The Role of IT in Organizational Networks, Individual Networks, and in Bridging These Two Levels

Andrea Carugati, Lapo Mola and Antonio Giangreco

Abstract In this paper, we seek to understand the role of technology at the nexus between the two network levels: as outcome of the decision process at the organizational level and as object of use and performance at the individual level. We aim to capture the role of IT in bridging the individual practices in the context of the larger network system [22]. To do so, we draw on a longitudinal case study of the development and diffusion of a software for the operation and management of nursing homes.

Keywords Social networks · Nursing home · Organizational impacts of IS

1 Introduction

It is widely recognized that the implementation of Enterprise Systems (ES) is a challenging endeavor with both high-risk [1, 2] and potential high rewards. The study of the implementation process [3, 4], and the succeeding stabilization has therefore become a classic topic in IS research. While IS research has essentially looked at the organizational level and the practice level, implementations do not happen in vacuum. Decisions to implement are made by organizations influenced by the network of organizations with whom they have relations [5, 6] or that

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simply are influential in the sector [7]. Decision about usage and adoption are instead made by individuals influenced by their network of colleagues, managers and peers [8–10], and other influential connections [11, 12]. Indeed the networks within which organizations and individuals are embedded have important consequences for the successes and failures of IT initiatives [13] such as ES implementations [5, 11, 14].

Thanks to studies in the organizational theory area, we have learned a great deal about what kinds of networks produce desirable outcomes and what situational characteristics shape how people and organizations construct their social networks [15, 16]. Previous studies have proved few overreaching concepts for drawing the most of one's networks. These results have shown both (i) the characteristic of the networks like bridging ties and filling structural holes [17] and the embeddedness of economic transactions in social networks [18, 19]; and (ii) the characteristics of the actors within the network connected in more or less useful ways [20].

However, from previous literature we can also identify areas that require further study. One of such areas, in the domain of organizational theory, is the nexus between personal networks and larger network systems. According to Ibarra et al. [15], this gap in research was already observed by Boissevain [21], but the organizational literature has grown as two separate camps, with few bridges linking the micro and macro.

The other interesting gap is to be found in IS literature where network studies are almost absent despite the fact that organizational networks—per their definition—include "people, organizational units, behaviors, procedures and technologies" [15], p. 365). In the IS domain, the call for more studies bridging levels of networks has so far being picked up only in few published paper [11]. Today, after much research about the role of networks on the successes of projects and initiatives, we still have much to learn about the role of the technology that makes the network possible and relevant at the same time. The understanding of how individuals and organizations use technology in their internal and external networks is still a question open for debate.

In this paper, we seek to understand the role of technology at the nexus between the two network levels: as outcome of the decision process at the organizational level and as object of use and performance at the individual level. We aim to capture the role of IT in bridging the individual practices in the context of the larger network system [22]. To do so, we draw on a longitudinal case study of the development and diffusion of a software for the operation and management of nursing homes. The software was developed internally and used by one nursing home, and it is now used in 100+ nursing homes, endorsed by the local health authority, and supported by a network of organizations. The story of the success and diffusion of this software is intimately linked to the interaction between the network of individual users reporting positively about the system and the network of organizations supporting its diffusion.

The idea of zooming back and forth between individual and collective phenomena is likely to highlight characteristics of technology as enabler and object of social networks that were previously ignored. This can further be embedded in a

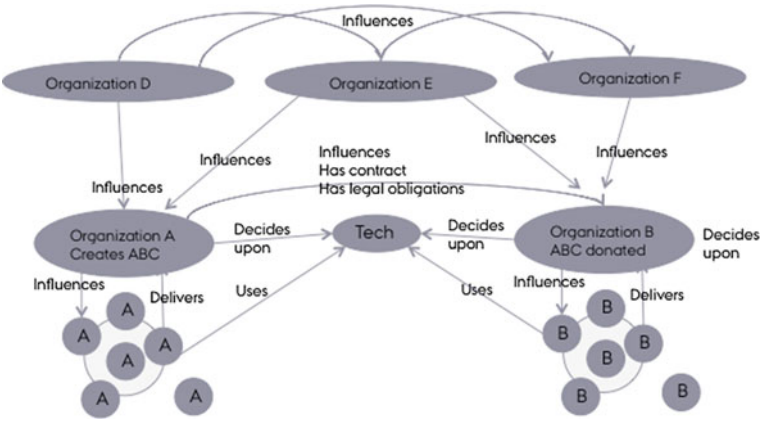

Fig. 1 Basic framework of analysis

discourse of how individuals enact structures of constraint and opportunity within systems of relations explicitly including technology [23, 24]. The basic framework of analysis is showed in Fig. 1. Expanding on this basic component we will build the analysis presented in the next sections.

2 Theoretical Perspectives on IS and Networks

IS literature deals with social networks from two main standpoints: the focus on human capital and the focus on the installed base.

Human capital is related to what people know and their practices. The human capital explanation of success with IT is that an individual will do better with technology if he/she is more capable, more skilled ([25], p. 32). The stream of research on human capital will therefore look at practice to find the explanation of IT uses. Practices and practice lens have become the hallmark of social studies of use and adoption of technology [26, 27]. The main implication of this stream of research is that users need training [9] and socialization with experts [28, 29] to improve their ability to deal with technology.

Installed base is related to how many users a specific technology has, relative to the number of adopters of a competing technology or the number of non-adopters [5]. The installed base explanation of the success of a technology says that success (dominance) depends on the number of adopters of the technology: the more, the better. The most common driver for this success is the appearance of network externalities as the installed base grows [30, 31]: The technology has some characteristics that make it such that every new user adds value to all existing users. Installed base and network externalities consider the users as a homogenous mass: Large numbers of users even out disparities in human capital and varying

influences of users in the social network. The main implication of this stream of research is that network externalities have to become apparent so to induce the next person to adopt because of continually increasing value [18, 32, 33].

Both the human capital explanation and the installed base explanation allow for *recursiveness* between IT and its effects. Increasing human capital (skills and practices) leads to higher interpretive flexibility and better configurations of the technology [34], which in turn leads to organizational changes [35]. The size of the installed base may lead to technological success, but the technological performance contributes to the growth or demise of the installed base. However, both in the human capital explanation and in the installed base explanation of the *recursiveness* between technology and organizations, there is no space for the structure of the network enabling and constraining the use of a certain technology.

The other set of studies dealing with technology evolution is to be found in network literature. Here the main idea is that players in the network are nodes connected by ties of various types [14, 36]. An actor within this network can be found central or peripheral [11] and at various network levels like group, organization, or industry [15, 37]. When discussing the diffusion of technology at multiple network levels, it is necessary to focus on two main diffusion processes: (1) diffusion of ideas because ideas participate in decision making of management when deciding upon technology implementation; and (2) diffusion of practice because users will decide upon use, adoption, and workarounds with technology depending on how this caters to their daily practice. The salient network characteristic in relation to diffusion of ideas and practices is the network *density* [20, 38].

Networks that are *dense*, i.e. populated by similar actors with aligned interests, will tend to diffuse new practices relatively fast because interests are aligned and language and trust to mobilize these interests are readily available [39]. Conversely, dense networks will tend to resist new ideas because of the uniformity of information circulating in the network [18, 39].

Networks that instead are *sparse* include multiple players from diverse fields and present abundance of structural holes [38]. Many different actors are more likely to contribute to the creation new ideas because boundary spanners [26] are likely to emerge and fill the structural holes and identify new opportunities [17, 25]. On the other side, sparse networks will not be conducive of new practices because of the many structural holes impeding common practices to be understood, valued, trusted, and adopted [40].

Dense and sparse networks are therefore respectively conducive of and resisting to new practices and new ideas. With respect to the processes of diffusion of technology (ideas) and practices, network studies would therefore suggest that dense networks, at group level, and sparse networks, at managerial level, would be conducive of the best condition for technology to diffuse and be adopted.

Network theory addresses the issue of network persistence and evolution over time with the concept of *residual* network [14]. Information is the mechanism that makes it possible to consider networks as stable entities: “In theory the network residue of yesterday would be irrelevant to the market behavior of tomorrow … Continuity would be a by-product of buyers and sellers seeking one another out as

a function of supply and demand … selecting requires that I have information … Information can be expected to spread across people in a market" ([25], pp. 33–34).

Thanks to studies from the network theory area, we can learn a great deal about what kinds of networks produce certain outcomes and what behavioral characteristics shape how people and organizations construct their social networks [15]. However, extant network literature does not address in depth the specificity of technology either as a product of the network or as an antecedent and enabler of it. Furthermore, the link between personal (ego) networks and larger (organizational) network systems, the nexus where ideas become decisions and actions become practices, is mostly absent from network theories [10, 15, 37]. In IS literature, the call for more studies of network's structures has so far being picked up only in few studies [11]. However, these few studies have focused on the impact of network structures on systems success and have not yet addressed the impact of technology on network success, its density or sparsity, the persistence or decrease of structural holes, the diffusion of actions and ideas. Today, after much research on the role of networks on the successes of projects and initiatives, we still have much to learn about the opposite dynamic: The role of the technology in making the network possible and successful at the same time.

3 Research Design and Context

To answer the research question, we studied the network dynamics around the design and diffusion of an ES for the management of nursing homes. The software was initially developed in an Italian nursing home, Fondazione Santa Clelia (FSC), where the manager felt the need to reorganize the work in a professional and modern manner. The system—called ABC—was used by the manager as a battling ram to do away with old habits (and employees) and pave the way for operations based on objective measures and standardized processes. On the basis of its effective implementation at FSC, the ABC software has diffused to other nursing homes; it has been handed over to a software house that follows its development professionally; and it has been named as best practice by the local health care authority. The software and it has now spread to more than 100 nursing homes in the region and beyond in a network that includes hospitals, banks, consultants, public officials, medical doctors, physiotherapists, psychologists, and more.

4 Data Collection and Analysis

The data collection at began with informal talks with FSC in 2005, though the data used in this article were collected formally in four field trips.

The first field trip (October 2008) aimed at understanding the dynamics of the network at the beginning of the ABC history. We interviewed five people: the general manager, the software developer, the administrative assistant, and two nurses. We used semi-structured interviews to understand how the software was developed and implemented from the original idea to the current use.

After analyzing the first set of data, we updated the interview guide for the second round of interviews (September 2009). We focused the second round of interviews on the individual network inside FSC. We investigated the individual uses and organizational consequences of ABC and how the changes were fed back to the programmer and included into the software. We interviewed 14 people: 10 employees, 2 guests, the general manager, and the developer. Moreover, one of the researchers observed a nurse during her shift to understand how the software was used and the impact of this IT tool on the way people worked and interacted.

The third field trip (October 2012) aimed at understanding the structure of the larger network system. We interviewed a manager of the local health authority responsible for the control and financing of the nursing homes of the region. We also interviewed the owner of the software house. Both interviews investigated the modality of diffusion of ABC: from the policy point of view for the local health authority, and from the commercial point of view for the software house. In this occasion we also gathered the contacts for the other nursing homes using the ABC system.

The fourth field trip (November 2012) focused on ABC as connecting element between the larger network and the individual networks of four nursing homes. We interviewed the directors of the nursing homes that had the contact with the local health authority and the software house and we interviewed the personnel—nurses and health technicians—regarding their use of ABC and their relation to the larger network system.

4.1 Data Analysis: From a Development Idea to a Regional Revolution

Our analysis of the evolution of ABC and of the networks around it shows five states of the networks that can be connected to five stages of maturity of the technology in use.

Phase 1. The first phase was started by an idea of the newly arrived general manager. The general manager had a business education and felt that he needed numbers to run the structure properly. As he admitted “IT was the only way I knew that we could use. But there was nothing on the market and I just did not know if we had the skills to do it”. He met however a retired software developer that volunteered his work for the development of ABC. The adventure of FSC with IT thus began in 1999. The initial network was essentially only internal at FSC. The network was selective in relation to the participants and was designed to be

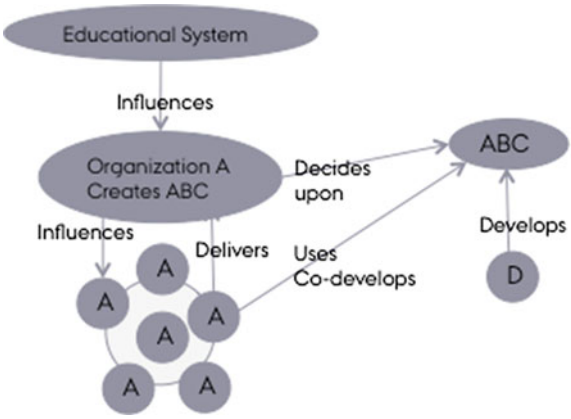

Fig. 2 FSC develops the ABC software

such because the purpose of the software was to create an elite group that would shape the future organization. This group was connected to the external developer to help FSC with their idea. In this phase IT attracted only internal actors (Fig. 2). The users (A) quickly understood the network characteristics of ABC using peer to peer sanctioning to assure the complete use of the system. They also interacted often with the developer (D) to gradually add elements to ABC according to emergent needs.

Phase 2. As the software became more performing and the users demanded more advanced features.

A manager talked about these features with colleagues from other nursing homes. The need for better management was felt in many nursing homes and a new generation of managers was stepping in. It did not take long for other managers of nursing homes to manifest their interest in installing the software (Fig. 3). In this second phase the performance of IT and the convincing arguments of the manager began to attract new actors to the organizational network while ABC is also influenced by the existing external network (e.g. the hospital).

Phase 3. More and more nursing homes began to get interested in using the system, but the engineer that was helping FSC realized that he could not follow additional implementations of the software and therefore the director on FSC made an agreement with a software house to further develop and commercialize the ABC. The software helps again in extending the external network and changes the function of the developer that assumes a more consulting role (Fig. 4). However, we also observed that, while in FSC the medical doctors were regular users of the system, in the other organizations this was not happening.

Phase 4. The main event in phase 4 is the active entrance in the network of the Local Health Care System (AUSL). Typically the role of the AUSL was that of control by manually going through paper records, and then digitize them. ABC gave the AUSL the possibility to receive data directly in electronic form decreasing costs while having more data, more often, and more precise. The AUSL established therefore a public interface for data transfer (Fig. 5).

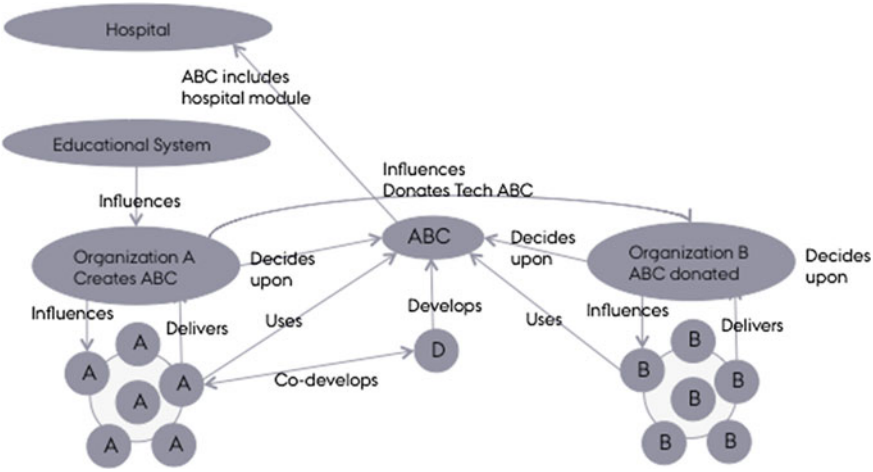

Fig. 3 ABC requested by other nursing homes (org *B* with users *B* as example)

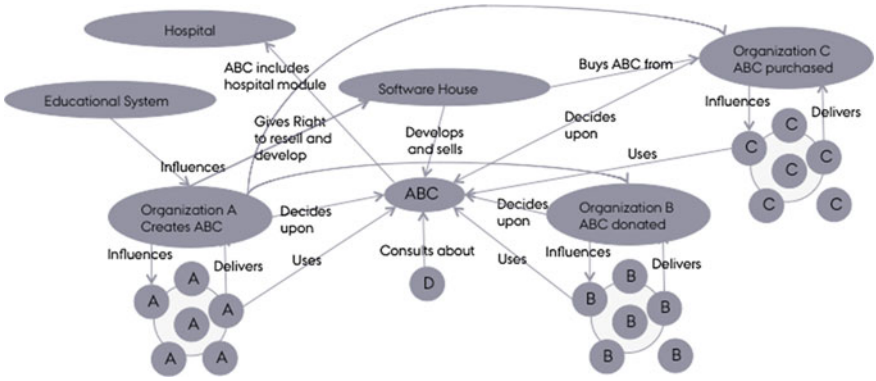

Fig. 4 ABC commercialized by software house and sold to other nursing homes

Phase 5. In the last phase identified so far, the AUSL has decided to declare ABC the software of choice for all the nursing homes in the county (about 60 organizations). To do so without stretching too much the budget of the nursing homes, the AUSL entered an agreement with the foundation of a local bank that would finance the cost (approximately 800 k €) of hardware and software ant the without costs for the adopting organizations. This allowed the diffusion time to be very short and already now all nursing homes in the county have adopted ABC.

Our preliminary interviews with this last group of organizations (Org. D in Fig. 6) shows a similar pattern as before with acceptance among nurses and technicians leading to high satisfaction with the system and non-acceptance among medical doctors.

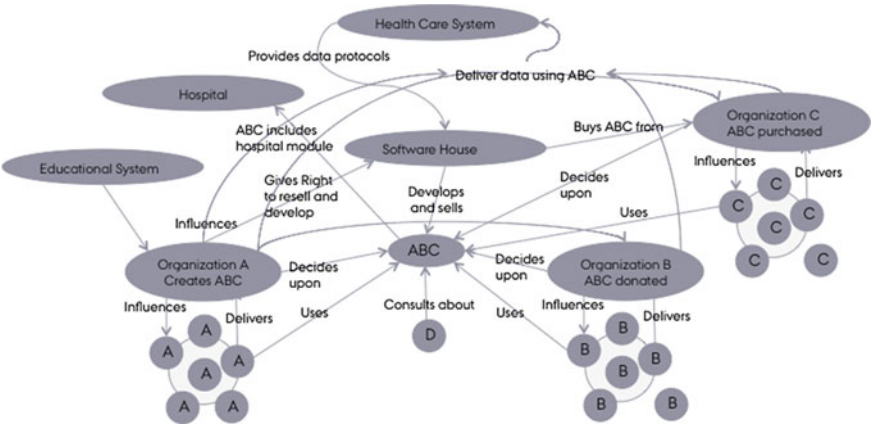

Fig. 5 ABC used to deliver data to the regional health care system

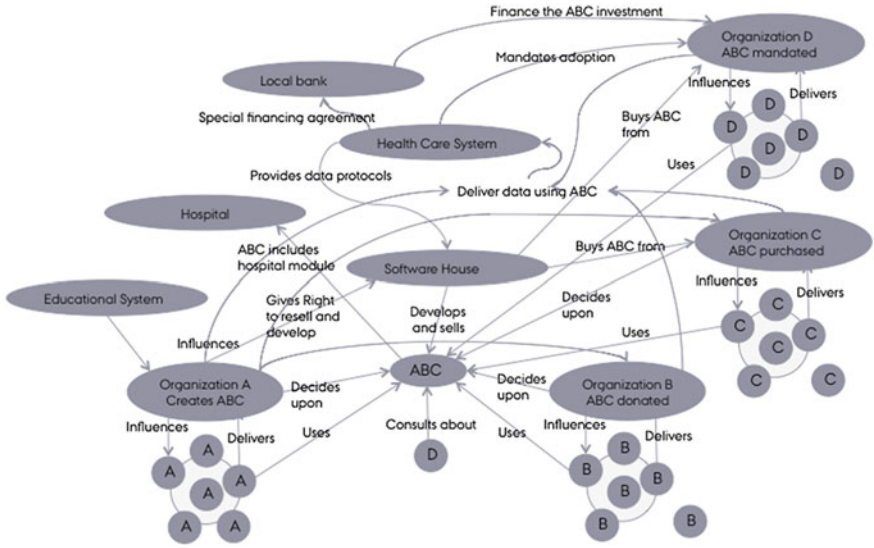

Fig. 6 ABC becomes the mandated solution from the regional health authority

5 Preliminary Contributions

The multi level analysis shows the diversity of emergent network elements and the—mostly unintended—entanglement of technology and networks. Over time we observe 3 main results:

- *Technology evolution is pivotal for network evolution*
- *Actors in the network and network levels are not organized hierarchically: They are emergent, dynamic, and included ad hoc*
- *Network structures do not replicate easily: Technology needs to account for the detail and network studies need to open the box or individual use.*

Technology plays a central role the network dynamics fostering the transformation of a loosely coupled network of organizations into a tightly coupled network [41]. The formation of the network, both at the level of the larger network system and at the individual level, is intimately linked to the state of the technology and emergent ad hoc rather than being the result of a pre-existent multilevel decomposition [37]. When the technology was at early stages and delivering small local results, the network was likewise small and only of closely related actors. In accordance to previous results (e.g. [11]), we find that the autonomy of the development team was instrumental for the initial system success. As the technology began to mature and produce bigger results, the network also began to grow beyond the borders of the initiator. At this stage, the technology played a double role: at the individual level within the organizations it had to be flexible enough to adapt to local needs (e.g. medical doctors refusing to use it or refusing to share their notes), while at the level of the larger network system it had to be standardized enough to be selected by the local health authority and hospitals as the technology of choice for data transfer. The impact of the degree of centralization on success in our analysis seems to be more connected to the fit with the individual and organizational network rather than on the characteristics of the actors in the system [11]. Albeit much of these design choices were the results of educated guesses, the fact that the software catered to the needs of both networks contributed to the positive cycle that brought a home made software created by nurses working from a morgue to be one of the most widespread solutions in the Italian sector of nursing homes … a rare feature indeed!

References

1. Grabski, S.V., Leech, S.A., Lu, B.: Enterprise system implementation risks and controls. In: Seddon, P.B., Willcocks, L., Shanks, G. (eds.) Second-Wave Enterprise Resource Planning Systems: Implementing for Effectiveness, pp. 1–19, Cambridge University Press, Cmabridge (2003)
2. Caporarello, L., Viachka, A.: Individual readiness for change in the con-text of enterprise resource planning systems implementation. Paper presented at the 16th Americas conference on information systems 2010, AMCIS 2010, 2 827–2 836
3. Sumner, M.R.: How alignment strategies influence ERP project success. Enterp. Info. Syst. **3**(4), 425–448 (2009)
4. Wenrich, K.I., Ahmad, N.: Lessons learned during a decade of ERP experience: a case study. Int. J. Enterp. Inf. Syst. **5**(1), 55–73 (2009)
5. Suarez, F.F.: Network effects revisited: the role of strong ties in technology selection. Acad. Manag. J. **48**(4), 710–720 (2005)

6. Powell, W.W., White, D.R., Koput, K.W., Owen-Smith, J.: Network dynamics and field evolution: the growth of interorganizational collaboration in the life sciences. Am. J. Sociol. **110**(4), 1132–1205 (2005)
7. Currie, W.: Contextualising the IT artefact: towards a wider research agenda for IS using institutional theory. Info. Technol. people **22**(1), 63–77 (2009)
8. Northcraft, G.B., Polzer, J.T., Neale, M.A., Kramer, M.R.: Diversity, social identity and performance: emergent social dynamics in cross-functional teams. In: Jackson, S.E., Ruderman, M.N. (eds.) Diversity in Work Teams: Research Paradigms for a Changing Workplace, pp. 69–96. APA, Washington, D.C. (1995)
9. Orlikowski, W.: Knowing in practice: enacting a collective capability in distributed organizing. Organ. Sci. **13**(3), 249–273 (2002)
10. Rossignoli, C.: The contribution of transaction cost theory and other network-oriented techniques to digital markets. IseB **7**(1), 57–79 (2009)
11. Sasidharan, S., Santhanam, R., Brass, D.J., Sambamurthy, V.: The effects of social network structure on enterprise systems success: a longitudinal multilevel analysis. Info. Syst. Res. **23**(3), 658–678 (2012). doi:10.1287/isre.1110.0388
12. Tichy, N.M.: Networks in organizations. In: Nystrom, P.C., Starbuck, W.H. (eds.) Handbook of Organizational Design, pp. 225–249. Oxford University Press, New York (1981)
13. Depaoli, P., Za, S.: Towards the Redesign of e-business Maturity Models for SMEs. In: Baskerville, R., De Marco, M., Spagnoletti, P. (eds.) Designing Organizational Systems. Lecture Notes in Information System and Organization LNISO, vol. 1. Springer, Heidelberg
14. Brass, D.J., Galaskiewicz, J., Greve, H.R., Tsai, W.: Taking stock of networks and organizations: a multilevel perspective. Acad. Manag. Rev. **47**(6), 795–817 (2004)
15. Ibarra, H., Kilduff, M., Wenpin, T.: Zooming in and out: connecting individuals and collectivities at the frontiers of organizational network research. Organ. Sci. **16**(4), 359–371 (2005). doi:10.1287/orsc.1050.0129
16. Magni, M., Pennarola, F.: Stand by me: the quality of interorganizational relationships as antecedent of IT adoption. Proceedings of the 13th European Conference on Information Systems, Information Systems in a Rapidly Changing Economy, ECIS 2005 (2005)
17. Burt, R.S.: Structural Holes: The Social Structure of Competition. Harvard University Press, Cambridge (1992)
18. Granovetter, M.S.: Economic action and social structure: the problem of embeddedness. Am. J. Sociol. **91**, 481–510 (1985)
19. Uzzi, B.: The sources and consequences of embeddedness for the economic performance of organizations: the network effect. Am. Sociol. Rev. **61**, 674–698 (1996)
20. Burt, R.S.: The contingent value of social capital. Adm. Sci. Q. **42**, 339–365 (1997)
21. Boissevain, J.: Friends of Friends: Networks, Manipulators and Coalitions. Basil Blackwell, London (1974)
22. Casalino, N., Buonocore, F., Rossignoli, C., Ricciardi, F.: Transparency, openness and knowledge sharing for rebuilding and strengthening government institutions (2013) IASTED Multiconferences—Proceedings of the IASTED International Conference on Web- Based Education, WBE 2013, pp. 866–871
23. Sorrentino, M.: Taking care of invisible technology. Eur. J. Info. Syst. **14**, 507–509 (2005)
24. Magni, M., Provera, B., Proserpio, L.: Individual attitude toward improvisation in information systems development. Behav. Info. Technol. **29**(3), 245–255 (2010)
25. Burt, R.S.: Structural holes versus network closure as social capital. In: Lin, N., Cook, K., Burt, R.S. (eds.) Social Capital: Theory and Research. Sociology and Economics: Controversy and Integration Series. Aldine de Gruyter, New York, pp 31–56 (2001)
26. Levina, N., Vaast, E.: The emergence of boundary spanning competence in practice: implications for implementation and use of information systems. MIS Q. **29**(2), 335–363 (2005)
27. Carlile, P.R.: Transferring, translating, and transforming: an integrative framework for managing knowledge across boundaries. Organ. Sci. **15**(5), 555–568 (2004)

28. Lave, J., Wenger, E.: Situated Learning: Legitimate Peripheral Participation. Cambridge University Press, Cambridge (1991)
29. Suchman, L.: Making a case: knowledge and routine work in document production. Workplace Studies: Recovering Work Practice and Informing System Design, pp. 29–45. Cambridge University Press, Cambridge (2000)
30. Brynjolfsson, E., Kemerer, C.F.: Network externalities in microcomputer software: An econometric analysis of the spreadsheet market. Manag. Sci. **42**(12), 1627–1647 (1996)
31. Burt, R.S.: Structural Holes: The Social Structure of Competition. Harvard University Press, Cambridge (1992)
32. Pontiggia, A., Virili, F.: Network effects in technology acceptance: laboratory evidence, (2008). ICIS 2008 Proceedings. Paper 130. http://aisel.aisnet.org/icis2008/130 (2008)
33. Cordella, A., Mola, L., Rossignoli, C.: Software market configuration: a socio-technical explanation. ICIS 2009 Proceedings, 154 (2009)
34. Tyre, M.J., Orlikowski, W.J.: Windows of opportunity: temporal patterns of technological adaptation in organizations. Organ. Sci. **5**(1), 98–118 (1994)
35. Orlikowski, W., Hoffman, D.: An imporvisational model for change managment: the case of groupware technologies. Inventing the Organizations of the 21st Century, pp. 265–282. MIT, Boston (1997)
36. Marzo F., Za S., Spagnoletti P.: Modeling Dependence Networks for Agent Based Simulation of Online and Offline Communities, Lecture Notes in Computer Science, vol. 7879, Springer, Heidelberg (2013)
37. Moliterno T.P., Mahony D.M.: Network theory of organization: a multilevel approach. J. Manag. **2** (37), 443–467 (2011)
38. Obstfeld, D.: Social networks, the Tertius Lungens orientation and involvement in innovation. Adm. Sci. Q. **50**(2005), 100–130 (2005)
39. Granovetter, M.: The impact of social structure on economic outcomes. J. Econ. Perspect. **19**, 33–50 (2005)
40. Krackhardt, D., Hanson, J.R.: Informal networks: the company behind the chart. Harv. Bus. Rev. OnPoint, Spring **2011**, 30–37 (2011)
41. D'Urso, P., De Giovanni, L., Spagnoletti, P.: A fuzzy taxonomy for e-Health projects, Int. J. Mach. Learn. Cybernet. **4**(6), xx, (2012). doi:10.1007/s13042-012-0118-4