

NETWORK OF TRUST RELATIONSHIPS IN THE REMOTE WORK MODEL

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Purpose: The article aimed to identify differences in the density of the trust network of team members in different work models (on-site, hybrid, and remote) and to identify opportunities for building knowledge and innovation in such work models based on the trust there. The method of experiment and a social networks analysis (SNA) was used to achieve the goal.

Design/methodology/approach: The research is based on an experiment as part of a strategic business simulation game. The participants of the investigation are MBA students. The variable in the experiment is the work model. In these three different situations, relationships developed in teams are identified. Based on the identified relationships, visualizations of the trust network were built.

Findings: The research confirmed that the hybrid and remote work models minimize the number of trust ties between team members. The network of trust based on the identified relationships is less dense. The decline in confidence leads to the conclusion that a company's innovation and ability to generate new knowledge are now under threat based only on group resources.

Research limitations/implications: Research is based on an experiment. The group subjected to the investigation is MBA students. The limited duration of the experiment may limit the formation of networks of trust (based on long-term, deep relationships). See also a summary.

Practical implications: The results indicate apparent differences in the density of trust relations between the organization's participants in the three analyzed work models. This points directly to the need to adjust tools supporting the development of innovation and knowledge creation for remote work models, different from those known from traditional (on-site) work models.

Originality/value: The study shows that trust relationships, e are more challenging to achieve in remote working conditions than in traditional work models. It gives managers guidelines on what tools (such as SNA) they can use to identify relationships between people in new work models.

Keywords: social networks analysis, trust networks, work models.

Category of the paper: Research paper.

1. Introduction

The economy that we know more and more often develops based on the flow of information and knowledge, resulting in increased innovation. The exchange of thoughts and experiences in the teams dynamically took place, mainly through the excellent organization of the cooperating groups. Of course, the organizations were working on new forms of this cooperation, including remote forms of work, but no one expected such a rapid breakthrough.

The outbreak of the COVID-19 pandemic resulted in an unprecedented development of methods supporting remote work. The need to change the model of daily work does not seem to be a temporary situation. Many changes resulting from the need to adapt to the COVID-19 pandemic quickly will remain with us and become the new standard. Within a few weeks, we had to change our operating methods, and now we have started to recognize the advantages and disadvantages of a new way of working.

Both managers and employees increasingly admit that there is no going back to previous operating models. The new remote-driven digital business models will be much more complex. Thus, the traditional tools and methods used to analyze these complex and dynamically changing data systems no longer meet the performance and maximum coverage requirements. The amount of data collected is increasing—additionally, their complexity increases. Moreover, the relational nature of a large amount of data, such as informal employment relationships, requires appropriate research methods.

Managers currently do not have the possibility of direct observation of their colleagues. They have almost no options for detecting undesirable trends in the existing practical cooperation, exchanging ideas, and building innovative solutions. More importantly, they don't know the most pressing issues to resolve. This research is intended to indicate, to some extent, the possibility of filling this gap.

Tools used in social network analysis, including network visualization, can be a response to emerging changes. It seems that SNA makes it possible to observe dependencies between employees in the remote work model, which can intuitively reflect the differences between the formation of relationships for the three approaches explored in the experiment.

2. Identification of the relationships of the participants in the experiment

2.1. Social Networks Analysis context

Managerial SNA, or Organizational Network Analysis (ONA), connects both networks and visualizations and could provide a solution to this vulnerability. Although it has been a proven human analytics tool for almost 30 years, the level of use is still relatively low (Kutlik, 2019).

Nevertheless, due to new ways of working, changing business requirements, and the constant advancement of technology, interest in SNA is proliferating. The leaders of human analytics indicated this analytical technique as the one they most wanted to know more about (Green, 2018). This is confirmed by recent research results that show that adopting different data sources and different analytical solutions (such as SNA) allows organizations to perform more sophisticated but more efficient analyzes (Visier, 2020).

Social network analysis is a method used in management research to gain insight into the informal organizational practices of employees. Social networks of interest to modern scientists exist both at the organizational level (Gulati et al., 2017) and between organizations (Baker, Faulkner, 2017). Network research helps to explain the essence of social phenomena, from individual creativity to the profitability of enterprises (Borgatti et al., 2009). Social networks understood as organizational networks, create relationships between actors (employees), shaping the everyday work environment. The areas of network analysis, indicated by Borgatti and Halgin (Borgatti, Halgin, 2013), are used to understand labor productivity (Sparrowe et al., 2001), trade (Kilduff, Krackhardt, 1994), promotion (Burt, 1992), project management (Pyrke, 2012), innovation (Obstfeld, 2005), creativity (Burt, 2004) and even unethical behavior (Brass et al., 1998). It is also widely accepted that SNA can be very beneficial in solving various managerial problems depending on the context (Polyakova et al., 2019; Shum et al., 2011; Cross et al., 2009). Moreover, in business consulting, network analyses are diagnostic tools that guide improvement activities (Anklam, 2007; Wasserman, Faust, 1994; Cross et al., 2002).

Taking into account that the network must contain both entities and relations, it is necessary to adopt a definition of the network based on the assumption that the (social) network is a structure of relations or variable relations between actors, also understood as participants in the organization (Wawrzynek, 2015). The adopted definition is consistent with the description given by Lewis (Lewis, 2009). The network defined in this way refers to a specific set of actors $\{1 \dots n\}$ and variables (relations) X_{ij} , indicating the relationship between the actor and the actor j . Due to the existence of two types of network (directed or undirected), the dependencies X_{ij} mentioned in the definition of the network may differ. If the relationship X_{ij} is a directed relationship, it means that X_{ij} is a different relationship than X_{ji} , although they involve the same two actors. In non-target networks, the relationships X_{ij} and X_{ji} will indicate the same relationship. In an organization, relations may describe the network depending on the characteristics of the analyzed relations. Referring to the general principles of the company's operation, one can assume the existence of processes, but also those assigned to those network processes, which are characterized by activity in the field of communication, information propagation, problem-solving, knowledge building, or its distribution.

A social network is a reflection of social relationships. It arises as a result of transforming the respondents' responses in the context of the studied context (communication, cooperation, trust, etc.). As a result of transformations, various networks are built specific to selected research issues and selected areas of the organization (in this case, processes). Social networks

can be targeted or not, can be based on relationships or binary values. Some of them are subject to reversal (Borgatti, Foster, 2003). The method of building social networking sites and issues related to social networking sites are presented in Table 1.

Table 1.
Social networks descriptions

Network Name	Description
Cooperation Network	Presents the relationships arising from cooperation relationships in terms of achieving results, efficiency (doability in the sense of decision-making and agency), as well as the strength of influence of individual people
Communication Network	Presents the connections resulting from the communication of actors in the network along with the occurrence of deeper and lasting relationships based on understanding and trust. It applies to both simple and complex messages
Information Network	Presents connections in relation to informal information about the organization. The structure of informal information circulation helps to explain seemingly incomprehensible phenomena, including negative ones
Knowledge Network	Presents the flow of knowledge acquired in the network from people who are their source
Innovation Network	Presents the connections of innovation and inspiration when creating new ideas and building openness or positive energy in the process of opening up to new solutions
Trust Network	A network of strong social relationships that shape trust, rapport and positive energy, and thus a sense of security, affects the effective use of potential by employees

Source: Authors' own work.

2.2. Network visualizations

One of the possibilities of social network analysis is based on its visualization. The two primary goals of web visualizations are data mining and the transfer of results (Borgatti, Foster, 2003). Therefore, the network visualization should display relevant information from an analytical perspective. It should be mentioned that there are many ways to construct a visualization and a lot of space for designing network visualization algorithms. Web visualizations enable the presentation of otherwise unattainable knowledge. Among the numerous forms of graphic representations of the network are various types of sets, tree maps, and matrices (Welles, Xu, 2018; Alsallakh et al., 2014). The most recent research-oriented reviews can be found, for example, in the works of Munzner (Munzner, 2014) or Grant (Grant, 2018). Nevertheless, the most commonly used network visualizations are node-link diagrams, especially those whose layout is based on an analogy to physical forces between nodes - force-oriented graphs (Okoe, 2018). Their meaning is usually clear and, to some extent, intuitive, even for a person unfamiliar with SNA. In their most basic form, they are designed for general data mining. However, effectively designing a network analysis visualization requires incorporating certain key concepts or network properties to understand better and then draw conclusions on the topic (Borgatti et al., 2018). The presentation of the relationships identified during the experiment will be the basis for inferring the existence of a network of trust in individual approaches to the implementation of the work model.

2.3. Top Team business game experiment

The research is based on a computer-simulated business game. It allows you to observe people's reactions to specific situations and business events. The formula of the experiment is based on an approach in which the primary source of information is people with their knowledge, behavior, and points of view. The context of the experiment is a game in which teams of participants compete against each other in a virtual market to ensure the best competitive position and maximize the company's value. Changes in the simulated market result from the scenario. The scenario, therefore, forces the participants to adapt their strategies and tactics quickly, suggesting the need to combine the forces of individual teams to achieve the best results in the game. The game takes place in a hypothetical future-oriented technology market that creates a business decision context other than that experienced by participants in their professional experiences. The game is iterative and consists of quarterly periods.

In every quarter there are several actions that companies must take—decisions related to investments in technology, distribution channels, or systems that improve organizational development. When the organization's development reaches a certain level, and the markets are increasing, the moment of decision comes. Teams can start cooperating with other groups in the competition model. This cooperation may be based on the operational, production, and technological levels or on sharing distribution channels. It may also be related to tactical cooperation in given markets or offering complementary products.

As a result of the undertaken cooperation, both within the team and between teams, extensive social networks are created based on the emerging relationships between participants. Despite their short duration, they are strongly felt by the participants due to the emotions caused by intense competition.

As part of the experiment, three similar simulations were carried out: the first in June 2019, the second in June 2020, and the third in October 2020. The work model was the independent variable in the simulation. Each complete simulation lasted three days and involved participants for approximately 18 hours. After about ten hours of play, the increasing complexity of the simulated companies naturally stimulated various forms of cooperation between companies.

This has led to the creation of diverse relationships between participants, allowing them to enter into various forms of business collaboration leading to new solutions and business models. These relationships represent various social networks that can be critical in shaping new and efficient digital business models. Understanding the key characteristics of these inter-organizational networks can therefore help managers reposition their teams across business networks to achieve the desired digital business models.

2.4. Data collection

A specific data collection procedure must be carried out to present a network of relations. Network data is more challenging to collect and takes more time to manage than other social science data (Borgatti et al., 2014). There are two approaches to collecting network data. The first is based on the declarative definition of relationships with other people. This method is traditional and often used in social and organizational networks (Monge, Contractor, 2003). It gives a high accuracy of the obtained mapping of relations significant from the point of view of the conducted research. It is characterized by the fact that the networks obtained based on the data collected in this way are exact.

There is, to be sure, a second option based on the observations of the actors' behavior. It could work if we were talking about analyzing the network of contacts, but in exploring the web of trust, such a possibility has no grounds to apply. The researcher's lack of knowledge about the interactions between the actors and the limited options for interpreting the obtained data are among the disadvantages of this approach (Wasserman, Faust, 1994).

Therefore, the experiment used the method of collecting data based on questionnaires. They were put into the context of the conducted research. The disadvantage of this approach is the large amount of work involved in the preparation and process of data collection, inadequate response of the questionnaires, subjectivism, different interpretations of the same question by different people, or possible concealment or other manipulation of data by respondents. To prevent this, it was previously agreed with the participants that such a study would be conducted. The questions (cognitive content) were discussed with them, and the ambiguities were explained together.

To analyze how managers perceive and understand social networks in making business decisions, after 15 hours of simulation as part of the experiment, each participant received a link to a survey in which the questions related to the existence of the relationship. Of course, the questions are arranged so that the entire dependence resulting from their interpretation is reflected in the possibility of confirming the presence or absence of the analyzed relationship (in our case, the relationship of trust between individual participants of the experiment).

To ensure a high response rate, a key factor for properly conducted social network analysis research, we have offered special "market" bonuses that unlock access to interesting business opportunities in the game. The study provided 1,789 indications of network relationships for the office work model before COVID-19, 2,185 for the remote work model after COVID-19, and 1,273 for the office work model after COVID-19.

Referring to the study presented in the article, one should remember the limitations. The one is the limitation resulting from the research method. Limitations of lab-based experimental work have been noticed in literature, e.g., supporting decision-making areas (MacGeorge et al., 2016). They are mostly connected with recruiting subjects who are entirely unacquainted with the issue (lack of domain knowledge) and who form random groups, which

was not the case in our scenario (the subjects were MBA students). Although this criticism is partially justifiable, research has shown that such experiments' results contribute to improving real-life decisions and interventions, which is why this technique is often recommended in publications (Sunstein, Hastie, 2014). For management practitioners, the lessons learned involve incorporating social network analysis visualizations and trying to infer their companies' most urgent troubles, which can increase the chance of successfully progressing in the digital transformation process.

3. Trust networks in various work models - results

The conducted experiment and the data collected during the experiment on the existence of relations between the participants were first analyzed in terms of various networks. As part of the analyzed results, only the relationships constituting the trust networks were examined—trust networks which, in its assumption, may significantly differ due to the work model. Additionally, networks of trust are the ones responsible for building an atmosphere for innovation development (Nahapiet, Ghoshal, 1998; Adler, Kwon, 2002; Moran, 2005).

With regard to the cited method of data analysis, the results of the three groups were compared, and differentiated from the model in which activities related to the competitor were carried out in the market simulated by the computer. The following three figures refer to the on-site work model, hybrid model, and remote work model.

3.1. Onsite Work model visualization (a)

Graphical analysis of the social network based on the trust relationship between the participants in the Onsite work model shows the existence of connections, including indirect ones, between all network participants. There are relationships among the people cooperating in the team, as well as relationships between competing teams. The network trusts are relatively high-density, and there are no single-character gaps between connections. Naturally, more relationships exist between people within a team than between individuals from different groups. In the figure below, the circles represent individuals. Their color is associated with belonging to a team, and their size results from their trust in other participants. The links between the circles reflect the trust relationships that bind them, resulting from the indications.

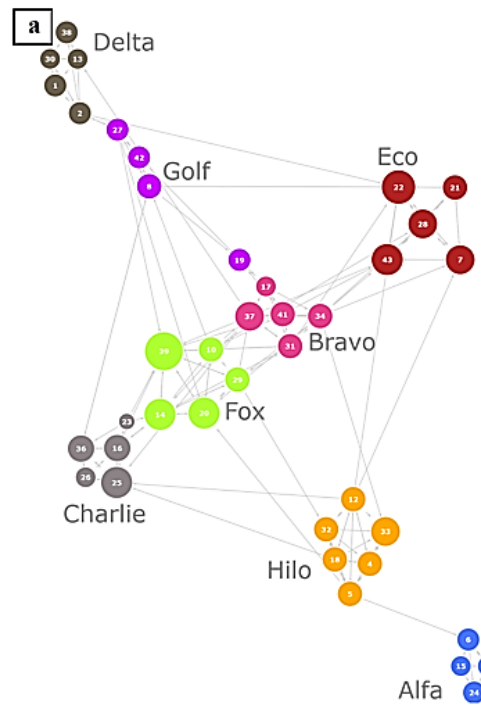


Figure 1. Office Work Model (OWM) – Trust between teams and individuals.

Source: Author's own work.

3.2. Hybrid Work model visualization (b)

The hybrid model indicates a significantly smaller number of trust relationships between participants. The density of relations between participants in individual teams is not low. There is one situation in which there is no relationship between one of the teams and the others (the team marked Golf has no relationship of trust with any of the other teams' participants). However, a detailed analysis shows a clearly more significant variation in the size of knots (circles) within the assemblies compared to the situation described previously. As in the previous visualization, the principles of using colors and the circles' sizes and connections are the same.

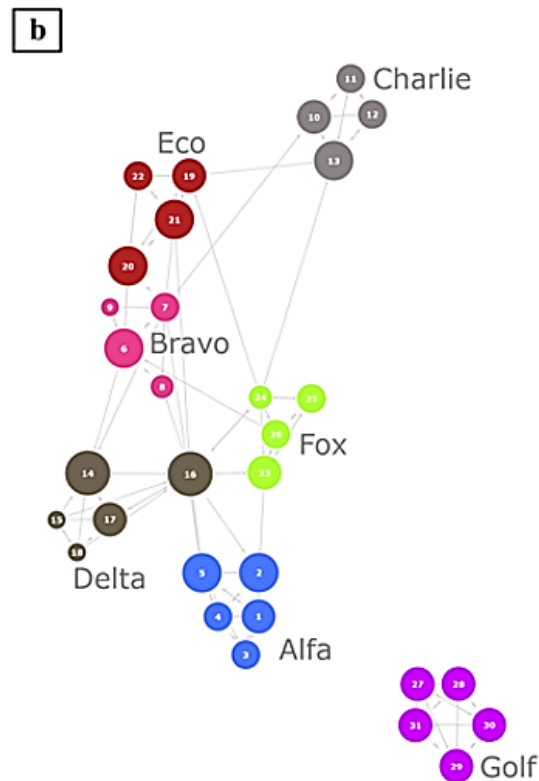


Figure 2. Hybrid Work Model (HWM) – Trust between teams and individuals.

Source: Author's own work.

3.3. Remote Work model visualization (c)

Working in the model indicates a relatively high level of relationship between the participants inside the teams. It could be assumed, based on the indicated visualizations, that the level of density is compared to the situation identified in the on-site work model. The problem is entirely different in the case of the relationship between participants from different teams. There are several teams that have no ties to others (Alfa, Bravo+Delta, Golf). As in the previous visualization, the principles of using colors and the circles' sizes and connections are the same.

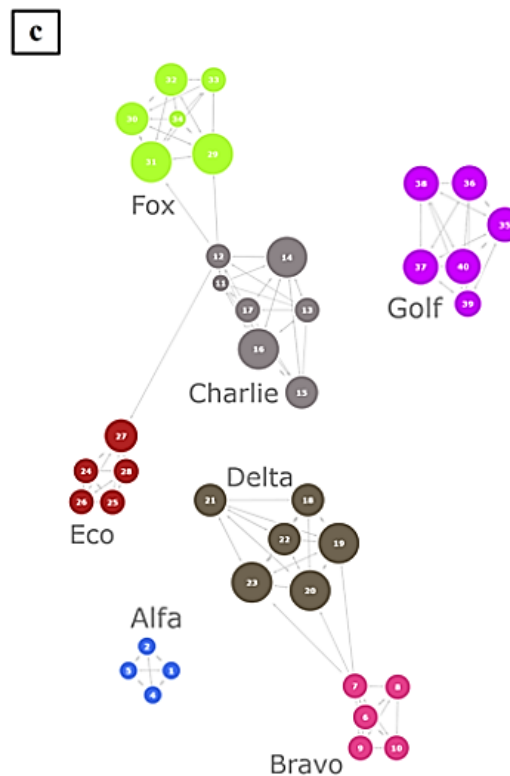


Figure 3. Remote Work Model (RWM) – Trust between teams and individuals.

Source: Author's own work.

4. From the relationship of trust to new possibilities for building knowledge

Coming to the indicated situation of the existence of a lower level of density of trust relationships, which have so far been responsible for the possibility of building new knowledge based on innovation, it is necessary to consider what other options for making knowledge will be available in the new work model (hybrid or remote). The question of the flow of knowledge between groups has been analyzed for a long time (Hansen, 1999). It indicates that necessary knowledge that builds innovation is transferred between groups based on solid relationships. However, this state of affairs does not ever apply to the relationship of trust in new teamwork; the survey research has already taken up the possibility of building new knowledge or innovation without solid relationships. Burt R.S. (1992) conducted exciting research in this area. A few years before Hansen, he formulated the problem of optimizing the intensity of group relations. He derived the theory of the structural hole, in which he proved that social value could be built based on minimizing the number of relationships. This theory applies to magnets (an actor's networks) and the relationship pattern in at least two unconnected social networks. Burt assumes a structural gap (gap) between two independent, unrelated groups. Such

a defined structural gap may occur in the organization between individual, uncoordinated areas and, at the process level, between individual tasks. The network participant who becomes the intermediary is of more importance in such a system.

There is no doubt that the existence of a lower-density network of trust is a fact. The question is whether it results only from the transition from the previous, traditional model of on-site work to the new one, which has not yet developed mechanisms of building trust relations at a similar level as in the conventional model, or whether such a density of trust networks in the new work model will not be achieved. If we assume that the new model will not be a copy of the traditional model from the point of view of network density, then we can see a chance in the new system of relationship formation.

The new system of relationships that can be identified in an organization operating in a remote or hybrid work model may be based on people important from the point of view of the network structure. It is essential because they will play a key role and will take on the burden of maintaining relationships that have hitherto been scattered among many different people.

Of course, we cannot talk about a new mechanism of creating innovation based on the one strong relationship of one of the participants in the network because the invention is defined more broadly and results not only from knowledge but also from the feeling of the possibility of developing it, looking for a new idea or the opportunity of discussing it favorably with people geared to its originator.

The challenge for managers who want to support innovation development within their organizations will not only be to understand the new mechanism of the possibility of building innovation in different ways than traditional work models. Above all, it will be a challenge to find new tools to support them. The mere understanding by the managers that we operate differently today does not give them additional mechanisms to support employees. It seems, therefore, that identifying and visualizing social networks that reflect relations between employees may be a good direction for looking for answers about tools for managers in the new work model layout.

Of course, the tools of network identification and visualization of relations provide the possibility of replacing the observation of people in their daily activities, but they will not replace the processes of supporting the construction of innovation and new knowledge, which cannot be replaced by the mere identification and visualization of relations. Therefore, it is important to identify trust relationships, but you should also constantly monitor the relationship between whether trust in new work models plays such an important role as before.

5. Summary

The postulated economic development is often based on innovation. So far, an element of action has been the flow of information and knowledge through the cooperation of closely cooperating people. However, the pandemic outbreak meant that the work model known for many years would no longer be the only one. Moreover, it can become only a secondary way of getting the job done, not only because of necessity but also because we see its advantages.

The complexity of new business models increases due to the shift in the approach to work performance towards moving away from the on-site work model. Managers no longer have the possibility of direct observation of employees; they cease understanding the group relations that arise between them. They do not see undesirable situations and problems arising on this basis.

The second important issue is that the previous innovation development was based on communicated and discussed ideas. Such communication of ideas was possible only in a situation of trust that the transferred ideas were not [the basis for a negative evaluation or were not appropriated. In the new model of work, perhaps not the high level of trust of all people in the team, but the trust of selected people from one group to chosen people from other areas of the organization may constitute a bridge for exchanging ideas and building innovative solutions.

Both these issues seem to be linked by the SNA, which on the one hand, collects this information. On the other hand, it allows for their research based on visualization. It responds to the need to understand what happens in geographically distant teams (working in remote or hybrid work models). The visualization of the network shows the possible paths of transition between groups based on selected employees who trust each other and as representatives of separate groups.

5.1. Limitations and future research

The first limitation is that market simulation simplifies the emergence and existence of competition and cooperation interactions, potentially influencing the social network structure. The second limitation is related to the inherent nature of the simulation, which obfuscates keeping the same conditions for all three cases. For instance, participants are different. However, even having the same set of people each time would hinder the hypothetical outcomes because after the first game, all people would know how to act during the simulation and the apparent bias appears. Finally, the third limitation is the use of only three simulations compared between one another, which do not provide the possibility of multiple verifications of the research method, the collected results, and conclusions.

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