and Mosakowski (2000) consider the length of teamwork to be a moderating variable between the cultural homogeneity or heterogeneity of a team and team efficiency, and demonstrate a positive influence. This is also true for Earley and Mosakowski (2000), however, only for culturally heterogeneous teams. Salk and Brannen (2000) reveal a generally positive influence of the length of teamwork on team efficiency, although they do not provide detailed arguments for this result.

To a wider extent, the existing studies provide consistent results for the relationship between task complexity as well as task uncertainty and team efficiency. Gibson (1999), Salk and Brannen (2000), and Maznevski and Chudoba (2000) suggest that global teams exhibit a higher efficiency with a high task complexity and uncertainty as compared to routine tasks. The results from the studies of Subramaniam and Venkatraman (2001), Lagerström and Anderson (2003) and Lunnan and Barth (2003), who reveal a positive influence of global teams on the ability to create innovation across countries, may also be interpreted in this way. In all six studies, however, little attention is given to systematically implementing and validating the measurement of task complexity or uncertainty. As a result, convincing evidence for these comprehensible findings is yet to exist.

With reference to the influence of team goals on team efficiency, Govindarajan and Gupta (2001) and Schweiger *et al.* (2003) argue that the definition of goals facilitates the cooperation of team members with different cultural backgrounds, as through this, decisions and actions are steered in a specified direction. Both studies, however, do not provide any conclusions in terms of under which conditions this applies and whether the clear definition of team goals is more important for routine than for creative tasks.

The influence of personal relationships between team members on team efficiency is also frequently investigated. Govindarajan and Gupta (2001) argue that the development of trust between team members decreases the risk of unproductive

conflicts and through this, cooperative teamwork is encouraged. In a similar way, Chevrier (2003) argues that personal relationships between team members are more important than all other determinants of team efficiency. In contrast, Joshi *et al.* (2002) point to the notion that close personal relationships between individual team members may lead to the formation of unproductive sub-groups and in turn, reduce team efficiency.

Although teamwork consisting of people with varying native languages is a central characteristic of global teams, the influence of foreign language knowledge is rarely analyzed. van Ryssen and Godar (2000), Govindarajan and Gupta (2001), Lagerström and Anderson (2003), and Schweiger *et al.* (2003) only briefly mention the negative influence of different native languages on interaction intensity and the creation of sub-groups. However, the studies do not go beyond general statements about foreign language capabilities, such as “I wish I spoke several languages” (Schweiger *et al.*, 2003, p. 138) or “You must speak decent English” (Lagerström and Anderson, 2003, p. 91). In more detail, Jarvenpaa and Leidner (1999) point out that the increased use of electronic media positively affects understanding because the team members have more time to think and as a result, make fewer mistakes and express themselves more precisely. This is particularly relevant for virtual global teams (Prasad and Akhilesh, 2002). A reason as to why this variable has only been marginally analyzed in previous empirical studies could be the fact that the majority was carried out by American authors, who are possibly less sensitive to language problems.

Closely related to the languages spoken in global teams is the influence of communication media on team efficiency. Jarvenpaa and Leidner (1999) come to the result that the use of electronic media improves understanding in global teams, because cultural differences in gestures and mimics as well as possible accents are less relevant. Thus, electronic media emphasize more the similarities between the team members rather than their cultural differences. On the other hand, Maznevski and Chudoba (2000) and Govindarajan and Gupta (2001) identify that creative tasks primarily require the exchange of implicit knowledge, where intensive personal communication is necessary. Hence, it can be argued that the relationship between the predominant communication media and team efficiency is moderated by the complexity of work tasks.

The impact of intercultural training on the success of global teams is investigated in a study from van Ryssen and Godar (2000). The authors generally regard training as important without, however, explicitly justifying it. As the study only provides few specifications about the research design as well as the measurement of intercultural training, concrete implications can hardly be taken from this insight.

Performance criteria of global teams

Current empirical research of the outcomes of global teams mainly focuses on team productivity as being the most important performance criterion. Cox *et al.* (1991), Thomas *et al.* (1996), Gibson (1999), and Earley and Mosakowski (2000) all consistently come to the conclusion that the use of global teams affects team productivity. As explained above, the findings of these studies are contradictory in regards to the direction of these effects, i.e. positive, negative and curvilinear effects were discovered.

Another group of studies deals with the question of whether global teams lead to more cooperative behavior or rather higher conflict intensity in organizations. Cox

et al. (1991) conclude that the likelihood of cooperative behavior correlates positively with the number of team members with a collectivist background. The stronger the collectivist background, the more likely it is that cooperative behavior is prevalent in strategic decision-making. In addition, culturally heterogeneous teams show more cooperative behavior than teams with a culturally homogenous member structure. In contrast, Joshi *et al.* (2002) argue that the conflict intensity rises with the increasing formation of sub-groups. Reasons for this could be cultural differences as well as goal conflicts. This particularly holds true if the team members come from different organizational units and if they have to interact across a large geographic distance.

A third performance impact, which has been the focus of many studies, is the ability to create innovations across countries. Subramaniam and Venkatraman (2001) claim that the ability to develop new products across countries is closely related to the prevalence of global teams. Lagerström and Anderson (2003) come to a similar result, however, without giving convincing evidence for this. Lunnan and Barth (2003) put these findings into perspective and claim that the geographical and cultural distance between the team members increase the likelihood of new knowledge development, however, the implementation and integration of this knowledge is hindered through these geographical and cultural distances.

Another stream of research is focusing on the influence of global teams on the degree of internationalization. Sambharya (1996), Athanassiou and Nigh (1999, 2000, 2002), and Reuber and Fischer (1997) agree that firms, whose top management teams have considerable international experience, show a higher degree of internationalization. However, the relationship between these two variables is unclear, i.e. whether the degree of internationalization exhibits the dependent or the independent variable.

What is striking about the empirical studies from Maznevski and Chudoba (2000), van Ryssen and Godar (2000), Salk and Brannen (2000), Govindarajan and Gupta (2001), Chevrier (2003), and Schweiger *et al.* (2003) is that they provide nearly no indications about the measurement of team efficiency. It is either vaguely defined or subjectively estimated, which strongly confines the statements and conclusions in these studies.

Identification of research gap

Our summary of the previous studies results reveals that much is known about individual aspects of global teams. Particularly, the influence of team composition, length of teamwork, job tasks, team goals, personal relationships, and communication media have been analyzed in great depth. Moreover, many studies discuss the efficiency of global teams in terms of team productivity and creativity as well as their ability to accelerate internationalization.

While previous studies provide detailed insights into a large number of aspects, they are also characterized by several shortcomings. First, most studies use quantitative methods of data collection and analysis. While these methods are suitable to analyze statistical relationships between single variables, they are less appropriate to understand complex relations between larger numbers of determinants. When qualitative methods (e.g. case studies) are applied, they are mostly restrained to relatively simple methods of data analysis such as citation

analyses (e.g. Chevrier, 2003), whereas more sophisticated methods such as computer-aided structural text analysis have only rarely been drawn upon in the investigation of global teams.

Second, the participants in many studies are students, and it is debatable whether the findings of these studies are transferable to global teams that consist of workers or managers who work under different conditions and are exposed to other time and economic constraints. Third, in most studies the global teams were composed *ad hoc* for the reason of the study. Thus, the team members have neither a common past nor a common future. It can be argued that global teams that have already been working together for a long period of time might act in a different way than artificially generated teams.

Finally, the country selection in the studies that were identified as relevant comprises of 35 countries or cultures altogether. This seemingly large number is misleading in that 13 of the countries are part of just one study and the individual countries in many studies are only represented by one or very few team members. In seven studies, there were not any specifications in regard to team composition. Additionally, a closer analysis reveals a clear focus on the USA and Western Europe. In contrast, global teams, whose members come from Eastern Europe, Arabic regions or Africa, have not yet been empirically investigated. Moreover, Asia and South America are greatly underrepresented. Thus, the existing studies reveal a high American-Western European bias.

Methodology

Sample

Based on the findings of previous studies and the research gap identified in the previous paragraph we conducted a network study among nine global teams in three organizations: EADS, Star Alliance and Volvo. The choice of these three organizations is based on the following reasons (Table II).

The European Aeronautic Defence and Space Company (EADS) was established in 1999 at the initiative of Germany, France, and Spain. It consists of different business units in aviation and aerospace such as Airbus, Ariane, Eurocopter, and Eurofighter, which were previously organized as a contractual network of independent companies and now operate under EADS as relatively independent subsidiaries. At EADS, global teams are results of political decisions to establish the company as the European counterweight to Boeing McDonnell-Douglas in the aircraft construction industry. Accordingly, employees from several countries consistently work together in global teams on all hierarchical levels. Because EADS operates in different locations, teamwork occurs in an actual as well as in a virtual sense. The primary task of global teams at EADS is to coordinate the involved partners as well as to promote creativity and innovation in all value activities (Berg, 2006b).

The Star Alliance, founded in 1997, also represents global teams as primarily being a result of now 21 countries constituting this network of participating airlines. In contrast to EADS, their goals are more externally oriented. Global teams mainly serve the purpose of satisfying the needs of extremely culturally heterogeneous flight passengers. In addition to the customer orientation, the cross-country coordination of the partner alliance represents another important task (Holtbrügge *et al.*, 2006). In the Star Alliance, global teams work constantly and are located on all hierarchical levels

Table II.
Characteristics of the
conducted interviews

	EADS	Star Alliance	Volvo
Number of investigated global teams	Three	Three	Three
Functional area and hierarchical level	Human resources development team, production team, sales team	Top management team, coordination team, service team	Research and development team, marketing team, production team
Cultural backgrounds of team members	Germany, Great Britain, France, Spain	Brazil, Germany, Denmark, Great Britain, Japan, Canada, Norway, New Zealand, Austria, Poland, Sweden, Singapore, Spain, South Korea, Thailand, USA	Belgium, Germany, The Netherlands, Sweden
Locations	Hamburg, Marseille, Toulouse	Frankfurt/Main	Gothenburg, Cologne
Number of respondents	Three	Seven	Three
Cultural origin of respondents	Germany, France, Great Britain, Spain	Germany, Great Britain, Mexico, Austria, Thailand, USA	Belgium, Germany, Sweden
Language(s)	German, French	German, English	German, English
Total length of the interviews	320 minutes	380 minutes	290 minutes

from the Alliance Management Board to the check-in crews. Especially on the higher hierarchical levels, the interaction of team members occurs virtually.

The most important reason to include Volvo in the study is its long-standing experience with global teams. As one of the first companies to ever use global teams, Volvo had already begun to incorporate group work in the 1960s. The plant in Uddevalla is still considered a worldwide pioneer of global teamwork (Rehder, 1992; Adler and Cole, 1993; Berggren, 1993). Additionally, the active use of cultural differences also plays a central role in the company's philosophy. Compared to the other two selected organizations, the global teams at Volvo also have the broadest application spectrum. Moreover, their use is not only motivated by economic reasons but also aimed to increase the job satisfaction of employees, thus reflecting another important aim of global teams.

Data collection

In order to find appropriate respondents we contacted the corporate communications departments of the three organizations. Our requests were forwarded to members of global teams in different functional areas and at different hierarchical levels. At EADS and Volvo three respondents were available for interviews, and at Star Alliance seven. The reason for the larger number of contacts at Star Alliance was that during a board meeting, we were able to interview five top managers simultaneously. All in all, three interviews in all three organizations were conducted. All respondents had many years of experience as members of global teams and worked in those areas typical for the

respective company. For this reason, the reliability of the interviews can be assumed as being high.

For the interviews, an interview guide was developed (see the Appendix). This includes questions from existing research (particularly from Canney Davison, 1995; Gibson and Zellmer-Bruhn, 2001; Athanassiou and Nigh, 2002) as well as questions that cover areas that have not been explored in previous studies. Open-ended questions were formulated that should have led the respondents to their own, uncontrolled answers (Seidman, 1998). This methodology is based on the paradigm of qualitative social research (e.g. Bernard, 2002; Richardson, 2002; Denzin and Lincoln, 2005) and is aimed at, first of all, collecting data about the research subject and then testing different concepts and theories in regards to their classification and interpretation. The goal is to select or develop a framework that best corresponds with the data.

Because we were dealing with respondents from different language areas, an English and a French version on the interview outline was developed in addition to the original German version. The equivalence of the survey was ensured through back translation (see in more detail Marschan-Piekkari and Reis, 2004). Hereby, two native speakers translated the surveys into English or French and then, the two translations were translated from two different persons back into German. Thereafter, obvious differences in meaning between the versions were discussed and cleared up with the participated translators.

We followed a recommendation from Daniels and Cannice (2004, p. 198) and addressed topics outside of the research (e.g. arrival, weather, new reports in the media) before the interviews in order to create a preferably unforced interview atmosphere and to increase the trust between the interview partners. All of the interviews were recorded on audiotape.

Data preparation

In a first step, all interviews were transcribed with the QSR NUD*IST Vivo (NVivo) software program (Fraser, 1999; Gibbs, 2003). NVivo allows for classifying, sorting, arranging, and exploring non-numerical and unstructured data. Afterwards the interview texts were coded. Coding is the process of identifying and recording discrete text passages that exemplify the same theoretical or descriptive idea and connecting them to a node. Nodes can be developed in two different ways (Gibbs, 2003). The deductive or concept-driven approach is based on either relevant theories or existing empirical studies which are integrated in a conceptual model. The aim is to accordingly test this model and the hypotheses derived from it with the statements from the respondents at hand. For this, the function “tree nodes” was used with which the coding for the underlying model can be related to. In contrast, the inductive or data-driven approach is not based on any preconditions about what analytical framework might be appropriate, i.e. text passages that proved to be relevant are coded in NVivo as “free notes”. This method has a more explorative nature and serves the purpose of exploiting the interviews’ heuristic potential as much as possible, as well as to uncover relationships not present in current research. Based on the results of previous empirical studies and the research gap derived above, we combined both approaches, thus starting with concepts identified in the literature and subsequently adding concepts that were highlighted by the respondents. All in all, 27 codes were used:

- (1) biculturalism;
- (2) communication media (electronic/personal);
- (3) communication style;
- (4) coordination;
- (5) competitive advantage;
- (6) cultural diversity;
- (7) customer orientation;
- (8) functional composition (homogeneous/interdisciplinary);
- (9) international experience;
- (10) intercultural training;
- (11) internal role differentiation;
- (12) job satisfaction;
- (13) job tasks;
- (14) learning;
- (15) language skills;
- (16) language training;
- (17) length of teamwork;
- (18) levels of application (top-management/lower hierarchical level);
- (19) motives of creation (active/reactive);
- (20) private relationships;
- (21) relationship to other organizational units;
- (22) selection of team members;
- (23) team language;
- (24) team leadership;
- (25) team spirit;
- (26) teamwork (continuing/temporary); and
- (27) teamwork (real/virtual).

Data analysis

We conducted a network analysis to identify multidimensional cause-effect-relationships between the concepts that were regarded as important. Networks consist of numerous concepts that are connected through different relationships. Concepts are basic units (nodes or entities) of a network, which do not have any meaning when not related to the other concepts. Graphically, these concepts are shown in a circle. The relevance of a concept, i.e. the frequency with which it was mentioned by the respondents, is represented through the thickness of the circle.

Concepts are connected to one another through relationships (connections) shown graphically as arrows. In order to derive the relationships between constructs in the interview texts, we searched for key words (e.g. because, as, that is why, therefore,

cause, leads to, results in) as well as further clues that would suggest possible connections.

Concepts that refer to other concepts are called anterior and are symbolized through an outward arrow. Concepts with are referred to by other concepts are know as posterior and are displayed with an inward arrow. In regards to the relationship strength, one can differentiate between strong and weak relationships. The strength of relationships, measured as the number of identified connections between two concepts, is shown graphically through the thickness of the arrow. Additionally, a numerical value is also given next to the arrow. All evaluations were registered in three relationship matrices (one for each organization) with the help of the software program UCINET. This program allows for both a graphical and a statistical analysis of network data (Borgatti *et al.*, 2002).

It should be stressed that the network approach in this study is not used to analyze global teams, but as a method to analyze texts about global teams. For that reason, no conclusions can be made from the network analysis about the subject “global teams” (content level), rather they can only be derived from the respondents’ reflections upon them (meta-level).

Results

Graphical analysis

In a first step, we converted the constructed relationship matrices into graphical illustrations, which allow a compressed and descriptive overview about the relationships between different concepts. In order to deliver a relatively clear graphical illustration of the constructed relationships, it is necessary to determine a cut-off criterion. This indicates how often one relationship between two constructs has to be listed in order to be included in the graph. Through this, constructs that were largely isolated from other constructs and those which were rated as having a relatively low relevance by the respondents were excluded from further observation. According to Carley (1997), the determination of the cut-off criteria is arbitrary i.e. it is up to the researcher to determine at which intensity the relationship will be seen as relevant. Carley suggests choosing the average strength of all relationships between the observed constructs as the boundary value. This value was 1.68 in the example of EADS, 2.09 for Star Alliance, and 1.36 for Volvo, so that in total, a cut-off value of two results. The graphical illustrations that were constructed in this way can be seen in Figures 1-3.

One of the most striking results for EADS is the weak unidirectional relationship between the two concepts “functional composition (interdisciplinary)” and “coordination” that show no relationship to the other constructs in the main network (Figure 1). Additionally, the EADS network is characterized by a relatively large number of constructs compared to Star Alliance and Volvo, which in turn, show many relationships to each other. This holds true particularly for the constructs “cultural diversity”, “language skills” and “selection of team members”. Thus, the number of multiple relationships between the constructs is high. The strength of these relationships does not show any large difference, meaning the arrows between the constructs have all about the same thickness. From that, one can derive the conclusion that global teams at EADS are a complex system of a number of determinants that are linked together and that all have about the same relevance.

Figure 1.
Graphical analysis of
global teams at EADS

Figure 2.
Graphical analysis of
global teams at Star
Alliance

When observing the Star Alliance network, it is obvious that it consists of two sub-networks that are connected through the “learning” construct (Figure 2). It is however noteworthy that although this construct takes on a central position inside of the network, it does not show many relationships to other constructs. The learning effects are generated through the “cultural diversity” of the team members as well as “personal communication” with one another. In turn, closely related to this is the “communication style” and the “relationships to other organizational units”. The latter

Figure 3.
Graphical analysis of
global teams at Volvo

especially contributes to the assumption that team processes also lead to competitive advantages. Similar to EADS, this construct is, however, only loosely integrated into the network.

Analogously to the example of EADS, where a connection between virtual teamwork in global teams and the use of electronic communication media was revealed, at Star Alliance, a relationship between the real and ongoing actual team work and the use of personal communication media is present. At Volvo, these two constructs are connected to another through the global teams' job tasks. With that, a reciprocal relationship exists between the form of teamwork and the dominating communication medium. The other relevant constructs are only weakly integrated into the network.

Volvo's network is characterized by the fewest number of constructs and relationships (Figure 3). The individual constructs also show – roughly compared to EADS – very few multiple relationships. The cultural heterogeneity of the team members takes a central position and refers to the “learning” and “job satisfaction”. Similar to the other two cases, the efficiency criteria of global teams (learning, job satisfaction) are only weakly integrated into the network.

Furthermore, the cultural heterogeneity is directly connected with the communication style and indirectly connected with further aspects of communication such as communication media and team members' language knowledge. From that, the conclusion can be derived that global teams at Volvo are constructed as a specific form of interaction between employees with different cultural backgrounds.

Last, a striking feature of global teams at Volvo is that “job tasks” and “intercultural training” are two relevant constructs, which do not appear in the networks of EADS or Star Alliance. The relevance of intercultural training suggests that Volvo sees this as an important instrument to increase team efficiency. A possible explanation for this is that Volvo has the longest experience with global teams and for that reason, its employees are purposefully prepared for the teamwork. Another explanation is that Volvo is located in a small home country and, as a result, has a larger empathy for cultural differences and their handling through intercultural training (for this argument see Hofstede, 2001, p. 294).

Statistical analysis

In addition to the graphical illustration, statistical methods of network analysis were applied. Descriptive statistics of global teams in the three organizations are presented in Table III.

As already pointed out in the graphical analysis, EADS presents the most constructs and relationships. However, the average strength of the relationships is low. Star Alliance shows not only the largest average and maximum relationship strength, but also the largest variance. Volvo exhibits the lowest values in all dimensions.

Table III also reveals that global teams at EADS are constructed as a complex combination of various determinants (three constructs = 16, three relationships = 21), which all have approximately the same relevance (σ relationship strength = 1.56). In contrast, at Star Alliance, cultural heterogeneity, learning, and personal communication are clearly given priority (minimal relationship strength = 2, maximal relationship strength = 9). At Volvo, global teams are characterized by a low number of determinants (three constructs = 11), which show approximately the same, although weak, relationship to each other (0 relationship strength = 2.23, σ relationship strength = 0.44).

In addition to descriptive statistics, the taxonomy of network characteristics from Carley (1997) was applied for further analysis. It distinguishes between three main dimensions of networks that can generally be further specified and can describe the relationship of one concept to other concepts in the network.

The density of a concept describes the number of other concepts with which it is related to. Thus, one can differentiate between anterior positions, by which the concept refers to other concepts, and posterior positions, by which other concepts relate to the concept. Graphically, the density is illustrated by the number of arrows outgoing from a concept (anterior positions) and the ingoing arrows (posterior positions) to a concept.

Table III.
Descriptive statistics of
the constructed networks

Parameters of network analysis	EADS	Star Alliance	Volvo
3 Constructs	16	13	11
3 Relationships	21	17	14
3 Relationship strengths	55	57	29
0 Relationship strength	2.62	3.35	2.23
Minimum relationship strength	2	2	2
Maximum relationship strength	4	9	3
σ Relationship strength	1.56	2.29	0.44

The theoretical maximum is $2^*(n - 1)$, the maximum number of anterior and posterior positions both amount to $n - 1$.

The conductivity is comprised of the number of two-step paths through a concept. It is operationalized as the product of anterior and posterior positions of a concept and can have $(n - 1)^2$ as theoretical maximum.

The intensity is the strength of direct relationships of one concept to other concepts. It is measured as the fraction of relationships that contain a concept in either the anterior or the posterior position with greater than average strength. The theoretical maximum for this dimension is 1.

Concepts that are high in density gain their importance through the value of other concepts to which they are attached. Highly dense concepts are likely to be used often. The relevance of concepts with high conductivity results from their ability to connect other concepts together, which would have otherwise remained separated, thus having a bridge function. Concepts with high intensity obtain their relevance through the degree to which there is social consensus over their relations to other concepts. Accordingly, they reveal a great amount of social embeddedness.

The combination of these three dimensions results in a taxonomy of concepts with eight ideal types, which all have different embedded meaning (Carley, 1997).

Ordinary concepts are low on all three dimensions. They are largely isolated from the other network concepts and for these purposes, not relevant.

Prototypes are high in density, but low in conductivity and intensity. Although they do have a large amount of connections and for that reason, take on a central position in the network their relevance for the entire network is low as they do not connect concepts nor are they socially embedded.

Buzzwords are high in conductivity but low in density and intensity. They are used frequently to describe a particular aspect, but they have a relatively low importance for the entire network because no social consensus exists about their specific meaning. Buzzwords often result from the belief that a certain concept has great importance without exactly specifying this importance. Generally, buzzwords have a short lifespan.

Factoids are concepts that are high in intensity but low in density and conductivity. They are likely to be socially embedded and are mainly used to define other concepts without being useful themselves. Examples for this are years with which people can associate a lot with such as, for Germany, 1945 or 1989.

Placeholders are high in density and conductivity but low in intensity. They are often used and result from a social consensus that they have great importance without, however, defining what importance that is. Their meaning is for that reason to a large extent negotiable.

Stereotypes possess a high density and intensity, but only a marginal conductivity. They are based upon a large social consensus and for that reason, can only be changed very slowly.

Emblems represent concepts with high conductivity and intensity but low density. They possess the ability to be identified quickly and for that reason, are frequently used. Their meaning is however, very narrowly defined.

Symbols are high in all three dimensions and represent the opposite of ordinary concepts. They tend to have great social embeddedness, great relevance, as well as a distinct meaning.

On the basis of these considerations, a taxonomy for all underlying constructs was developed (Table IV). As with the graphical illustration, a cut-off value of two was chosen, meaning only those concepts that were connected with other concepts at least twice were included. For a better overview, the absolute frequency of occurrences is listed with the individual concepts.

Table IV shows that a large number of ordinary concepts, stereotypes, and emblems are found in each of the three cases. At EADS, for example, “functional composition (interdisciplinary)”, “private relationships”, and “teamwork (virtual)” are all parts of the ordinary concepts. Also at Star Alliance, this applies to “team language”. These concepts are characterized by the fact that they are low on all three dimensions and thus, they are barely linked to other concepts. The respondents mentioned these concepts often without, however, having any relationship to the other determinants of global teams in their minds.

The concepts that fall in the category of stereotypes show a high density and intensity, but only a marginal conductivity. What is striking is that “cultural diversity” falls into this category in all three cases. Because stereotypes rely on a strong social consensus and can only be changed very slowly, this shows that cultural diversity proved to be a central determinant of global teams. The conductivity of this construct, however, is pretty low, meaning that it is hardly able to connect other constructs together. The reason for this is that this construct possesses an anterior position to other concepts in all relationships. This can be interpreted to mean that cultural diversity is seen as a very important requirement for global teams. However, it does not influence the team itself and is more influenced by the selection of team members. Hence, global teams are more of a reactive result of the increasing cultural heterogeneity of organizations while little is done to actively increase the cultural diversity in order to be able to take advantage of the benefits of global teams.

In the emblem category, we find most notably constructs that show a reference to communication in global teams. This holds true in all three cases for the communication style. Emblems can be identified quickly and for that reason, they are used quite often. Given their high conductivity, they are also important causes and effects of other concepts. Thus, the different aspects of communication can be understood as being intervening and moderating variables, which do not have a great importance for the realization of the goals associated with global teams alone, however, they influence or strengthen the effects of other factors.

Global teams’ efficiency criteria (learning, coordination, competitive advantages, and job satisfaction) are either ordinary concepts or buzzwords in all three cases. They are mentioned by the respondents often without really defining their meaning. Graphically, this feature is demonstrated by these constructs taking on a predominately posterior position to other constructs. This can be interpreted as the notion that global teams – as expected – have positive outcomes without, however, deriving further implications from it. For example, little is done to evaluate these outcomes or to actively increase them.

In a final step, we changed the level of analysis from the individual concepts to the entire network profiles. For this, the values of the three dimensions of density, conductivity, and intensity for every concept are determined and then added together. Hence, the density of one network yields the frequencies of all network concepts arithmetically. The conductivity and intensity are calculated in a similar way. Table V presents the network profiles constructed in this way for EADS, Star Alliance, and Volvo.

Type of concept	EADS	Star Alliance	Volvo
	<i>n</i>	<i>n</i>	<i>n</i>
<i>Ordinary concepts</i>			
Density: low	Functional composition (interdisciplinary)	Team language	Job satisfaction
Conductivity: low	Coordination	Competitive advantage	Learning
Intensity: low	Private relationship		
	Competitive advantage		
	Teamwork (virtual)		
<i>Prototypes</i>			
Density: high	Job tasks	International experience	Job tasks
Conductivity: low		Biculturalism	
Intensity: low			
<i>Buzzwords</i>			
Density: low	Functional composition (homogeneous)	Selection of team members	Intercultural training
Conductivity: high		Learning	
Intensity: low		Team spirit	
<i>Factoids</i>			
Density: low	Team language		
Conductivity: low			
Intensity: high			
<i>Place holders</i>			
Density: high			
Conductivity: high			
Intensity: low			
<i>Stereotypes</i>			
Density: high	International experience	Relationships to other organizational units	Cultural diversity
Conductivity: low	Cultural diversity	Communication media (personal)	Language knowledge
Intensity: high		Cultural diversity	Teamwork (real)
<i>Emblems</i>			
Density: low	Communication media (electronic)	Teamwork (continuing)	Selection of team members
Conductivity: high	Communication style	Communication style	Communication media (personal)
Intensity: high	Customer orientation	Language knowledge	Communication style
	Language training		
<i>Symbols</i>			
Density: high	Selection of team members	Teamwork (real)	
Conductivity: high	Language skills		
Intensity: high			

Table IV.
Taxonomy of global teams at EADS, Star Alliance and Volvo

Table V.
Network profiles of
global teams at EADS,
Star Alliance, and Volvo

	Mean	Standard deviation	Actual maximum	Theoretical maximum	Mean in % of theoretical maximum
<i>EADS</i>					
Density	2.63	1.31	5	30	8.53
Conductivity	1.25	1.73	6	225	0.50
Intensity	0.56	0.51	1	1	0.56
<i>Star Alliance</i>					
Density	2.62	1.04	4	24	11.21
Conductivity	1.00	1.41	4	144	0.80
Intensity	0.62	0.51	1	1	0.62
<i>Volvo</i>					
Density	2.55	1.03	4	20	13.20
Conductivity	0.82	1.17	3	100	0.82
Intensity	0.55	0.52	1	1	0.66

Table V reveals that the mean of the three network dimensions only differs marginally between the three cases. Noticeable differences are solely evident for conductivity. EADS in particular has many concepts of global teams that act as bridges to other concepts, whereas at Volvo, many concepts display either only anterior or only posterior relationships. Hence, the statistical analysis confirms the results from the graphical illustrations that global teams at EADS are constructed as a complex combination of a variety of determinants. In contrast, the complexity of connections at Volvo is rather low and the individual constructs show hardly any bidirectional connections to other concepts. In this regard, Star Alliance takes on more of a middle position.

At EADS, network density as well as conductivity reveals notably higher standard deviations as with Star Alliance or Volvo. From that, we can draw the conclusion that at EADS, there are some determinants of global teams that are relatively tightly intertwined with others, while other determinants only show loose relationships to one another. In contrast, these differences between determinants that were strongly and less strongly linked to each other are considerably less present at Volvo.

When comparing the actual and the theoretical maximum, Volvo demonstrates the highest value[1]. Star Alliance has about the same values for conductivity and intensity, while the values for relative density and conductivity at EADS only make up about two-thirds of the values from Volvo. For that, the conclusion can be derived that global teams at EADS are constructed as a complex combination of various determinants; however, the connections between them are noticeably weaker as with those in the other cases. While the network at Volvo in particular shows a relatively high density – meaning the individual determinants of global teams are tightly linked together – this is characterized by a larger number of relevant determinants at EADS that only have a relatively loose coupling to one another.

Contributions, limitations and implications for future studies

The aim of this article was to investigate the relationship between the various determinants of global teams and their impact on team efficiency. In a first step, the

existing empirical studies of global teams were critically analyzed. Based on the identified research gap, a network study of nine global teams in the automotive and airline industries was conducted. The software programs NVivo and UCINET were applied to analyze the relationships between various team characteristics and their impact on team efficiency.

A main contribution of the study is the finding that the relationship between team characteristics and team performance is more complex than most previous suggested. For example, our analysis shows that the interaction of team members from different cultures does not directly impact the productivity and creativity of teams. This relationship is rather influenced by various determinants such as task complexity, language skills, communication media, and intercultural training.

The study also shows that global teams have different aims and thus require different compositions in different organizational settings. Depending on whether creative tasks, the reflection of diverse customer demands, or rather the coordination of different organizational units is the main objective, different factors are becoming important. For example, our study shows that organizational learning and customer orientation are associated with cultural diversity and communication, while for coordination tasks the functional composition of global teams is more relevant. Thus, an important implication for managers is to adjust the configuration of global teams to the particular objectives.

Another important result of the study is that it clearly shows the pivotal role of communication media and language skills. For the success of global teams, it would be necessary to focus on these important determinants which have been rarely analyzed in existing studies. When the members of global teams are not able to communicate effectively, positive outcomes of teamwork can hardly be expected. This aspect becomes the more important, the more creative the tasks of global teams are and the more diverse their cultural composition is.

Several methodological implications can be derived from the study as well. First, it has been revealed that through a qualitative research approach with real global teams, considerable additional knowledge could be generated. The analysis of real teams enables a far more realistic picture as previous experimental studies conducted in this area, which deal with simulated teams whose members do not have a shared past nor a shared future. In contrast to previous studies with students, managers were surveyed who work together under time and economic constraints and may thus, have a different view of global teams. In particular, the present study presents a more realistic picture of the long-term aspects of global teams such as team spirit and intercultural learning.

Another important methodical contribution of this study is that, in contrast to former qualitative studies in this field, it is not restricted to an analysis of quotations. Rather, it relies on more sophisticated methods of data analysis. In particular, a network approach was applied for the analysis of complex relationships between different determinants of global teams. This approach enables for a presentation of qualitative and unstructured data in a compressed form and thus, overcomes the deficit of previous qualitative studies. In the future, the further development of the methods used here could contribute to dispelling the frequently expressed reservations about qualitative research and to increasing the chance of them being published in renowned academic journals.

The use of the NVivo software program further increased the reliability of this study. The computer-aided text analysis enabled us to systematically analyze large amounts of data and reduced the risk of mistakes through convenient search and comparison functions (e.g. the oversight of relevant text passages). Furthermore, NVivo structures the research process, in that the program provides standardized analysis procedures.

Some limitations have to be taken into account when interpreting and generalizing the study's results. One restriction of this study is its point-in-time-based observation. A longitudinal study would particularly enable an investigation of the dynamic aspects of global teams such as learning effects, the impact of management interventions or changes in team composition. Additionally, the outcomes of global teams over time could be studied in more depth.

Another restriction of this study is its Eurocentricity, meaning its regional concentration on teams with members from European cultures. Especially Asian cultures are underrepresented in the observed teams. Although many global teams at Star Alliance also have members from Japan, Singapore, South Korea, Thailand, members from the emerging markets China and India are not represented in our study. This is insofar an important restriction, as the attitudes and the behavior of individuals from Asian countries differ remarkably from those in Western countries (e.g. Hofstede, 2001).

Compared to previous studies that show a strong North American bias, this study, however, has two particular advantages. First, the North American perspective is complemented with a European dimension and thus, it expands the knowledge of global teams. Second, members from Asian cultures are represented in the observed teams at least to a minor degree. Future research should broaden this perspective and focus on global teams with a more diverse composition in terms of culture. For example, it would be interesting to know whether for global teams in Asia, South America, or Africa, similar or different determinants are relevant.

Note

1. Because the observed networks do not reveal exactly definable features and borders, unlike employee or capital networks, the absolute values are largely influenced by the research methods. In order to interpret the network profile, one can then only draw upon the relations between the three cases, because these were acquired with the same research methods.

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Appendix. Interview guide

1. Personal information

- 1.1 Name.
- 1.2 Age.
- 1.3 Sex.
- 1.4 Position.

- 1.5 Home country.
- 1.6 Language skills.
- 1.7 Foreign assignments (longer than six months).

2. *Functional areas and hierarchical levels*

- 2.1 On which functional areas is your team established?
- 2.2 On which hierarchical level is your team established?

3. *Aims*

- 3.1 Which aims does your team have?

4. *Tasks*

- 4.1 What are the tasks of the team you work in?
- 4.2 How are tasks and responsibilities divided between the team members?

5. *Structure and members*

- 5.1 How many members does your team have?
- 5.2 How is the cultural composition of your team?
- 5.3 How were these members selected?
- 5.4 Which role did intercultural differences play when the team members were selected?
- 5.5 Which cultural differences exist between the team members?

6. *Length and continuity of team existence*

- 6.1 How long does this team exist?
- 6.2 Was this team established for an indefinite period of time or does it only temporarily exist?

7. *Relationships to the top-management and to other organizational units*

- 7.1 How would you describe the relationships to the top-management and to other organizational units?

8. *Team language*

- 8.1 In which language do you communicate with other team-members?
- 8.2 Do you think that different knowledge of team language affects team performance, and if yes, how?
- 8.3 In team meetings, do the team members equally contribute to discussions or are these dominated by certain members?
- 8.4 Does the culture of a team member or his/her command of language impacts his/her contribution to discussions in team meetings?
- 8.5 Are there any incentives to learn the mother languages of other team members?

9. *Communication*

- 9.1 Which media to you use particularly when you communicate with other team members?
- 9.2 Do you have regular personal contacts to other team members or do you communicate with them above all in a virtual way?

10. *Intercultural training*

- 10.1 Have you and the other team members been trained systematically to work together with individuals from other cultures?
- 10.2 How do you assess the role of intercultural training for the success of your team?

11. *Team efficiency*

- 11.1 How do you assess the efficiency of your team?
- 11.2 How do cultural differences between the team members impact team efficiency?
- 11.3 Is this impact more positive or more negative? Can you give examples for this?

12. *Miscellaneous*

- 12.1 Is there anything else you would like to add?

About the authors

Nicola Berg (PhD and habilitation, University of Dortmund) is Professor of Strategic Management at the University of Hamburg. Her research interests include international management, human resource management and public affairs management. She has published several articles in refereed journals such as *International Business Review*, *Journal of Business Ethics*, *Journal of East European Management Studies* and *Management International Review*, among others. Nicola Berg is the corresponding author and can be contacted at: nicola.berg@uni-hamburg.de

Dirk Holtbrügge (PhD and habilitation, University of Dortmund) is Professor of International Management at the University of Erlangen-Nuremberg, Germany. His research interests include international management, human resource management, and management in Asia and Eastern Europe. He has published eight books and more than 70 articles in refereed journals such as *Journal of International Business Studies*, *Academy of Management Learning & Education*, *European Management Journal*, *International Business Review*, *Journal of Business Ethics*, *Journal of International Management* and *Management International Review*, among others. He serves as a member of the editorial board of *Management International Review*.