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Network Embeddedness and Public Agency Performance: The Strength of Strong Ties in Dutch Higher Education

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ABSTRACT

Current research in public management reports a positive effect of agency network activity in the interorganizational network on its performance (degree centrality hypothesis). This study presents a different hypothesis: The embeddedness of agency network relations in cohesive subgroups in the interorganizational network positively affects its performance ("cohesive subgroup" hypothesis). The dependent variable in the present study is organizational performance and measured in terms of individual client satisfaction. The hypotheses are tested using data on the interorganizational network of Dutch colleges for the training of primary education teachers (n = 28). These data are combined with college-level performance and contextual data for 2002–2005 (n = 90), and with the evaluations of college graduates in a large sample of graduates for the same period (n = 7,119). Multilevel logistic regression analyses show that colleges' cohesive subgroup membership rather than college degree centrality significantly contributes to a positive evaluation by graduates. These analyses control for various control variables at the college level and the graduate level.

INTRODUCTION

Research in public management shows that interorganizational networks are important determinants of the performance of public agencies and policies (Agranoff and McGuire 2003; Bardach 1998; O'Toole 1997). The body of research on interorganizational networks is growing rapidly (Klijn and Koppenjan 2000), and studies of agency

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performance (Rethemeyer and Hatmaker 2007) as well as network performance (Knoke et al. 1996; Provan, Fish, and Sydow 2007) have become available. Recent empirical studies on agency performance report that the *network activity* of public agencies explains organizational performance (Andrews et al. 2005; Nicholson-Crotty and O'Toole 2004; O'Toole and Meier 2004). For example, analyses of the "Texas public school district data" consistently reveal significant positive effects of the network activity of directors of Texas school districts on various indicators of performance of their district, such as pass rates and dropout rates (O'Toole and Meier 2004).[1] Effects of organizational network activity are also reported for firm performance, measured by increased survival rates, economic output, and innovativeness (Powell and Smith-Doerr 2005; Zaheer, McEvily, and Perrone 1998).

In an interorganizational network, network activity is captured by the concept of *degree centrality*: The most active agencies are those who have the most network ties to other agencies in the network (Wasserman and Faust 1994, 178). The present article analyzes how an agency's network activity—in terms of degree centrality—affects its performance. On the basis of current research in public administration and organizational sociology, the article argues that agencies with a high degree centrality in the interorganizational network have ample access to resources and a potential for learning and cooperation. Access to resources and information enables agencies to exploit their environment and buffer environmental shocks—such as changes in political, economic, and technical demands (Meier and O'Toole 2003; O'Toole 1997). Consequently, agencies with high levels of network activity are expected to perform better.

Subsequently, the present article proposes an additional (or further) network effect on agency performance: that of the *embeddedness* of agency relations in the interorganizational network (Granovetter 1985). In terms of network analysis, network embeddedness is captured by the concept of organizational membership of a cohesive subgroup. The most embedded agencies are those who are a member of a cohesive subgroup of agencies in the network, all tied together by strong relations (Wasserman and Faust 1994, 251–2). The article argues that cohesive subgroup membership in the network positively affects performance (Borgatti and Foster 2003; Brass et al. 2004).[2] The mechanism of network embeddedness is different from the mechanism of network activity: An agency's access to more, and more diverse, resources (as expressed by degree centrality) is neither necessary nor sufficient for it to perform well. In order for an agency to perform well, resources must be delivered with the quality agreed upon. The likelihood that resources are delivered to an agency with the quality agreed upon is greatly enhanced by the building of interagency trust. The building of mutual trust is promoted by strong and cohesive relations in subgroups in the interorganizational network (Provan and Sebastian 1998; Schneider et al. 2003). In strong and cohesive subgroups, information about the (noncompliant) behavior of an agency comes readily available to all agencies, which affects the agency's reputation, and its potential benefits from future cooperation (Raub and Weesie 1990).

1 Studies at the level of the *network* report that the structure of network relations explains performance of the network in terms of the aggregate post hoc satisfaction of network members (Klijn and Koppenjan 2000), or in terms of policy effectiveness and problem-solving capacity (Provan and Milward 1995, 2001; Provan and Kenis 2008).

2 By taking cohesive subgroups, we focus on both "relational" embeddedness (referring to the strength or quality of relations) and "structural" embeddedness (referring to the pattern of relations in the network). See Granovetter (1992).

An important aim of the present article concerns the dependent variable: to analyze agency performance at the level of the *client population*. Most studies define performance indicators at the organizational level, often developed to quantify the monitoring and control of agencies (Boyne 2006). Examples of performance indicators at the level of the organization are the number of criminals arrested as a performance measure for police departments, or dropout rates as a performance measure for schools (Propper and Wilson 2003). However, public agencies deliver services at the individual level and need to satisfy the demands of clients. Provan and Milward (1995) argue that client satisfaction is a more appropriate performance measure because public agencies are much less driven by profit-maximizing incentives than firms.

Finally, the present article applies *multilevel analysis*, which is the proper statistical design to account for simultaneous variation at the level of the public agency and the level of individual clients. Because data must be available with a relatively large number of cases at each level, scholars in public administration seldom apply multilevel analysis and focus instead on performance measures at the organizational level (Brewer and Selden 2000). However, if we do not analyze organizational and client-level variation simultaneously, it is not possible to validly estimate the effects of variables at the agency level and at the client level. An additional advantage of multilevel analysis is that we are able to control for selection effects at the level of the client. Although it is not immediately obvious whether more innately talented graduates would evaluate their college more positively or more negatively than their less talented peers, it is important to be able to control for this.

For the present study, we compiled a unique data set that provides enough statistical power to apply a multilevel design to study organizational network effects on the satisfaction of clients of public agencies with the services provided. Data were collected in the field of Dutch higher education: the interorganizational affiliation network of 28 Dutch primary education teacher training colleges. We selected this sector for two main reasons. First, the student population is relatively large. Secondly, the training program is largely standardized for all the colleges, so that the content of the educational programs offered is held more or less constant. Performance was measured as the satisfaction of a large number of graduates ($n = 7{,}119$) with their study program for four cohorts in the period 2002–2005. In order to assess how the colleges are embedded in the affiliation network, data were collected on the network relations between *all* network members. This is seldom done in the field of public administration, where the standard approach is to measure the "ego networks" of agencies (e.g., Agranoff and McGuire 2003; O'Toole and Meier 2004) partly because of the difficulty of obtaining data on complete interorganizational networks. On the basis of these data, the article demonstrates that an empirical link exists between graduate satisfaction and the embeddedness of their colleges in the interorganizational network. An exploration of all potential mediating and moderating mechanisms that may explain this link—such as teacher motivation or the design of study programs—is beyond the scope of the present article.

RESEARCH CONTEXT: COLLEGES FOR PRIMARY EDUCATION TEACHER TRAINING

The object of the study in the present article is the network of 28 primary education teacher training colleges in the Netherlands (in Dutch: *Pedagogische Academie Basisonderwijs* or PABO). These colleges form part of the Dutch system of universities of applied sciences

(HBO), which offers more applied studies as compared to the research-oriented system of Dutch universities.[3] PABOs typically prepare students for a bachelors degree—although recently two inter-college masters programs have been established. Within the universities of applied sciences, these colleges offer a specific, 4-year bachelor program to train teachers in primary education. They are the largest colleges within the system of universities of applied sciences in the Netherlands (in 2006 total enrollment amounted to 35,000 students). A PABO can be either part of a larger multisectoral general university of applied sciences or constitute a single monosectoral college by itself. There are 20 multisectoral and eight monosectoral colleges in the Netherlands. In contrast to the large general multisectoral colleges (in 2006 enrollment ranged between 1,500 and 40,000), the monosectoral colleges are relatively small (in 2006 enrollment ranged between 500 and 1,500 students). Differences in size between the PABOs themselves are less pronounced. Due to the particular history of Dutch education, colleges can be public, catholic, or protestant, and this still plays a role in the identity of the college and its training program.

Because the average PABO is dependent on the central government for about 65% of its funding, the most important external partner for these organizations is the Ministry of Education, Science and Culture. Funding is based primarily on total student enrollment but also includes a "dynamic demand factor," which incorporates performance measures such as dropout rates in the previous year and enrollment in the present year (Kaiser, Vossensteyn, and Koelman 2001). Thus, these colleges have to compete for students and resources. However, the colleges also have common interests. For example, the reputation of the whole sector was damaged when heated political debate and media attention focused on the poor math and language skills of PABO students. The Minister of Education, Science and Culture personally intervened in their programs. The PABOs are not only embedded in their sector but also in local networks. These networks include the local authority, (boards of) local primary schools, and local regulatory agencies.

The interorganizational network of the colleges for primary school teacher training is characterized by (1) participation in institutions or associations and (2) informal, bilateral relationships between their directors and managers. The focus of the present article is on the first aspect (cf. Kraatz 1998). The most important formal institution is the "Netherlands Association of Universities of Applied Sciences" or *HBO-raad*.[4] The HBO-raad has one central board of directors and two different advisory boards: a general advisory board for all universities of applied sciences, and a specific advisory board for the PABOs. Participation of colleges in the general advisory board comprises *direct participation* by directors of monosectoral colleges and *representation* of PABOs within general multisectoral colleges by a college board member. The HBO-raad is also

3 Whereas the Dutch system of higher education in general is believed to have shifted from bureaucratic control to a networked system (De Boer, Enders, and Leisyte 2007), the specific sector of primary education teacher training still is subjected to strong regulatory control by parliament, ministers, and the Department of Education. Currently, major reforms are being implemented in Dutch higher education. These reforms are the result of the Bologna Declaration of 1999, promoting Europe-wide student mobility, access to higher education, and comparability of degrees. The Bologna Declaration led to the introduction of bachelors, masters, and doctorate degrees in Dutch higher education. The universities of applied sciences seized the opportunity to develop masters programs in addition to their 4-year bachelors programs.

4 This council could be described as a "network administrative organization" (Provan and Kenis 2008) because it coordinates activities between universities of applied sciences and is the primary lobby institution for the sector.

responsible for special committees, which monitor the implementation of government regulations into the training programs, and in which some of the colleges are involved. In addition to the HBO-raad, other institutions have developed in the past. For example, all college managers meet in a consultation platform to discuss operational matters. This platform has grown into a lobby network alternative to the PABO board of the HBO-raad. Within the sector, two cooperation networks of smaller colleges emerged. In addition, two inter-college masters programs have been developed in which a subset of the colleges collaborate. In each of these affiliations, PABOs develop common policies, set the agenda for specific problems, and exchange vital information about standards, program innovations, and resources. The joint activities and information exchange have spin-off for the internal organization, and affect the cross-fertilization of information and resources across different colleges.

THEORETICAL BACKGROUND

Degree Centrality and College Performance

The public management literature stresses that the network activity of public agencies enhances their performance. Systematic empirical evidence, however, is relatively scarce (Boyne et al. 2006). A seminal work in this field is the model of Meier and O'Toole, which relates different types of management activities of agencies to their performance (Meier and O'Toole 2003; O'Toole and Meier 2004). In the Meier-O'Toole model, agency performance is determined by the agency's past performance, its environment, and network management. The environment represents structural opportunities (e.g., funding possibilities) and constraints (e.g., a high proportion of students from poor families) an actor faces. In the model, the agency's ability to yield a surplus value from environmental forces is a function of "network management." Two types of network management are distinguished: (1) management that exploits resources in the agency's environment and (2) management that buffers environmental shocks, such as political, economic, and technical demands (O'Toole 1997).

Meier and O'Toole test different variants of their model on the performance of Texas school districts. In the empirical application to the Texas school districts, network management is defined in terms of network activity. District superintendents are asked to indicate how frequently they interact with different categories of actors, such as school board members, the Texas education agency, other superintendents, state legislators, or local business leaders (Meier and O'Toole 2003, 692). In social network analysis, these are so-called ego-centered network data. Meier and O'Toole (2003, 692) report that network activity highly correlates across the different categories of actors, distinguishing the less active from the more active managers. Many different tests of the model on the Texas school district data consistently show positive effects of network activity of superintendents on the performance of their district—conditional upon a certain degree of homogeneity of resources and environmental stability (O'Toole and Meier 2004).

The present article studies a complete network of PABO colleges, which is a stable interorganizational structure of public agencies voluntarily participating in formal collaborative platforms. The PABO network is a fixed set of agencies (a complete interorganizational network), in which all organizations are individually identified. For such networks,

network activity is captured by the concept of degree centrality, which is the number of network ties to other agencies in the network (Wasserman and Faust 1994, 178).[5] Isolated agencies have a degree centrality of zero, whereas the maximum possible value is $n - 1$ relations, where n is the number of agencies in the network. The concept of degree centrality is more narrow than the intensity of relations to an undefined number of actors within a broad category, for which the assumption is that higher intensity implies interaction with more actors.

PABO colleges enter the interorganizational platforms to extract resources from each other and to share vital information about their environment, for example, about accreditation, fund raising, learning practices, or other methodical expertise. In addition, the PABO colleges coordinate lobby activities and develop joint programs, such as master programs. Thus, for PABOs, network activity has the same implication as for Texas school districts. It yields a surplus value from organizational and environmental resources. High levels of activity in the interorganizational network provide a PABO with access to many other PABOs—and hence to more, and more diverse, resources and information. Consequently, PABOs learn and make use of new educational practices, technologies, and management innovations (Brass et al. 2004; Kraatz 1998; Mizruchi 1994; Stuart and Podolny 1999; Tsai 2001). PABOs with high levels of degree centrality in the interorganizational network are more likely to join strategic alliances, which often have a positive effect on performance, as research in R&D shows (Powell and Brantley 1992; Powell et al. 2005). Because the exploitation of resources and information, and the buffer to environmental shocks are expected to contribute to the performance of PABOs, we specify the relation between degree centrality and performance as follows.

HYPOTHESIS 1. *College degree centrality*: The degree centrality of a college for primary teacher training (PABO) in the interorganizational college network positively affects its performance.

Cohesive Subgroups and College Performance

In interorganizational networks, the exchange of resources and information, and cooperation in joint programs and activities, is not always straightforward. Resources obtained must have some quality in order to contribute to the performance of the agency. Information must be reliable and correct in order to stimulate learning. Likewise, the commitment of agencies to cooperate in joint programs and actions—such as lobby activities—must be credible in order to yield a surplus value from the agency's environment (Coleman 1990). Investments in time (Agranoff 2007) or contracts ensure that exchanges of resources and information, and cooperation in joint programs are not frustrated by opportunistic behavior of partners (Williamson 1991).

An important mechanism to reduce transaction costs and nevertheless ensure agencies' credibility and reliability is the building of mutual trust. The existence of mutual trust between agencies reduces transaction costs and stimulates their cooperation because agencies adjust their beliefs about the likelihood that a network partner will "defect" or instead

5 In the present study we focus on degree centrality as the standard indicator for network activity in a complete network. There are other rival notions of centrality in network analysis that capture other network characteristics. For example, betweenness centrality captures the control of an actor over the interactions between other actors.

act in accordance with the agreements made. Thus, performance is expected to be better for agencies with *trustworthy* network relations (Provan and Sebastian 1998, 460).

In interorganizational networks, trust between agencies is promoted by network embeddedness and not by network activity. An agency's network relations are defined as "embedded" when they are simultaneously strong and "closed." A *strong* network relation between agencies stimulates the availability of information (Uzzi 1996) and the understanding of mutual needs and interests (Gulati 2007; Schneider et al. 2003). A *closed* network relation implies that the two agencies share a link with other agencies (Coleman 1990). In closed network, relations information about the behavior of agencies becomes available to third parties. Consequently, an agency's reputation can be easily damaged when it provides incorrect information, insufficient resources, or withdraws from cooperation (Raub and Weesie 1990). The agency's reputation affects the likelihood of receiving valuable information and resources in the future, from all parties involved in the closed subnetwork (Buskens and Raub 2002).

In the complete network of PABO colleges, the appropriate indicator for network embeddedness is *cohesive subgroup membership*. Network analysis defines a "cohesive subgroup" as a set of actors who all are strongly tied to each other by a relation with a specified strength (Wasserman and Faust 1994, 254, 277–82). Sociological studies find support for the idea that cohesive subgroup membership improves performance (Gulati 2007; Uzzi 1997), especially in relatively stable contexts (Rowley, Behrens, and Krackhardt 2000). In the field of public management research, Provan and Sebastian (1998) report that a clique of mental health service organizations with overlapping activities (which can be interpreted as an indicator of strength) positively affects client satisfaction. For the PABO colleges, we thus arrive at the following hypothesis.

HYPOTHESIS 2. *College cohesive subgroups:* Colleges for primary teacher training (PABO) that form cohesive subgroups within the interorganizational college network perform better than weakly integrated colleges or isolated colleges.

Contextual Effects

Interorganizational networks do not develop independently (Mizruchi 1994) from the broader institutional context and organizational characteristics. Peng and Luo (2000) control for industrial growth rate and firm size when analyzing effects of managerial networking on returns on assets and market shares. O'Toole and Meier (2004) identify and model contextual effects on the performance of Texas high school districts. Because we evaluate agency performance through client satisfaction, contextual factors include variables at the level of the agency as well as variables at the level of clients.

It is obvious that PABO colleges with limited access to financial means are expected to perform worse, controlling for size of the student population. Although state funding of universities of applied sciences in the Netherlands is equally distributed (Boezerooy 2003), some of the parameters that determine funding are subject to fluctuations in student enrollment or dropout rates. Some colleges also raise additional resources through contract activities. Other factors at the level of the college may also determine performance. O'Toole and Meier (2004) mention stability in personnel, mission or program stability, production process, and procedures. For the present study of colleges for training primary

school teachers, we take into account the variability in a number of college characteristics for the period 2002–2005. In the Netherlands, wages are not under direct managerial control and wage changes affect all colleges in a similar way. Consequently, we do not include them as contextual variables at the level of the colleges.

The composition of the student population also affects the performance of colleges. Most importantly, students will differ in their capabilities and motivation due to selection effects. Such selection effects should be accounted for if the dependent variable is at the individual level (which is the case in the present study). It is not immediately obvious what effect innate abilities and motivation would be likely to have on satisfaction with the chosen college. On one hand, such students might attribute achievements that are due to their own personal characteristics in part to the college, resulting in a higher level of satisfaction. On the other hand, gifted and/or motivated students may have higher expectations, and report lower levels of satisfaction for a given level of college performance. In either case, if networking colleges differ from nonnetworking colleges in their ability to attract the most intelligent and diligent students in the population, it is important to control for this.

RESEARCH DESIGN AND DATA

To test the hypotheses, we focused on the performance of colleges for the training of primary education teachers in the period between 2002 and 2005. The motivation for the selection of primary education teacher training is two-fold. First, the student population is relatively large, and thus, we can expect that the sample sizes for college year combinations is large enough to allow for statistical testing. Secondly, the training program is largely standardized for all PABOs. The selection of years was motivated by the availability of data.

We constructed one large data set from three different sources. The first data source is a number of qualitative interviews and document analyses, which—combined with some of the tools of social network analysis—enabled us to make a reconstruction of the *interorganizational PABO network* over the past years. The second data source is the management information system of the universities of applied sciences, which is publicly accessible (www.hbo-raad.nl) and provides, among others, all available facts and figures on *PABO characteristics*. The third data source is the "HBO monitor," coordinated by the Research Centre for Education and the Labour Market (ROA). This monitor is a yearly survey among a large sample of all graduates of universities of applied sciences in the Netherlands. We selected the subset of all graduates in the sample who graduated at a PABO between 2002 and 2005. The HBO monitor contains several questions about a graduate's evaluation of PABO performance. More specifically, we use *graduate satisfaction* with the PABO study program as our dependent variable and main indicator for PABO performance. The years reflect evaluations by separate groups of individual graduates, who are also nested in the PABOs. Changes over time thus refer to differences between cohorts, not changes within individuals.

In this way, we created a multilevel data set, in which graduates are nested in years (of graduation) and PABOs. In total, 28 cases are available at the highest PABO level.[6] At the

6 In total, there are 28 PABOs in the Netherlands. The data set contains 24 PABOs, of which two have multiple locations (four and two). In the analyses, these locations are treated as separate colleges.

PABO by year level, 90 cases are available.[7] At the level of individual graduates, there are 9,146 cases, of which 7,119 have no missing value on any of the variables used in our analyses. These 7,119 cases are used to test for effects of all variables at the different levels on graduate satisfaction. Obviously, our research design does not permit us to generalize beyond the sector of PABOs because this would require a comparative study of more interorganizational networks in a similar fashion.[8]

The Interorganizational PABO Network

There are many different ways to define relations in a "total" or "whole" interorganizational network. Examples are interlocks between managers, information exchange networks, task-dependency relations, trust relations, or authority relations. For the present study, we studied the network that develops from multiple "affiliations" of (representatives of) organizations. Organizations are affiliated with more or less formal institutions, cooperative networks, joint programs, and so forth. Data on the affiliations of PABOs were collected using structured interviews with in total three key informants who are experts in the domain of higher education. In addition, an extensive analysis of documents and reports was performed. We analyzed annual PABO reports, reports from the HBO-raad, accreditation reports, and minutes of meetings for indications of membership to in collaborative bodies or alliances and joint projects (for an overview of the methodology used, see Marsden 2005; Torenvlied and van Schuur 1994). Informants were selected on the basis of their long experience in the PABO field and complementary competences (in policy making, management, and inter-PABO collaborative bodies). One informant has been director of a large PABO college for more than 15 years and involved in top managerial activities in the field. Two informants are management assistants to a collaborative body. Two interviews were held face to face and one by telephone. All interviews were held in February 2008 and lasted for over 2 h. We cross-validated the information of all sources to rule out potential retrospective biases (Torenvlied 2000). The informants were asked which affiliations existed in which at least two PABOs cooperated at the managerial level on either policy formulation or joint program development.

It appears that in the Netherlands, colleges for training primary education teachers participate in eight different affiliations. These include three formal institutions (three subcouncils of the HBO-raad), a platform for smaller colleges, two cooperative networks of smaller PABOs, and two inter-PABO masters programs.[9] In six of these affiliations, multiple PABO colleges participate, indicating joint affiliation. We assigned a PABO to an affiliation only if it is directly represented in the affiliation by a director or board member of the PABO.

7 Potentially, $28 \times 4 = 112$ cases are available, but the sample of graduates is empty for some PABO year combinations.

8 It is the ambition of the authors to make a comparative study of a large number of interorganizational networks using a similar multilevel approach. The present article is a first step in that direction.

9 The full names are as follows: the HBO General Council, the HBO sectoral advisory committee for the educational sector, an HBO steering committee for the educational policy agenda and monitoring of the quality of study programs, the so-called "Ede-Beraad," "Interactum," and "ZEG" (Zwolle, Ede, Gouda), and development of master's programs "Magistrum" and "Octaaf."

Under the assumption that organizations have stronger (cooperative) relations if their representatives meet more often, we collapsed the $N \times A$ affiliation matrix into an $N \times N$ network matrix, with the number of mutual affiliations as entries. We used UCINET (Borgatti, Everett, and Freeman 1999) to perform these operations. The interorganizational network relations are valued, indicating the strength of the tie in the affiliation network (by the number of mutual affiliations). From the network, we computed two measures, corresponding to the theoretical concepts of college centrality and cohesive subgroups. With respect to college centrality, we define degree centrality of a focal PABO as the total number of other PABOs it is linked to. We define *cohesive subgroups* as cliques of actors tied together with relations of some minimal strength (Wasserman and Faust 1994, 278–8).

Context Variables and Other PABO Characteristics

Theoretically, we assume that network embeddedness complements the effects of context variables on organizational performance. We therefore add a number of control variables that provide alternative explanations for network effects on organizational performance. We distinguish between two types of context variables: environmental variables and organizational variables. With respect to environmental context variables, we follow O'Toole and Meier (2004) who distinguish between (1) dependence upon state funding and (2) diversity of funding. We define *dependence on state funding* as the percentage of a PABOs total budget funded by government. We define *diversity of funding* as a fractionalization measure of four sources of funding: (1) government funding, (2) tuition fees, (3) contract activities, and (4) other funds. We computed an inverse Hirschman-Herfindahl concentration index, that is, $1 - \sum_{s=1}^{S} x_s^2$, where s denotes the source of funding, S denotes the total number of sources, and x_s denotes the fraction of the PABO budget funded by the source. Both measures refer to each specific year of graduation.

With respect to organizational characteristics, we distinguish between (1) organizational stability, (2) the availability of resources, and (3) college performance. We include two measures for organizational stability. The first measure is the *change in student enrolment*, defined as the mean yearly absolute change in student enrolment over the 5 years preceding graduation. The second measure is the *change in personnel costs*, defined as mean yearly absolute change in total costs for one full-time equivalent (fte) per student over the 5 years preceding graduation in thousands of euros. We also include two variables for the availability of resources. The first measure is the *student-personnel ratio*, defined as total student enrollment divided by the total fte. for staff in the year of graduation. The second measure is the *solvency* of the college. Personnel costs, student-personnel ratio, and solvency are measured for the universities of applied sciences as a whole and refer to the year of graduation. In the case of multisectoral colleges, we assume that these measures are distributed equally across different programs.

Graduate satisfaction could be affected by the performance of the college in the year of graduation.[10] To control for some indicators of college performance in the year of

10 We expect that significant events in a students' last year are primarily affected by college performance in the same year and not in preceding years. Tests for effects of college performance in the years preceding graduation did not change results.

graduation we applied two measures: (1) the diploma rate and (2) the student dropout rate.[11] The *diploma rate* is defined as the number of graduates in a given year divided by the mean of yearly total enrolment in the PABO over the period 1996–2005. We take the number of graduates relative to the mean enrolment for a long period to rule out short-term fluctuations in enrolment. Freshmen enrollment affects diploma rates (even though it also could be interpreted as an indicator for good performance). When freshmen enrollment increases, it also causes diploma rates to go down and is highly confounded with size of the college. The student *dropout rate* is defined as the number of freshmen dropouts as a proportion of the total freshmen student enrolment for a given year. High dropout rates are indicators for bad performance because colleges are assumed to motivate their students.[12] Finally, we added the important control variable *enrolment in the PABO college*. This variable is defined as the total student enrolment for the given year of graduation and is an indicator for the size of the organization. Organization size provides information about the ability to buffer shocks, such as employee illness. At the same time, graduates tend to evaluate smaller colleges more positively than larger ones.

Graduate Satisfaction and Graduate-Level Control Measures

At the level of the graduates, we make use of the data provided by the HBO monitor. More than 85% of all colleges participate in the survey. Items are included that measure graduates' perceptions of the educational program in which they were enrolled. Data are collected between 1 and 1.5 years after graduation, and the average response rates are about 40%–45% for PABO graduates (and a similar response rate for all college graduates). Data for the period between 2002 and 2005 indicate that 90% of the graduates found a job within 1 year: 85% as a primary school teacher and 5% as a teacher in a different field.

Organizational performance is a multifaceted concept, especially in the public sector, where organizational goals are multidimensional (Boyne 2003; Provan and Milward 1995). Objective measures of performance (''hard'' indicators) are often used to monitor performance and figure predominantly in research on organizational effectiveness. However, there is growing consensus that hard indicators by themselves are insufficient for evaluating agency performance and need to be supplemented by ''soft'' indicators, such as perceived program quality (Andrews, Boyne, and Walker 2006; Bouckaert and van de Walle 2003). Subjective measures of agency performance are sometimes criticized because clients would be ill informed about policies (Brown and Coulter 1983). Such concerns are raised primarily with respect to local municipal services (Kelly and Swindell 2002). In contrast, it can be assumed that college graduates possess accurate and detailed knowledge of their past study program.

We measured the dependent variable graduate satisfaction using an item that confronted graduates with the question whether they would choose the same program *at the same institution* again. If not, the graduate could indicate whether (1) she would choose the same program at a different institution, (2) she would choose a different program

11 Correlations are as follows: $\rho_{\text{diploma rate, dropout rate}} = -0.05$ ($p > .05$); $\rho_{\text{diploma rate, graduate satisfaction}} = -0.07$ ($p > .05$); $\rho_{\text{dropout rate, graduate satisfaction}} = -0.21$ ($p < .05$), the unit being school by year ($n = 90$).

12 Some colleges may apply binding recommendations regarding the continuation of studies in the first year. This could be an alternative explanation for high dropout rates.

altogether, or (3) she would choose not to study again at all. We collapsed the last three categories, creating a dummy variable for graduate satisfaction with the PABO college.[13] The variable could capture many things, varying from satisfaction with teachers to the evaluation of facilities or traineeships. However, the measure is a simple and attractive indicator for the evaluation of PABO performance by graduates. Furthermore, this dummy variable has been used in other studies on program performance as well (Allen and Ramaekers 1999), and it is a core measure used in government study program evaluations and college benchmarking.

Of all 8,050 PABO graduates in the data set who answered this question, 6,089 responded positively—which is about 75%. We also included control variables at the level of the graduates. We include *gender* and *age* as standard control variables. Gender is heavily skewed: in the data set, 89% being women. Age ranges from 18 to 62 years, with a mean of 29 years. In addition, we included a proxy for ability: a dummy variable *level of secondary education* to single out those students whose enrollment was based on *academic* secondary education, which is the usual entry qualification for research-oriented Dutch universities, as opposed to *general* secondary, which is the usual entry qualification for universities of *applied* science (including PABOs). Descriptive statistics for all the independent variables used are given in the appendix.

RESULTS

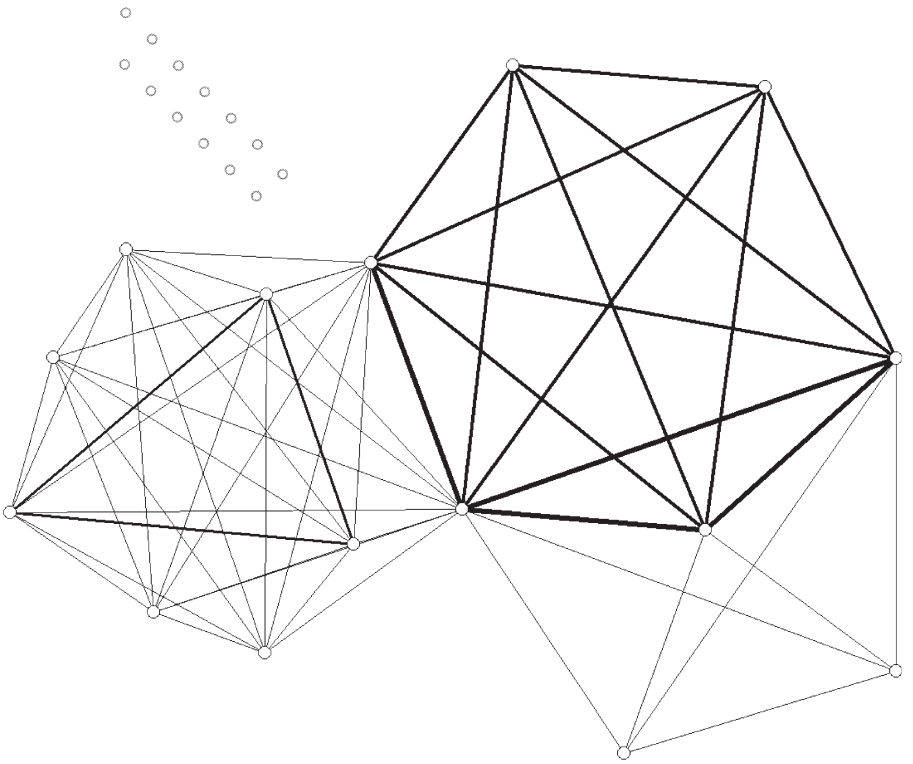
The Interorganizational Network Structure

The network of affiliation relations between the 28 PABOs is presented in figure 1 as a valued graph. Each node in the graph represents a college and each line represents the existence of at least one overlapping affiliation. We did not insert labels since we were required to ensure the anonymity of the colleges. The graph is valued, that is, the thickness of a line indicates the number of overlapping affiliations. Of the 28 PABOs, 13 are isolates. Their director or board member is not directly involved in any of the affiliations. For the 15 PABOs with relations in the interorganizational network, degree centrality varies between 4 and 14 contacts.

When we increase a threshold value for strength of relations, two cohesive subgroups emerge. The first, *cohesive subgroup* emerges at strength greater than 1 and is clearly

13 Some colleagues pointed out that there may be important differences between the three categories of graduates who would not do the same study program at the same institution again. For the present study, we assume that a graduate who would opt to do the same study program at a different institution and another graduate who would opt to do a different study program both base their choice upon the basis of the same criterion: their satisfaction with the study program at their institution. Students' assessments of various dimension of PABO quality, such as practical relevance and coherence of the program and quality of teachers, differ far more strongly between the first and the latter three categories than between each pair of the three contrast categories. Nonetheless, it is possible that the choice for another study program altogether could be based upon a mismatch between the student's preferences and the specific content of the PABO study program, regardless of the institution offering the program. To check for such effects, we performed our analyses presented in the results section also *without* graduates who would opt for a different study program altogether (n decreases to 6,535). We still included those graduates who would opt not to study again ($n = 77$) because they did not differ systematically from the other graduates with respect to their satisfaction across PABO colleges. The effects for all cohesive subgroup dummies are stable across the different multilevel models (in fact they even become stronger). The effect of degree centrality in the network model disappears. This indicates that for graduates who would choose a different study program, the network effects are weaker, although still present. Hence, dissatisfaction with the specific college remains the primary determinant for choosing another study program.

Figure 1
The Interorganizational PABO Network



visible within the left subgraph of the interorganizational network. It is a clique of three PABOs, which are embedded in a broader cohesive network of weak relations. The second, *highly cohesive subgroup* remains at strength greater than 2 and dominates the right subgraph. It is a clique of six PABOs, not well embedded in the total interorganizational network. In addition to the two cohesive subgroups, we observe a subgroup of *networking colleges*. These have ties with other PABOs but never stronger than one joint affiliation. Finally, the 13 *isolated colleges* form a distinct, non-cohesive subgroup within the interorganizational network. In figure 1, these colleges are represented by unconnected dots.

Before testing the hypotheses on network activity and cohesive subgroups, we must first inspect whether degree centrality is associated with the subgroups in the interorganizational network. If such an association exists, both network variables measure the same phenomenon—a common problem in the analysis of small networks. Table 1 shows how the colleges are distributed for degree centrality and cohesiveness. From the table, we can conclude that the two network measures partition the PABOs differently. The mean degree centrality does not differ between the groups of highly cohesive, cohesive, and networking colleges, and highly cohesive subgroups do not necessarily have more ties than colleges in the other groups. However, there is still a strong association between degree centrality and

Table 1
Association Between Cohesiveness and Degree Centrality of PABOs in the Interorganizational Network

	Degree centrality		
Cohesiveness	Mean	Range	*n*
Highly cohesive subgroup	8	5–14	6
Cohesive subgroup	8	8–8	3
Networking colleges	7	4–8	6
Isolated colleges	0	0	13

cohesiveness, which is obviously driven by the isolated colleges that are neither member of a subgroup nor have any ties. The fact that there is a strong association for our data implies that we must test the two variables separately in the multilevel analysis.

Test of Hypotheses for Graduate Satisfaction

In order to test the effect of network centrality of PABOs (hypothesis 1) and the embeddedness of PABOs in cohesive subgroups (hypothesis 2) on individual evaluations of their graduates, we estimated a series of multilevel generalized linear models (Bryk and Raudenbusch 1992; Hox 2002). The dependent variable (the satisfaction measure) indicates whether a graduate would in retrospect choose the same PABO if given the chance to choose again. Since this variable is dichotomous, we apply a logit function, and link the linear multilevel predictions to probabilities. The nested models contain three levels of analysis: graduates (level 1) are nested in years (level 2), which are nested in PABOs (level 3). The statistical multilevel approach allows us to explicitly incorporate the dependencies between graduates that result from being enrolled in a particular PABO in a particular year. Thus, we are able to partition the variance in graduate satisfaction between the three levels (a PABO component, a year component, and a graduate component).

The three-level logistic model has the following form. Assume we have a number of explanatory variables ($X_{\mathrm{p}}, \ldots X_{\mathrm{P}}$) at the *graduate level* (level 1), a number of explanatory variables ($Z_{\mathrm{q}}, \ldots Z_{\mathrm{Q}}$) at the *year level* (level 2), and a number of explanatory variables ($G_{\mathrm{r}}, \ldots G_{\mathrm{R}}$) at the *PABO level* (level 3). The probability that graduate i, who graduated in year j at PABO k, would choose for the same PABO again is given by π_{ijk} . Now, the prediction model can be written as follows:

$$\mathrm{logit}\left(\pi_{ijk}\right) = \beta_{0jk} + \beta_{p00} X_{ijk}. \tag{1}$$

where:

$$\beta_{0jk} = \delta_{00k} + \beta_{0q0} Z_{0jk} + u_{0jk}. \tag{2}$$

$$\delta_{00k} = \gamma_{000} + \beta_{00r} G_{00k} + v_{00k}. \tag{3}$$

This is a random intercept model for a binary response variable. The individual error distribution $\mathrm{var}\left(e_{ijk}\right)$ is fixed at $\frac{1}{3}\pi^2$, and hence, no error term is specified at the graduate level (because it is already part of this specification of the error distribution, see Snijders and Bosker 1999). The intercept β_{0jk} is assumed to vary across years and across PABOs. This effectively implies that we expect the average graduate satisfaction score to vary across both levels. Variation in β_{0jk} is explained by year variables Z_{0q0} and PABO variables G_{00k}. The

terms u_{0j} and v_{0k} are the year-level and PABO-level variance terms, respectively. Thus, we focus on the estimation of effects of network variables G_{00k}—those that vary only between PABOs—on average graduate satisfaction, controlling for contextual factors that may vary both at the year and PABO levels, as well as control variables that vary at the graduate level. To test hypothesis 1 (the positive effect of network activity on performance), we include degree centrality. To test hypothesis 2 (the positive effect of membership of a cohesive subgroup), we include three dummy variables to capture the different subgroups.

One cautionary remark must be made with respect to the estimation of the model. The statistical power for parametric tests of effects of variables at the PABO level is limited since we only have 28 cases in the data set. Therefore, we cannot test for cross-level interactions, such as the moderating effects of network characteristics (e.g., that degree centrality particularly affects the evaluations of motivated students). The limited statistical power at the PABO level also implies that we can introduce only few control variables in each model.

We first fit an empty model to find out how much variance in graduate satisfaction is to be found at the different levels of analysis. Subsequently, we fit five different models for each hypothesis. The *network model* includes only the independent network variables at the PABO level. The other four models also include these network variables and control successively for four different groups of control variables at the PABO year level. The *performance model* includes the PABO "diploma rate" and "dropout rate." The *environment model* includes the environmental factors "diversity of funding" and "dependence on state funding." The *stability model* includes the organizational stability factors "fluctuation in personnel costs" and "fluctuation in student enrolment." Finally, the *resources model* includes the effects of "student-personnel ratio" and "PABO solvency." "Enrolment in the PABO college" is included as a variable in all models.[14] In addition, we include age, gender, and level of secondary education as controls in all five models at the graduate level.

Table 2 shows the results of the multilevel analyses with degree centrality. The empty model informs us about how much of the total variance in graduate evaluations can be attributed to the graduate level, the year level, and the PABO level. The proportion of variance in graduate evaluations attributed to a specific level is computed by dividing the variance at the specific level by the sum of the three different variance components. In general, the explained variance in any logistic regression is considerably lower than the standard R^2 for continuous dependent variables. Of the total variance in graduate evaluations, 6.29% can be attributed to the PABO level, and 4.89% to the year level. These numbers are still considerable, taking into account the many factors that could play a role at the individual level.

The results of the analyses for all five models clearly show that graduates of the actively networking PABOs are not significantly more likely to have a positive view of their past education at the college. The second column of table 2 shows a weakly significant effect of PABO degree centrality at $p < .10$ in the expected direction (more ties lead to more graduate satisfaction). However, when controlling for general college performance or contextual factors, this effect disappears. Hence, we must reject hypothesis 1 for graduate satisfaction. A possible explanation for the weak effect of PABO degree centrality found is that ties do not only yield benefits (of learning, joint problem solving, and

14 We truncated the variables "enrolment PABO college" and "diversity of funding" by 1,000.

Table 2
Degree Centrality: Multilevel Logistic Regression of PABO Graduate Satisfaction 2002–2005 (n = 7,119)

			Models With Control Variables at the PABO Year Level			
	Empty Model	Network Model	Performance Variables	Environment Variables	Stability Variables	Resources Variables
Network activity						
Degree centrality		0.035 (0.025)*	0.027 (0.026)	0.036 (0.025)*	0.029 (0.024)	0.032 (0.026)
PABO year level						
Diploma rate			−0.090 (1.835)			
Dropout rate			−2.018 (1.395)*			
Diversity of funding				0.128 (0.129)		
Dependence state funding				−0.882 (0.868)		
Change in personnel costs					1.223 (0.469)##	
Change in enrolment					−0.002 (0.002)	
Student/personnel ratio						−0.008 (0.057)
Solvency						1.107 (0.614)**
Enrolment PABO college			0.018 (0.149)	−0.009 (0.150)	0.168 (0.175)	0.035 (0.153)
Graduate level						
Female		0.263 (0.001)***	0.264 (0.001)***	0.262 (0.001)***	0.265 (0.001)***	0.267 (0.001)***
Age		0.027 (0.000)***	0.027 (0.000)***	0.027 (0.000)***	0.027 (0.000)***	0.027 (0.000)***
Level of secondary education		−0.125 (0.001)***	−0.125 (0.001)***	−0.124 (0.001)***	−0.125 (0.001)***	−0.126 (0.001)***
Intercept	1.109 (0.103)###	0.016 (0.146)	0.550 (0.570)	−0.030 (0.948)	−0.369 (0.266)#	−0.300 (0.826)
Variance components						
σ^2_e (scale factor)	3.29	3.29	3.29	3.29	3.29	3.29
σ^2_{u0} (year)	0.181 (0.032)###	0.173 (0.031)###	0.171 (0.031)###	0.167 (0.030)###	0.167 (0.029)###	0.179 (0.032)###
σ^2_{v0} (pabo)	0.233 (0.080)###	0.248 (0.083)###	0.237 (0.080)###	0.241 (0.081)###	0.205 (0.070)###	0.251 (0.085)###

*$p < .10$ (one tailed), **$p < .05$ (one tailed), ***$p < .01$ (one tailed), #$p < .10$ (two tailed), ##$p < .05$ (two tailed), ###$p < .01$ (two tailed).

coordination) but also costs (e.g., opportunistic behavior by partners). Such costs could be lower for more stable contexts, which may explain the slightly significant effects in the network model and the environment model.

Hypothesis 2 stated that cohesive subgroups within the interorganizational network perform better than weakly integrated colleges or isolated colleges. We introduced three dummy variables identifying these different subgroups, with the subgroup of isolated PABOs as a reference category. Table 3 shows the results of the multilevel analyses with cohesive subgroups as the independent network variables at the PABO level. All models show that, in contrast with network activity, subgroup cohesion and tie strength at the PABO level have strong and robust effects on individual graduates' satisfaction.

With respect to the direction of the effects, table 3 clearly shows that the graduates of colleges in both the cohesive and the highly cohesive subgroups have a significantly higher likelihood of having a favorable opinion about their past education. Interestingly, graduate satisfaction is not higher for PABOs that have only weak ties in the interorganizational network. Their average satisfaction is even lower than that of the reference group of isolated colleges, although the difference is not statistically significant. The effect of the two cohesive subgroups on satisfaction remains in all models, controlling for college performance and for different contextual variables. Hence, the analyses on graduate satisfaction firmly corroborate hypothesis 2. The direction of the effects of the independent variables at the PABO year level (college performance and contextual variables) is comparable with that in the previous analyses (network centrality). The results become even more convincing if we consider the fact that the average satisfaction level in the data is high (.75). Because the distribution in the model is binomial or S shaped, it is more difficult to detect significant differences in probabilities between schools around a high mean.

We add a final analysis to our test of the different multilevel models. The interpretation of estimates becomes quite complex in a multilevel analysis with a binary outcome variable and multiple levels of analysis. To explore effect sizes, let us concentrate on the network model from table 3 and conduct an analysis of explained variance of the estimated dummy coefficients for each of the two cohesive subgroups in the interorganizational network. Explained variance in multilevel logistic regression models can be computed by dividing the variance of the linear predictor by the total variance (Snijders and Bosker 1999).[15] In addition, for all four subgroups, we computed the mean and range of the predicted probabilities that a graduate would positively evaluate the past education. This gives an idea of the variation in mean graduate satisfaction between the different subgroups of PABOs in the interorganizational network. Table 4 shows the results.

As we would expect, table 4 shows that the PABO dummies explain a small portion of the total variation in graduate satisfaction at the individual level. In general, the explained variance in any logistic regression model is considerably lower than the standard R^2 for continuous dependent variables. However, at the PABO level, the dummy variables explain 17.53% and 13.19% of the variation in graduate satisfaction. In total, the network model explains 41% of the PABO-level variance (not reported in table 4). In addition, we observe a marked difference in predicted probabilities between the two cohesive subgroups on the

15 The explained variance for each dummy is computed by subtracting the total explained variance of the linear predictor without the estimated coefficient from total explained variance with the estimated coefficient, taking into account the scaling of graduate-level variance. The percentage variance explained is the additive variance to all the other variables in the network model, which contains all PABO dummies and the graduate-level controls.

Table 3
Cohesive Subgroups: Multilevel Logistic Regression of PABO Graduate Satisfaction 2002–2005 (n = 7,119)

		Models With Control Variables at the PABO Year Level			
	Network Model	Performance Variables	Environment Variables	Stability Variables	Resources Variables
Cohesive subgroups[a]					
Networking colleges	−0.236 (0.220)	−0.315 (0.231)	−0.304 (0.227)	−0.309 (0.216)	−0.366 (0.229)
Cohesive subgroup	0.742 (0.280)***	0.730 (0.309)***	0.745 (0.275)***	0.507 (0.280)**	0.737 (0.284)***
Highly cohesive subgroup	0.747 (0.230)***	0.730 (0.230)***	0.852 (0.242)***	0.738 (0.212)***	0.705 (0.234)***
PABO year level					
Diploma rate		−0.734 (1.741)			
Dropout rate		−0.662 (1.368)			
Diversity of funding			0.200 (0.121)**		
Dependence state funding			0.061 (0.750)		
Change in personnel costs				1.111 (0.443)**	
Change in enrolment				−0.002 (0.002)	
Student/personnel ratio					−0.037 (0.050)
Solvency					0.973 (0.529)**
Enrolment PABO college		0.150 (0.132)	0.113 (0.130)	0.285 (0.158)	0.173 (0.130)
Graduate level					
Female	0.268 (0.001)***	0.269 (0.001)***	0.269 (0.001)***	0.270 (0.001)***	0.270 (0.001)***
Age	0.027 (0.000)***	0.027 (0.000)***	0.027 (0.000)***	0.027 (0.000)***	0.027 (0.000)***
Level of secondary education	−0.128 (0.001)***	−0.128 (0.000)***	−0.128 (0.000)***	−0.128 (0.000)***	−0.128 (0.000)***
Intercept	0.002 (0.124)	0.184 (0.546)	−1.165 (0.855)	−0.480 (0.225)##	−1.013 (0.724)
Variance components					
σ^2_e (scale factor)	3.29	3.29	3.29	3.29	3.29
σ^2_{u0} (year)	0.167 (0.030)###	0.164 (0.029)###	0.158 (0.028)###	0.157 (0.028)###	0.168 (0.030)###
σ^2_{v0} (pabo)	0.143 (0.055)###	0.140 (0.053)###	0.129 (0.050)###	0.116 (0.046)##	0.134 (0.052)###

[a]Reference category = isolated PABOs.
*$p < .10$ (one tailed), **$p < .05$ (one tailed), ***$p < .01$ (one tailed), #$p < .10$ (two tailed), ##$p < .05$ (two tailed), ###$p < .01$ (two tailed).

Table 4
Network Model: Differences Between Subgroups of PABOs in the Interorganizational network in (1) Percentages Variance Explained of Graduate Satisfaction and (2) Predicted Probabilities of Graduates to Positively Evaluate Their Past Study

	% Variance Explained		Predicted Probabilities		
	PABO Level	Total	Mean	Range	*n*
Highly cohesive subgroup	17.53	2.15	0.84	0.65–0.96	972
Cohesive subgroup	13.19	1.27	0.83	0.69–0.94	671
Networking colleges	n.s.	n.s.	0.72	0.27–0.91	2,842
Isolated colleges[a]	Reference	Reference	0.73	0.25–0.94	2,634

[a]Reference category in the network model. n.s., not significant.

one hand, and the networking colleges and isolated colleges at the other hand. To start with, if we look at the range of predicted probabilities, no graduate in either of the cohesive subgroups has a predicted probability lower than .65, which means that they are always more likely to be satisfied than not. The mean predicted probability of graduates to have a positive opinion about their past education is about 85% for these groups. In comparison to the other colleges, this yields an increase of about 10%. This result is somewhat stronger than the 5% increase in aggregate performance of school districts due to the network management activities of superintendents (O'Toole and Meier 2004, 472).[16]

CONCLUSIONS

This article systematically examined the effects of network activity and network embeddedness of 28 Dutch colleges for the training of primary education teachers on their performance. The article first tested the effect of network activity of colleges on the satisfaction of their graduates with the program offered. The results show that having more network relations per se is not sufficient to perform well. A weak effect of degree centrality of colleges in the interorganizational network on graduate satisfaction disappeared when controlling for organizational stability, access to resources, and organizational-level performance. Hence, network activity of the Dutch colleges does not affect graduate satisfaction, whereas the network activity of Texas superintendents strongly contributes to their pupils' achievements (Meier and O'Toole 2003; O'Toole and Meier 2004).

The difference in results found can be attributed to a number of factors. In the first place, the context of a Dutch interorganizational network of colleges in higher education is different from the context of Texan public school districts. In the second place, the indicator of network activity in the present article (degree centrality) is different from the contact frequency of individual superintendents. The contact frequency of individual superintendents with broad categories of other actors has a wider scope than degree centrality within an interorganizational network. Further research should reveal whether contact frequencies of

16 Studies of graduate satisfaction typically focus on moderating variables between network characteristics and graduate satisfaction. For Dutch universities of applied sciences, programs that were strongly related to occupational practice and programs that were regarded as challenging were favorably evaluated (Allen and Ramaekers 1999). It was also found that a longer study duration was associated with a lower level of satisfaction. It seems likely that any effect of network characteristics of PABOs would work through improved implementation of program characteristics such as those mentioned above, and through the provision of study facilities that allow a maximum number of students to complete the program with a minimum of delay.

colleges in a wider environment also affects their performance. In the third place, the graduate satisfaction is a different indicator for performance than pupil achievements, which the Texas school studies explain (Meier and O'Toole 2003; O'Toole and Meier 2004).

The analyses show that graduates' satisfaction is consistently and significantly higher for colleges that are member of strong cohesive subgroups in the interorganizational network, which was a different hypothesis in the present study. Our results confirm previous studies (Provan and Sebastian 1998; Uzzi 1996) on network embeddedness and performance. Thus, in the context of the college affiliation networks in higher education, maintaining strong and closed relations positively affects graduate satisfaction. Indeed, based on a study of three mental health care networks, Provan and Sebastian (1998, 461) conclude that "at least in certain contexts, strong, multiplex, reciprocal ties among small network subgroups can be particularly effective." We demonstrated that significant network effects exist that justify further investigation, in particular for contexts different from Dutch higher education.

The article contributes to the scarce research about network effects on subjective client evaluation (Andrews, Boyne, and Walker 2006; Provan and Milward 1995; Provan and Sebastian 1998). Client evaluations are a crucial aspect of public service performance (Provan and Milward 1995) but seldom integrated as individual cases in one analysis (Forbes and Lynn 2005, 569). The present article studied the satisfaction of college graduates in a European setting, taking into account the complex nesting structure of graduates in years (cohorts) and in colleges. Although a full explanation of performance at the client level was not the aim of the present article, we integrated agency network data, agency performance data, and client evaluations of agency performance into one statistical design.

The article did not intend to reveal all possible mechanisms that may underlie a systematic association between agency network embeddedness and client satisfaction. Hence, many routes for future research exist. First, theoretical research should focus more in depth on the mechanisms that relate network activity and network embeddedness to performance. Secondly, it is necessary to further investigate whether cohesive subgroups indeed benefit from higher levels of interorganizational trust, as postulated. Because interorganizational trust is so crucial in the literature, future research should focus more in depth on the mechanisms that link network embeddedness and interorganizational trust to performance. Thirdly, the multilevel analysis shows that much of the variation in graduates' evaluations is attributable to mechanisms at the client level. This suggests that future research must ultimately incorporate large-*n* data on the interactions between "street-level" officers (teachers) and clients (students) to explain client satisfaction.

Given the relatively small number of cases at the level of colleges for the training of primary teachers ($n = 28$), and the fact that effects of network embeddedness remained while controlling for important environmental and organizational context variables, the effects found could be considered to be an underestimation. Hence, further research should extend the present study to other contexts than one sector of Dutch higher education. A comparative analysis of multiple sectors offers the possibility to increase the power of the test while still including evaluations of graduates as performance measures at the client level.

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APPENDIX 1

Table A1
Descriptive Statistics for the Independent Variables in the Analysis

Variables	2002–2005 Collapsed					2002				
	n	Mean	SD	Minimum	Maximum	*n*	Mean	SD	Minimum	Maximum
Network level variables										
Degree centrality	90 (28)	4.10	4.30	0	14	24	4.04	4.21	0	14
Cohesiveness	90 (28)	2.00	1.00	1	4	24	2.00	1.14	1	4
PABO—year-level variables										
Diploma rate	90	0.23	0.03	0.14	0.32	24	0.20	0.03	0.14	0.25
Dropout rate	90	0.25	0.05	0.10	0.43	24	0.26	0.05	0.15	0.36
Diversity of funding	90	4959.24	562.41	2784.00	6570.00	24	4883.17	461.31	3898.00	6249.00
Dependence state funding	90	0.66	0.09	0.12	0.76	24	0.68	0.04	0.55	0.76
Change in personnel costs	90	0.29	0.16	0.13	0.95	24	0.29	0.16	0.14	0.92
Change in enrolment	90	68.96	45.29	21.43	253.40	24	77.17	51.05	26.32	247.00
Student/personnel ratio	90	13.93	1.47	11.40	17.1	24	13.57	1.43	11.60	16.80
Solvency	90	0.37	0.15	0.16	0.75	24	0.36	0.15	0.16	0.68
Enrolment PABO college	90	1195.72	712.30	333.00	3991.00	24	1058.13	651.25	348.00	3284.00
Graduate-level variables										
Female	7119	0.89	0.31	0	1	1228	0.90	0.31	0	1
Age	7119	29.13	9.20	18	62	1228	29.13	9.20	18	62
Level of secondary education	7119	0.12	0.33	0	1	1228	0.14	0.35	0	1

Continued

Table A1 *(continued)*
Descriptive Statistics for the Independent Variables in the Analysis

Variables	2003					2004					2005				
	n	Mean	SD	Minimum	Maximum	*n*	Mean	SD	Minimum	Maximum	*n*	Mean	SD	Minimum	Maximum
Network level variables															
Degree centrality	23	3.48	4.02	0	12	21	4.05	3.97	0	12	22	3.50	3.94	0	12
Cohesiveness	23	1.87	1.10	1	4	21	2.10	1.18	1	4	22	1.95	1.17	1	4
PABO—year-level variables															
Diploma rate	23	0.22	0.02	0.19	0.26	21	0.24	0.03	0.18	0.32	22	0.24	0.03	0.20	0.32
Dropout rate	23	0.23	0.04	0.11	0.32	21	0.24	0.05	0.10	0.32	22	0.26	0.07	0.10	0.43
Diversity of funding	23	5063.22	475.06	4011.00	6417.00	21	4906.76	668.44	2784.00	6485.00	22	4983.64	650.10	3198.00	6570.00
Dependence state funding	23	0.67	0.04	0.53	0.75	21	0.64	0.13	0.12	0.72	22	0.64	0.12	0.15	0.74
Change in personnel costs	23	0.26	0.13	0.13	0.77	21	0.29	0.17	0.13	0.81	22	0.32	0.21	0.13	0.95
Change in enrolment	23	72.71	50.15	21.43	253.40	21	65.01	42.84	27.60	221.20	22	59.80	35.48	22.80	182.20
Student/personnel ratio	23	13.76	1.37	11.60	16.50	21	14.12	1.67	11.5	17.1	22	14.28	1.40	11.40	16.70
Solvency	23	0.37	0.16	0.18	0.72	21	0.38	0.16	0.17	0.71	22	0.39	0.15	0.20	0.75
Enrolment PABO college	23	1090.94	718.96	333.00	3598.00	21	1232.76	748.82	564.00	3849.00	22	1272.75	757.98	602.00	3991.00
Graduate-level variables															
Female	1640	0.90	0.30	0	1	1924	0.89	0.32	0	1	2327	0.89	0.31	0	1
Age	1640	27.12	7.63	18	57	1924	30.75	10.31	18	62	2327	30.60	9.72	20	60
Level of secondary education	1640	0.13	0.34	0	1	1924	0.11	0.32	0	1	2327	0.12	0.32	0	1

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