



# Relations Between Formal and Emergent Structures

A Case Study of Social Network Analysis at the International School of Havana

Oscar Avila Akerberg

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## **ABSTRACT**

Tampereen ammattikorkeakoulu  
Tampere University of Applied Sciences  
Masters in Business Administration  
Educational Leadership

AVILA AKERBERG, OSCAR  
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There is growing interest in studying the relationship between deliberate formal organizational structures in schools and the social relationship patterns that emerge from these. While many schools worldwide are mostly designed and managed based on bureaucratic concepts such as division of labour, formalization or centralized decision-making, the informal structures that emerge within the organization are often overlooked.

Recent studies suggest that the emergent informal structures that are formed through social relationships may positively impact organizational outcomes such as student achievement. It is therefore important to be able to better understand the informal structures, and thus be able to influence and support them to improve school performance.

This case study aimed to build a deeper understanding of the relationship between the formal structure of a school and how it may affect emerging social networks within it. The study used network surveys to collect data from all employees in an international school. Social network theory and analysis was used to explore properties of the informal organization and to contrast these properties with employees' perceptions of the school's formal structure.

The results obtained suggest that a broader understanding of social networks within the school and how these emerge from and influence the formal structure can be beneficial for school administrators.

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Key words: organizational structure, social network analysis, social capital, school improvement

## CONTENTS

1	INTRODUCTION .....	5
2	THEORETICAL BACKGROUND.....	8
2.1	The formal structure in schools .....	8
2.1.1	Key elements in the formal organization structure .....	8
2.1.2	Job specialization and departmentalization.....	9
2.1.3	Chain of command and span of control.....	11
2.1.4	Centralization and formalization .....	12
2.2	Beyond the formal structure .....	14
2.2.1	Social capital .....	15
2.2.2	Social Network Analysis .....	17
3	METHODOLOGY.....	19
3.1	Overview .....	19
3.2	Context.....	20
3.3	Sampling .....	21
3.4	Survey implementation and data collection.....	22
3.4.1	Survey Pre-Test.....	22
3.4.2	The survey.....	23
3.5	Ethical considerations .....	23
3.5.1	Anonymity of surveys .....	23
3.5.2	Researcher and actor .....	24
3.6	Measurements and data analysis .....	25
3.6.1	Formal organizational structure .....	25
3.7	Organizational diagram .....	26
3.8	Social network analysis.....	26
3.8.1	Whole-network measurements.....	27
3.8.2	People-specific measurements: Centrality .....	28
3.8.3	Network communities: Modularity.....	29
4	RESULTS .....	30
4.1	Formal structure .....	30
4.1.1	Lines of authority .....	30
4.1.2	Departmentalization and specialization .....	31
4.1.3	Centralization and Formalization at ISH.....	33
4.2	Emergent structure.....	34
4.2.1	Support network .....	35
4.2.2	Network centrality .....	36
4.2.3	Instrumental and expressive networks .....	38

4.3	Network communities .....	41
4.4	Relations between the formal and emergent structures.....	43
4.4.1	Organization structures .....	44
4.4.2	Perception of centralization and formalization in the networks ...	46
4.4.3	Formal centralization and network centralization .....	47
5	DISCUSSION AND EVALUATION .....	49
5.1	Overview of results.....	49
5.2	Implications of the results.....	50
5.2.1	Defining formal positions based on informal influence .....	51
5.2.2	Diffusion of innovation .....	52
5.2.3	Nurturing networks for better school performance .....	54
5.2.4	Network theory: explanatory and outcome variables .....	55
5.3	Reliability and limitations of the study .....	57
5.3.1	Exploratory case study .....	57
5.3.2	Data collection .....	58
5.4	Conclusion .....	60
6	FUTURE RESEARCH .....	62
6.1	Distributed Leadership .....	62
6.2	Comparative studies .....	63
6.3	Network dynamics.....	63
6.4	Systems thinking .....	64
	REFERENCES.....	65
	APPENDICES .....	69

## 1 INTRODUCTION

Organizational structure refers to the formal pattern of relationships between actors in organizations. It defines the ways in which individuals relate to each other in order to achieve the goals and objectives of the organization (Bauer and Brazer, 2019). Both researchers and managers have focused on theories of organizational structure precisely to better predict the behaviour of organizations and, by doing so, to maximize their efficiency.

However, in designing organizations, or while making decisions pertaining the organization, managers oftentimes ignore the social dimensions of structure—the emergent system of interpersonal relationships that form within the formal organization (Krackhardt and Hanson, 1993; Rank, 2008; Rodway, J. and Daly, A.J., 2018).

The emergent structure appears as a natural order that evolves from the needs of actors as they interact in their workspace by talking about personal, social or organizational issues. The patterns of emergent relationships that develop, and that coexist with the formal organization, have been referred to as the informal or emergent organization (Johanson, 2000; Guimerà *et al.*, 2006; Rank, 2008). The behaviour of complex organizations such as schools cannot simply be predicted and controlled by the deliberate design of formal structures. Traditionally, schools have adopted their structures from Weber's bureaucratic model of organization (Bauer and Brazer, 2019). In its ideal type, the formal organization structure is defined by the division of labour (specialization and departmentalization), hierarchy of authority (centralization), rules and regulations (formalization), impersonality and career orientation (Hoy and Miskel, 2008). However, although the basic and deliberate formal structure of schools is based on the bureaucratic model, a less obvious and probably more important factor in achieving organizational outcomes arises from the interaction between the formal and the social-relationships structures (Rank, 2008).

Social capital is generally defined as the actual and potential resources that are embedded in the relationships between individuals in an organization (Lin,

2001; Adler and Kwon, 2002). Social capital benefits organizational members by providing them with access to resources that they would otherwise not have on their own. Social capital plays a key role in the development of organizations, as it provides (or hinders) the necessary conditions for individuals to work better together.

There is growing empirical evidence of relationships between the social capital in schools and their performance (Dika and Singh, 2002; Leana and Pil, 2006; Moolenaar, Sleegers and Daly, 2012). However, while the importance of identifying and nurturing social capital through the emergent social-relationships structure is evident, school leaders and managers still lack the necessary tools to study the organization through the social-relationships lens. By using social network analysis, administrators in schools may gain empirical data on different levels of organizational performance and could thus make more informed decisions in order to better achieve explicit goals.

This study aims to reveal the social relationships structure of the International School of Havana (ISH) and to compare it with parts of the formal, or bureaucratic, structure. In particular, the study aims to answer the questions:

1. What are the similarities and differences between the formal organization and the emergent structures of the school? And, how can such comparison inform administrators to improve school performance?
2. How can we quantitatively measure centralization in the school and how does this compare with the employees' perception of centralization?
3. What can administrators learn from using a social network analysis in their own organizations?

The objectives of the study are thus:

1. To build two structural maps of the school. One map is based on vertical authority and horizontal departmentalization (i.e. an organizational chart); and the other is based on the social interactions between all employees.

2. To determine whether there exists a correlation between centralized decision-making and network centralization; and between centralized decision making and cohesion of the network.
3. Through social network analysis, to identify the areas which are relevant to school improvement, for use in conducting future investigations.

To do this, a case study was conducted at ISH. Social relationships data as well as perceptions of centralization and formalization were collected through a saturation survey given to all employees at the school. A social network analysis was conducted to quantify measurements of network centralization and emergent communities within the organization.

Both the formal organizational chart and the network structure of ISH were obtained and compared. The comparison reveals discrepancies in the centrality, or influence, of organizational actors between the formal and the emergent structures. In addition, a direct correlation between the perception of centralization for sub-groups in the organization and the centralization of the corresponding networks was found.

The results have many implications for school leaders and for researchers alike. For instance, organizational design and allocations of formal positions at the school may be chosen based on the structural positions of actors within the social network. Moreover, new school initiatives may be more efficiently implemented by targeting the actors with greater influence in the network. Finally, these results may serve as a reference to improve school performance by making deliberate efforts to increase network cohesion. This can be achieved, for example, by intentionally creating environments that foster collaboration between support staff, administration and teachers.

## 2 THEORETICAL BACKGROUND

### 2.1 The formal structure in schools

*"Every organized human activity, from the making of pots to the placing of a man on the moon, gives rise to two fundamental and opposing requirements: the division of labour into various tasks to be performed, and the coordination of these tasks to accomplish the activity. The structure of the organization can be defined simple as the sum total of the ways in which it divides its labour into distinct tasks and the achieves coordination among them."* Henry Mintzberg (1989).

The structure of schools refers to the formal patterns of relationships between people in the organization. It expresses an explicit form of the ways in which the employees relate to each other in order to attain organizational goals and objectives. The formal structure includes all the rules, policies and procedures that define what employees are supposed to do and how to perform their work. It also defines how jobs and tasks are divided and who has authority over whom (Hoy and Miskel, 2008; Bauer and Brazer, 2019). Almost all organizations today, including schools, have a number of the characteristics proposed by Max Weber: specialization, division of labour, an impersonal orientation, hierarchy of authority, regulations and rules and a career orientation. In the ideal type, Weber's model represents the bureaucratic structure of schools.

#### 2.1.1 Key elements in the formal organization structure

Organizations are influenced by dimensions that describe the organizational design traits (Daft, 2010). Daft characterizes organization dimensions into two different categories: The structural dimensions provide the terms to describe organizations from an internal perspective and to be able to compare them with other organizations. The contextual dimensions characterize the whole organization, including the environment in which it operates, its size and goals. These



describe the organizational setting within which the structural dimensions are defined (Daft, 2010).

The structural dimensions are intentionally, and often explicitly, defined in organizations; they are carefully crafted in order for the organization to achieve its goals in an efficient manner. When designing and managing organizations such as schools, managers often decide on aspects such as vertical control and horizontal coordination.

The structural dimensions of organization have been studied and quantified (Pugh *et al.*, 1968; Wang and Ahmed, 2003). While there are small differences in nomenclature, most of the classifications of dimensions of organizational structure define aspects related to the structuring of activities as well as the concentration of authority.

### **2.1.2 Job specialization and departmentalization**

One of the basic concepts of organization structure is being able to divide the work into specialized tasks and organize these into distinct units. Job specialization refers to the extent to which the overall goal of the school can be subdivided into smaller component parts. For instance, a school may employ the director, principals, teachers, counsellors, and a range of support staff including bus drivers, cleaning staff, accountants and so on. At a larger level each of the different jobs contributes to the overall goal of the school organization.

Job specialization is an important concept for organizations for various reasons. The biggest benefit obtained from job specialization is the expertise that employees develop by repeating their tasks over time. As school employees become better at their jobs, their efficiency and productivity improves. Second, job specialization allows for a range of different tasks to be performed simultaneously. For instance, in a school various tasks such as teaching, budgeting, cleaning, and coordinating can occur at the same time by different people. Finally, job specialization allows for wage economics in the organization. Thus a

highly complex job can be staffed with skilled personnel while simple jobs with unskilled staff.

On the other hand, despite its benefits, overdoing job specialization in schools can lead to monotony, boredom, fatigue and, ultimately, low morale. This in turn can lead to high turnover or a lower quality of work produced.

Once the school is divided in a range of specialized jobs, these may be grouped into organizational units such as divisions, departments or teams. This division of jobs into subsets is also referred to as departmentalization. One of the most common ways to divide the organization is by functional units where people perform similar or related tasks.

Departmentalization in schools can adopt various forms including dividing the organization into primary and secondary; the IT or finance department; or subdividing into different teaching departments such as the math, science or language departments. Departments also indicate hierarchical relationships as, often, each department has a “head of department”, for example, the head of the IT department, the secondary and primary principal, the middle school coordinator, or the head of science department. This way of organization is typical of functional departmentalization, where people are grouped together based on similar expertise levels in the functional area. The relative ease of decision-making and coordination represent an advantage of functional departmentalization, as the department heads need to be familiar only with a specific set of skills. However, functional departmentalization can have some disadvantages too. While people in departments can develop highly skilled qualities, they may also develop very narrow viewpoints of the organization and thus lose sight of the holistic or systemic perspective of the organization. In addition, communication and coordination across departments can be difficult at times as each division focuses on their own responsibilities and interests only.

### 2.1.3 Chain of command and span of control

The *chain of command* in an organization refers to its hierarchy of reporting relationships. It is associated with the flow of authority and responsibility within organizations. The chain of command represents a line of authority that links people in the organization and shows who reports to whom. It acts as a formal representation of hierarchical authority, or vertical division, within the organization. Positions at the top of the hierarchy have more formal authority than positions at the bottom. For instance, if a problem or a complex situation arises that the personnel don't know how to act or respond to, it can be referred up to the next level in the hierarchy. Once someone in a higher level solves the issue, the answer can be passed down. In schools there are typical vertical differentiations of positions ranging from the board of directors, the director, principals, coordinators, teachers and students.

*Span of control* usually refers to the number of individuals reporting directly to a supervisor. The span of control can widely vary across and within organizations. The distribution of span of control in an organization effectively determines whether it is a tall (with many middle managing positions) or a flat (with few middle managers) structure (Daft, 2010). Within organizations, it is common to see a wider span of control at lower levels of the hierarchy. Since employees at the lower levels typically perform more routine tasks, they are therefore easier to supervise and control. Although some agreement exists that there is a limit to the number of people a manager can effectively supervise, there is no agreement on the precise number. Lunenburg (Lunenburg, 2010) suggests six critical factors in determining the appropriate span of control.

1. Similarity of functions: As the similarity of functions to be supervised increases, the span of control should be larger.
2. Geographic proximity: As the functions to be supervised are more geographically dispersed, the span of control should be smaller.
3. Complexity of functions: Span of control should be smaller for subordinates performing more complex functions than those with simpler tasks.
4. Degree of interdependence among units: Span of control should be smaller for a larger need of coordination between interdependent units.

5. Level of motivation of personnel: Higher levels of motivation among personnel allow for a larger span of control; and similarly, larger span of control increases motivation as it may cause employees to feel greater ownership of their work.
6. Competence of managers: The ability of managers to delegate authority varies across and within organizations. The span of control for managers who can delegate more responsibility can be much higher than those who can delegate little authority.

#### **2.1.4 Centralization and formalization**

A key concept of organizational structure is the degree to which authority is delegated between superior and subordinate members of the organization. The cumulative effect of this delegation of authority can have a great impact on the organization. The concept of centralization/decentralization is related to the degree to which authority is concentrated or dispersed. While delegation of authority usually occurs at the individual level, decentralization is systematically dispersing decision-making and power within the organization. On the other hand, a systematic concentration of authority and decision-making at the top results in a centralized organization. No school organization is completely centralized or decentralized. Rather, schools lie in between these extremes on a continuum. There are a number of characteristics that can determine how centralized/decentralized a school is relative to others (Lunenburg 2010). These include:

1. The number of decisions made. The more decisions teachers, or those in lower levels of the hierarchy, can make, the more decentralized the school is.
2. The importance of the decisions. If members at lower levels in the hierarchy can make important decisions (for example, those related to budget or decisions that would commit the school to a new direction), the more decentralization there is.
3. The scope of the decisions. If the decisions at the lower level affect more than one function or department, there will be more decentralization.

4. The amount of checking with an authority figure. In a highly decentralized school, teachers (or personnel at lower levels of the hierarchy) can make day-to-day decisions without directly consulting with their line managers.

There are many advantages associated with decentralization in school systems. For example, it makes better use of human resources; it takes away the burden for higher administrators to micromanage; it allows decisions to be made by skilled and specialized personnel close to the front line where the issues that matter occur; and finally, it allows for a quicker response to external fluctuations and a changing environment. Nevertheless, complete decentralization would not be desirable either, as different units require adequate coordination. The question for schools is, therefore, not whether to have a centralized or decentralized decision-making system, but to consider the extent to which decentralization may help in achieving the institutional goals.

*Formalization* refers to the extent to which an organization explicitly specifies a set of rules or codes to govern how work is done (Burton, 2011; Daft 2010). These rules or codes include policies, job descriptions, protocols, procedures and regulations written and explicitly articulated.

One of the simplest ways to coordinate the work in an organization is through formal rules and regulations that mandate how work is to be done, by whom and under what circumstances and constraints. Formalization is high if these written rules are detailed and documented as policies, and are constantly communicated to personnel. It is also possible to have a high level of formalization even when rules are not written down. Rules can be communicated verbally, through training in the institution or by the modelling of behaviours that are expected to be learned over time by all employees. An important aspect of formalization is that it demands clear expectations for how tasks or jobs should be done. Usually, high formalization also involves feedback mechanisms to monitor whether work processes according to the expectations. In addition, in highly formal organizations there are clear consequences for breaking rules.

If, on the contrary, an organization doesn't have an extensive set of rules, or if these are unaccepted or not followed through, the organization will have a low

level of formalization. If the formalization is low there is higher flexibility in the procedures and methods used to coordinate an organization. In addition, rules may change over time and adapt to different circumstances. At the extremes, highly formal organizations are bureaucratic and stifling while organizations with no formalization can become chaotic. Practically, organizations operate between the two extremes, and ideally adopt the form of formalization best suited to achieve their purpose.

## **2.2 Beyond the formal structure**

Beyond the formal arrangements and definitions of organizations, there is a less obvious and not immediately perceivable dimension: the day-to-day social interactions of employees. These social interactions can be based on friendships, on employees seeking advice, or different types of collaboration.

Researchers are working to understand school organizations from many different viewpoints (Rodway, J. and Daly, A.J., 2018). However, there is a significant lack of knowledge and understanding about how things get actually done, how individuals interact socially within the organization, and what the organization does to facilitate this interaction. When dealing with issues of school improvement, staffing, budgeting and collaboration, many schools focus on human capital and formal structures of operations. However, a relational perspective focusing on the interdependence of people, policies and processes is still missing as a practical way to approach these issues (Moolenaar, 2012; Rodway, J. and Daly, A.J., 2018). The distinction as well as the interaction between the formal and informal organizational structures has been subject of various studies (Baker, Gibbons and Murphy, 1999; Johanson, 2000; Scott, 2003; Watson and Weaver, 2003; Rank, 2008). The formal structures of organizations are regarded as the result of deliberate design and decisions aimed at maximizing effectiveness to attain organizational goals. The informal networks develop as the patterned interactions between the members of the organization. These patterns of social interaction are formed as a result of communication, cooperation and competition between actors. As the actors in the organization seek to attend to needs, emergent structures and ways of organizing arise. As a result,

the behaviour of the organization is not only determined by the formal expectations of the school, but also by the informal structure that emerges as members interact with each other. The informal organization is continually emerging from the formal and consistently influencing it.

For this reason, understanding how informal organizations emerge within the school as well as how they behave is very important for managers. School administrators need to recognize the existence of informal structures and try to influence these structures to align them better with the organizational goals. It is therefore important for school administrators to intentionally design formal structures that will enable teachers to have access to the resources embedded in social relationships and, by doing so, develop a shared commitment to the goals of the organization (Penuel *et al.*, 2009).

### **2.2.1 Social capital**

Social capital is a concept that has been widely used for decades to explain the intrinsic value created by the interpersonal relationships that exist in social groups. In broad terms, social capital can be referred to as the resources that are embedded in and exchanged through social interactions within a particular social network (Lin, 2001). At its core, social capital represents the availability and access to various resources through social interactions (Adler and Kwon, 2002). Resources can include knowledge, advice, expertise, social support, influence in a group, friendship, etc. Social capital therefore focuses on whom you know, the resources that may be available through specific relationships, and the advantages or disadvantages resulting from those interactions. Therefore, social capital is linked to the value of having access to various resources through social relationships.

Most of the definitions of social capital emphasise two aspects: the embedded resources and the network location (Carolan, 2014). First, the actual resources embedded in relationships to which one can directly or indirectly have access. For instance, the resources, or assets, such as advice, information or status may be available through network ties. Second, network location refers to direct

or indirect access to resources depending on proximity to those resources. For example, an individual who is close to others with high status would benefit more than one who is not. When the emphasis of social capital is on embedded resources we refer this to network content, whereas a focus on network location is also referred to as network structure.

Nan Lin defines social capital as *"the resources embedded in one's social networks, resources that can be accessed or mobilized through ties in the networks"* (Lin, 2001). The main sources, according to Lin, for social capital are 1) the structural positions of actors with respect to the hierarchical structure of social stratification, 2) the network locations of particular actors, and 3) the purposes of action or relationships, such as instrumental (those relationships related to work matters) and expressive (those relationships related to personal wellbeing).

Social capital has been studied widely and is also increasingly seen as a predictor for group and organizational performance. There is a growing interest in the study of social capital as an explanatory variable for school performance (Dika and Singh, 2002). For instance, through an empirical study Leana and Pil (2006) provided evidence that social capital has an impact on student performance in mathematics through improvement in the quality of instruction by teachers (Leana and Pil, 2006). The work of Alan Daly and Nienke Moolenaar also points at a direct relationship between teachers' social capital, as measured by teachers' professional connections, and student performance (Moolenaar, Slegers and Daly, 2012; Daly *et al.*, 2014).

Depending on the definitions used, social capital can be measured in a variety of ways. According to Lin's definition of social capital, network locations and embedded resources are to be emphasized. To do this scholars have turned to social network analysis and theory, as it provides precise and quantifiable definitions (Rodway, J. and Daly, A.J., 2018).



### 2.2.2 Social Network Analysis

The goal of social network analysis is to better understand a community by mapping the relationships that connect each of the individuals as a network (Marin and Wellman, 2014). A social network approach requires a shift of paradigm, switching the perspective from the elements, or actors, in an organization to the different types of relationships and interactions, or links, that connect resources, policy and people within school systems. Relationships can be of different dimensions (Borgatti and Ofem, 2010; Nonino, 2013). People can be friends or colleagues, they can exchange knowledge, they can like each other (or not), they can help each other, they can trust each other (or not), and so on. A relational perspective of a school structure requires imagining constellations of simultaneous social networks, with each bringing different effects and social consequences, some of which may be positive and others negative. Each school (or classroom or system of schools) represents a unique relational ecosystem that is influenced by a variety of factors and, in turn, influences the school organization (Daly *et al.*, 2014).

Social network theory and analysis offers specific definitions. Specifically, a network contains a set of actors (also referred to as network nodes) who are connected to each other by sharing resources through connections called ties (also referred to as network links). The nodes, or actors, in a network are most commonly persons, groups or organizations. In principle, any unit that can be connected to another unit can be studied as a node (Marin and Wellman, 2014). The network can therefore be determined by choosing a set of nodes and identifying the links between them. From this perspective, a network is defined not by the goals or joint work in an organization, but rather by the exchange of resources that occur within the organization itself.

Social networks are usually shaped by the purpose or content of the social resources that are exchanged within the network (Lin, 2001; Moolenaar, 2012). Studies suggest that the exchange and distribution of resources in a network depends on the content of the network. For example, a social network that is built and maintained with the purpose of sharing expertise and work-related

knowledge will probably look very different from a network that was originally built for personal support and personal matters.

A classification of the nature of the ties within a network can be beneficial in better understanding an organization based on its social network behaviour. Ibarra (Ibarra, 1992) identified three types of ties within networks: prescribed ties, instrumental ties and expressive ties. *Prescribed ties* are interactions that are dictated by external agents (for example the director or any other person with authority). Where it is mandated to meet to discuss work related matters, for example to evaluate students of concern, the exchange of information represents a prescribed relationship.

*Instrumental ties* encompass social interactions that directly affect the way actors perform their work and which are ultimately aimed at achieving the goals of the organization. For example, instrumental ties can be related to teachers seeking advice or expertise from other teachers to construct a unit, or from a member of the IT department for help with troubleshooting computer issues.

*Expressive ties* are formed through social interaction that is not directly related to work matters. These ties represent the affective components of relationships, such as trust, friendship or personal support. Generally, expressive relationships are believed to be stronger and more durable (Ibarra, 1992)

### 3 METHODOLOGY

#### 3.1 Overview

This study aims to start an exploration of the relationship between the formal deliberate structure and the emergent social-relationship structure of the International School of Havana. The investigation was done in the format of a case study. A case study is an appropriate approach to gain in-depth understanding and detailed knowledge of a specific research target such as a school (Ojasalo, Moilanen and Ritalahti, 2020). The knowledge and understanding produced through a case study can help produce suggestions for future development. In addition, case studies allow the study of specific target groups as entities rather than exploring broader issues through larger populations or a collection of groups. Both quantitative and qualitative analysis, or a combination of both, are typical methods used for case studies.

For the purposes of the research, most of the data gathered was quantitative in nature. All of the data was gathered through surveys given to all employees at the International School of Havana and through interviews with a few members of the leadership team.

The data gathered aimed to address the objectives of the study:

1. To build two structural maps of the school. One map is based on vertical authority and horizontal departmentalization (i.e. an organizational chart); and the other is based on the social interactions between all employees.
2. Through social network analysis, to identify the areas which are relevant to school improvement, for use in conducting future investigations.
3. To determine whether there exists a correlation between centralized decision-making and network centralization; and between centralized decision making and cohesion of the network.

### 3.2 Context

The International School of Havana (ISH) is a K-12 international school located in Havana, Cuba. The school was founded in 1965 under the name The Hillside School, with the purpose of providing the foreign community in Cuba, particularly families serving in diplomatic missions, with formal education. Currently, ISH is located in the Miramar district, where most of the embassies in Havana are located. The school consists of two separate campuses, one on Calle 18- for early years, primary and middle school students- and one on Calle 22, for high school students in grades 9 to 12.

In the current academic year 2021-2022, there are 248 students enrolled (132 in primary school and 116 in secondary school), with the top learner nationalities being Spanish, Italian, Argentinean and French. The school hosts students from a total of 55 nationalities.

The school employs 42 local teachers and teaching assistants, 29 local support staff, and 16 local administrative staff. There are 16 expat teachers who hail from eight different countries, with the largest group being Canadian. Among the foreign teachers there are also five full-time administrators, including the director, two divisional principals, a curriculum coordinator, and a counsellor.

In its origins, the school aimed to serve the foreign community, particularly the diplomatic families in Cuba. For this reason, the local government does not officially recognize the school. On the contrary, the school is regarded as extra-official adjunct to the diplomatic community in Cuba. The umbrella host country organization is therefore the MINREX (Cuban Ministry of Foreign Affairs).

The board of governors is self-perpetuating. It consists of a minimum of eleven members out of whom five must be from the diplomatic community and three of which must be Heads of Mission. The chairman of the Board must be a Head of Mission.

In August 2020 a completely new Leadership Team began its work at the school with the arrival of the current Director and the current Primary and Sec-

ondary Principals. They arrived at an unprecedented time due to the COVID-19 pandemic and had to lead the organization at a time when there were no protocols in place to address the urgent need to implement distance learning. In addition, the new Leadership Team arrived at a very challenging time, following the decision by the previous administration to release a large number of employees, without forewarning, on the last day of the previous school year. Most of the current staff is still trying to manage the stress caused both by the layoffs of staff and the continued unpredictability due to the COVID-19 pandemic.

### **3.3 Sampling**

We conducted one survey at the International School of Havana, Cuba. Due to the nature of the analysis performed, a survey was given to all employees using a saturation sampling technique (Agneessens and Labianca, 2022). In contrast to other social science surveys that collect samples of subsets in the population to later generalize the results (Andres, 2012), whole-network studies often require collecting data on relationships among all actors in the target population (Marsden, 2016). This is because network analysis requires data of the relational properties of all actors. This method for data collection is most appropriate when the network's boundaries are clearly specified. For this to be realistic, the sample should be done in relatively small populations.

The survey was sent to all staff in the school. This survey intended to acquire data specifically related to each individual actor's perception about centralization of decision-making and formalization of documentation in the school. It was also intended to collect data to investigate the properties of the whole network. Surveys to assess the whole network usually implement some variant of the sociometric test developed by Moreno (Fox, 1987). The basic technique of the sociometric test asks each individual  $i$  in the network to identify other individuals  $j$  with whom she has a specific type of relationship. This yields a matrix  $a_{ij}$  based on the person  $i$ 's choice of  $j$ 's. In addition, the relative strength of the link can be obtained through the frequency of interaction between the two actors (for example, person 3 talks about work every day with person 9, but only once a week with person 5). The survey aimed to gather data related to two

types of relationships: instrumental (or work-related) and expressive (or personal) ties (Moolenaar, 2012). The instrumental relationships were assessed through the network content of professional support, whereas the expressive relations were assessed with personal advice.

In order to assess the key elements of the formal structure of the school, including the vertical line of authority and horizontal departmentalization, interviews were done with the top management team: the school director, the business manager and the primary and secondary principals.

### **3.4 Survey implementation and data collection**

In order to arrive at the final version of the survey, a test survey was created and implemented with few individuals. Once the surveys were finalized, they were given to all employees at ISH.

#### **3.4.1 Survey Pre-Test**

Surveys should always be tested in small populations before their final release (Ojasalo, Moilanend and Ritalahti, 2020). Once we obtained permission to carry out the investigation from the director of the school, a test survey was implemented with a small sample of the population. This sample was intentionally chosen from administrators and teachers who would provide honest feedback with constructive criticism. In total, five individuals were given the surveys. After receiving feedback from the sample group and taking into account the particular and delicate situation of the school and the current low levels of trust between governance, leadership and staff, some of the questions of the original survey were omitted. This new survey included the "bare minimum" information needed to conduct the data analysis.

### **3.4.2 The survey**

After the final version of the survey was approved, the surveys were printed and personally given to each employee in the school. This was an active strategy to get both the management and employees engaged in the process (Agneessens and Labianca, 2022). The reason why the surveys were printed, as opposed to being sent online, was to gain trust in the study and its method of data collection. Given that the success of the methodology relies on obtaining broad data from most of the actors in the organization, special attention had to be given to the means of gathering data. Currently the school climate is tense, and obtaining personal information and opinions about the structure and organization of the school can be sensitive. The fact that the data analysis requires survey responses to be non-anonymous also adds another level of complexity. This is why we chose to print the survey and individually ask all employees of the school to fill it in.

As the responses came in, these were logged from the hand-written surveys to matrixes using Google sheets and Microsoft Excel. Once ready, the data was then imported in two separate sheets to a network graphics and analysis software (Gephi). One included the nodes and the other one the links. All network graphs and the statistical information were retrieved by various algorithms already available in Gephi.

## **3.5 Ethical considerations**

The ethics associated with a network analysis given the current situation at the International School of Havana needed careful consideration.

### **3.5.1 Anonymity of surveys**

In order to carry out a social network analysis, detailed information that directly relates to specific individuals is needed. For this reason, the surveys could not be fully done anonymously. The potential ramifications of poor data collection

for network analysis, including an accidental (or even intentional) data breach can affect employee's wellbeing, for example by influencing their job appraisals, potential for advancement or likelihood for non-extension of contracts. For these reasons, all data containing the identification of individuals was treated carefully. For instance, a series of steps were taken in order to treat the data with more confidentiality. The first step was to distribute the surveys personally and on paper. By doing this, I was able to speak with every member of the community, explain the reasons why this investigation was being made and gain trust with the respondents. Second, although the survey was not anonymous, at no point were any names written on the survey. Instead, in order to identify themselves, and to select the targets for the social network analysis, the respondents were given an identification sheet that contained the names of all staff labelled with a code (see appendix). The answers were therefore coded, thus preventing from immediate identification any particular staff member, in case any other member of the community accidentally saw a completed survey. In addition, in logging the data in the computer, a different key that linked the codes with new numbers was used. All those new numbers were used as the final input for the data analysis. This step was taken so no one could identify an actor (even if they had the original key associating names with codes) once the final analysis was complete.

### **3.5.2 Researcher and actor**

One more complication that requires ethical consideration is the fact that while I am the researcher conducting the investigation, I am also an actor in the networks that were being constructed. Collecting data as a member of the community can be sensitive since I would have access to information that nobody else would. In fact, for this reason a couple of top managers decided not to respond to the survey. In addition, a further potential complication that requires ethical consideration lies in the fact that the researcher has a very close and personal relationship with the secondary principal, who is part of the senior leadership of the school. To address this point, I made it clear to all respondents that this is an independent investigation that has no relation with the governance, leadership and management of the school. While the results will provide information



for recommendations to the board of governors and the director, any information shared will only relate to overall network characteristics. No information will be ever released on individual actors. Indeed, the individual data will be treated confidentially and only results pertaining to the general properties of the network will be publicly available. All survey respondents were informed of the specific goals of the research and the implications for the improvement of the school.

### 3.6 Measurements and data analysis

Consistent with the conceptual framing mentioned above, the methods focus on the quantification of the formal organization structure through a set of parameters and the uncovering of the relational structure through its social capital, quantified by social network analysis.

#### 3.6.1 Formal organizational structure

The measures of formal organizational structure were obtained from quantitative and qualitative data from the leadership and management of the school. The variables measured to determine the formal organizational structure are shown in the following Table 1 (Lunenburg and Ornstein, 2022):

TABLE 1. Variables determining the formal structure of the school and the guiding questions to assess them.

<b>Formal structure variable</b>	<b>Guiding Question</b>
<b>Specialization</b>	To what extent and to what degree are the activities and tasks subdivided into separate jobs?
<b>Departmentalization</b>	What is the basis for grouping jobs together?
<b>Chain of command</b>	To whom do individuals in the organization report?
<b>Span of control</b>	How many people report to a particular manager or leader?
<b>Centralization</b>	Where does the decision-making authority lie in the

	school?
<b>Formalization</b>	To what extent are the school's policies, rules, job descriptions, procedures and rules written and explicitly articulated?

While data for all key elements of the formal organizational structure was gathered from a sub-sample of the population consisting of managers and leaders in the school, all employees reported on their perspective related to centralization and formalization of the school.

### 3.7 Organizational diagram

An organizational diagram (or chart) is a visual representation of the structured relationships among the people and the tasks they perform. In order to construct the organizational diagram of the school, both horizontal and vertical components of the variables were analysed. The degree of horizontality or verticality of an organization can be obtained through the analysis of above-mentioned variables. Specialization and departmentalization provide a measure of horizontality while chain of command and span of control represent the verticality of the organization.

### 3.8 Social network analysis

Social network analysis is a common technique used to analyse patterns of relationships in a systematic manner. It aims to understand how the actions or perceptions of individuals are situated in structural configurations (Moolenaar, 2012; Scott and Carrington, 2014). To measure the relational structure of the organization, we focused on both instrumental (work-related) and expressive (personal-related) relationships (Rodway, J. and Daly, A.J., 2018). The instrumental relationships were explored through two questions: Whom do you turn to for support related to your work? (support), and whom do you go to for work-related advice? (advice) (Moolenaar, 2012)

In addition, the strength of the links for both instrumental and expressive relationships was obtained by measuring the frequency of interactions. For this, respondents had to answer questions regarding both the people with whom they relate as well as the frequency of their interactions. To do this, respondents selected a number (3 - very frequently, 2 - frequently, 1 - less frequently) to quantify the frequency. This number was added to the network matrix as the edge weight variable.

### 3.8.1 Whole-network measurements

We used social network measures of density, average degree centralization and average path length for both the instrumental and expressive networks.

The density of a network can be calculated by the proportion of existing ties to the maximum number of ties possible in the network. For example, in a network with ten actors ( $N=10$ ), the maximum number of ties possible for this network is 90 ( $N*(N-1)$ ). If, on average, each actor is connected to three other actors, there would be 30 connections, giving a network density of 0.33. Network density is highly dependent on size. Indeed, as the size of the network increases linearly, the possibilities of connections increase exponentially. For instance, even if all actors in a network have an average of, for example, five connections each, as the network size increases, the density will decrease exponentially.

Centralization of a social network refers to the difference between the degree-centrality (the amount of links joining a node) between a highly central actor and more peripheral ones. A highly centralized network is one where many of the links will run through one or few highly central actors. To calculate the centralization of a network we used the algorithm developed by Freeman (Freeman, 1978). Centralization can thus be calculated by:

$$Centralization = \frac{\sum_{i=1}^N (c_{max} - c_i)}{(N-1)(N-2)} \quad (1)$$

Where  $c_i$  is the number of in-degree connections for node  $i$ ;  $c_{max}$  is the maximum number of in-degree connections for all nodes, and  $N$  is the number of

nodes. Centralization can have a value between 0 and 1. A centralization of 1 would represent the most centralized network possible (with one node having  $N-1$  in-degree ties and all other nodes having 0).

A path length measures the number of nodes to reach a particular node. The average path length of the network is the average distance for all nodes in the network. A smaller average path length will indicate that, on average, it will be easier for a particular node to be connected to another one as compared to a higher average path length.

### **3.8.2 People-specific measurements: Centrality**

Measurements related to individual actors, or nodes, include in-degree and betweenness centrality (Brass, 1995). Degree simply measures the amount of links a specific node has. Those links may be directed outwards (for example, person A seeking advice from others), usually called out-degree, and they can also be directed inwards (person A giving advice to others in the network), also called in-degree. The degree of nodes is a simple measurement of how connected people are. A denser network will have, on average, a higher degree level per individual. Degree is important for social capital development, since the more connected the network is, the more opportunities may exist for sharing resources within the network (Leana and Pil, 2006).

Centrality, as above, measures the extent to which individual actors are central to the network. Two common definitions of actors' centrality in social networks exist: in-degree centrality and betweenness centrality. As stated above, in-degree centrality simply measures the amount of links directed towards a particular actor. A higher number of links means that the actor is sought more and therefore can be regarded as a central actor. On the other hand, betweenness centrality measures how often an actor appears on the shortest paths between other actors. Betweenness centrality therefore measures the extent to which a particular actor can facilitate information flow in the network and thus plays an important role in the functioning of the organization.

### 3.8.3 Network communities: Modularity

Regardless of the formal specifications of the division of labour into departments, communities within the organization form spontaneously. A community represents a subset of actors within the network such that the connections between them are denser than with the rest of the network (Radicchi *et al.*, 2004). Communities may form as a consequence of many factors, including physical proximity in the school. For example, teachers working in the primary school (which is physically distant from secondary) will be more likely to interact with each other rather than with the teachers in the secondary school. Communities formed by physical proximity may also arise by the segregation of teachers' workspaces. For example, teachers who share an office will be more likely to interact with each other. Communities can also be formed by formal work links or by informal connections that form as a result of friendship or shared background (as for teachers and staff with similar contexts).

In social network analysis communities can be detected and explored using an algorithm called modularity (Blondel *et al.*, 2008). The modularity class partitions the network into groups of nodes that share more connections amongst each other than they do with the rest of the actors in the network. By changing the resolution, the algorithm can detect more and smaller communities or fewer and larger ones.

## **4 RESULTS**

We conducted the surveys across the two campuses. The initial list of employees at ISH had 103 names. One of the employees in the list has been absent for the past few months and was therefore discarded for data collection or analysis purposes. In addition, during the period of data collection one of the employees left the school. Unfortunately, this person represented a significant node in the structure of the school and the networks, and we could not obtain his answers. Of the remaining 101 names, two declined to complete the survey and one completed it only partially. The remaining 98 employees fully responded to the survey. This brought the response rate to 97%.

### **4.1 Formal structure**

We collected information about the school's formal structure using two different methods. Through interviews with the director and business manager, we obtained information about the lines of authority and departmentalization in the school. We used this information to create the school's organisation chart. In the survey, we gathered information about the perception of all of the school's employees regarding the level of centralized decision-making and formalization in the school.

#### **4.1.1 Lines of authority**

The board of governors is the highest authority in the school. The director acts as the chief operations executive and has four deputies under him: the Primary and Secondary principals, the Curriculum Coordinator and the Business manager. Each of the division principals has a division coordinator (three in the case of the secondary school), a personal assistant and a counsellor.

In the case of the business manager, his line of authority extends to various departments including the IT, finance, operations, medical and human resource

departments. Of these departments, the operations department is the biggest, and the operations manager leads it. The operations manager has authority over all the support staff of the school (figure 1).

#### 4.1.2 Departmentalization and specialization

ISH, like many other schools and organizations, is organized by departmental groups with specialized professionals in each department. The most general distinction amongst employees is teachers, administrators and support staff members. Each of these departments consists of various sub-departments with specialized functions. All departments and sub-departments, as well as the roles of the individuals within each of them, are shown in Table 2.

TABLE 2.. Departmentalization at ISH. The departments are generally divided into administration, support staff and teaching staff. Each division is further sub-divided into sub-departments with various roles. Size represents the number of individuals in each sub-department.

<b>Administration</b>		
<b>Sub-department</b>	<b>Roles</b>	<b>Size</b>
<i>Academic support</i>	Secretaries, curriculum coordinator, counselor	4
<i>Admissions office</i>	Admissions coordinator	1
<i>Finance</i>	Finance manager and staff	3
<i>HR</i>	Human resources coordinator	1
<i>IT</i>	IT staff	4
<i>Leadership</i>	Director, principals and business manager	4
<i>Medical</i>	Whole school nurse	1
<i>Operations</i>	Operations manager, support, warehouse	3
<b>Support Staff</b>		
<b>Sub-department</b>	<b>Roles</b>	<b>Size</b>
<i>Cleaners</i>	Primary and secondary school cleaners	8
<i>Cooks</i>	Head cook and assistant	2
<i>Drivers</i>	School bus drivers, purchasing	4
<i>Guards</i>	Night shifts, school-day shifts	8
<i>Support &amp; Maintenance</i>	Electricians, plumbers, gardeners, builders	7
<b>Teaching staff</b>		
<b>Sub-department</b>	<b>Roles</b>	<b>Size</b>
<i>Primary coordinator</i>	Coordination of primary academic program	1
<i>Primary counselor</i>	Counselor and learning support	2
<i>Primary ECAP coordinator</i>	Primary extracurricular activities coordinator	1

<i>Primary teachers</i>	Teachers and learning assistants	24
<i>MS coordinator</i>	Coordination of middle school Grades 6-8	1
<i>IGCSE coordinator</i>	Coordination of Grades 9 and 10 academic program	1
<i>IB coordinator</i>	Coordination of Grades 11 and 12 academic program	1
<i>Secondary counselor</i>	Academic, wellbeing and university counselor	1
<i>Secondary ECAP coordinator</i>	Secondary extracurricular activities coordinator	1
<i>Secondary Teachers</i>	Teachers and learning assistants	19
<hr/>		
Total		102

The board of governors is also divided into three committees: the operations committee, the evaluation and appointments committee and the finance committee. The summary of departmentalization and specialization at ISH can be represented by the classic organization chart shown in figure 1.

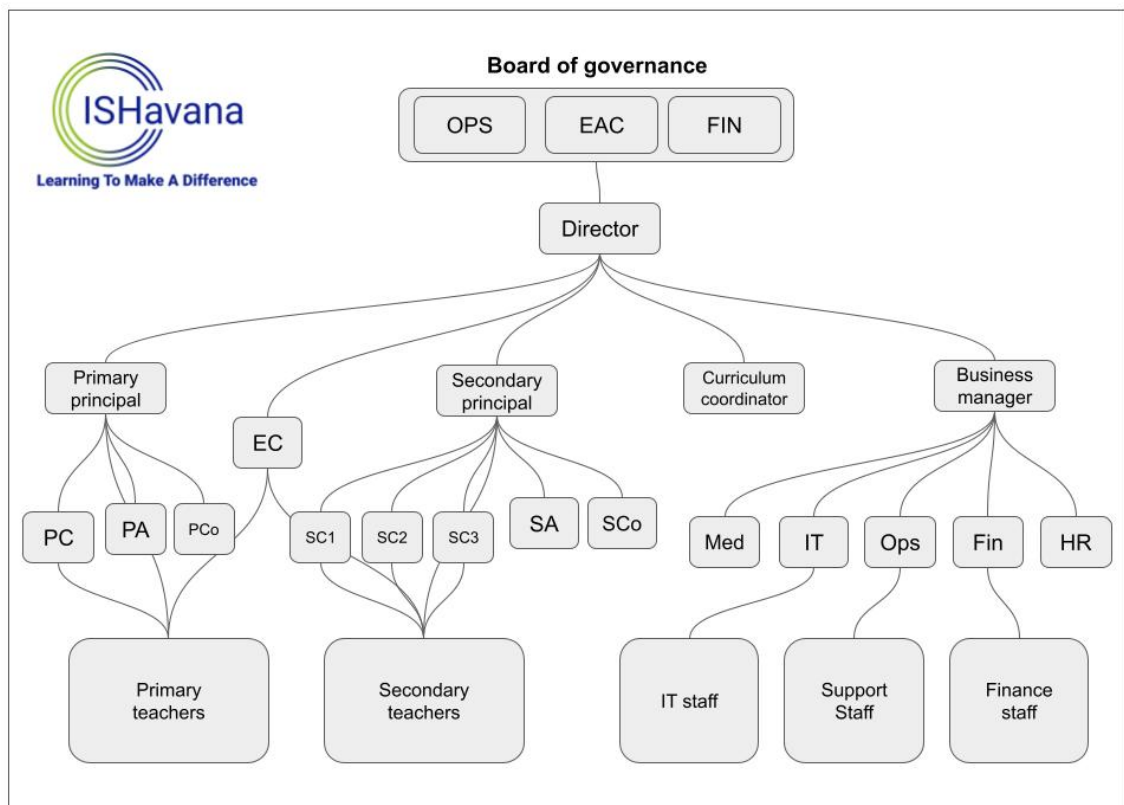


FIGURE 1. Organization chart of the International School of Havana. Labels: OPS - operations committee; EAC - evaluation and appointments committee; FIN - finance committee; PC - primary coordinator; PA - primary assistant; PCo - primary counsellors; EC - extracurricular activities coordinators; SC1 - middle-school coordinator; SC2 - IGCSE coordinator; SC3 - IB coordinator; SA - secondary assistant; SCo - secondary counsellors; etc.



The organization chart of ISH represents the current structure for coordination and control of activities of all staff in the organization. The span of control becomes wider for lower levels, especially in the case of the primary and secondary principals, who manage around 25 teachers each, and for the operations manager, who supervises the work of all support staff. The primary and secondary principals are supported by the division coordinators, the assistants and the counsellors.

#### 4.1.3 Centralization and Formalization at ISH

All staff members were asked about their opinion regarding how decision-making works at the school, and the extent to which explicit documentation about policies and role descriptions exists and whether it is followed. The questions asked invited respondents to place the organization on a range of low (1) to high (5) centralization and formalization according to a predefined statement.

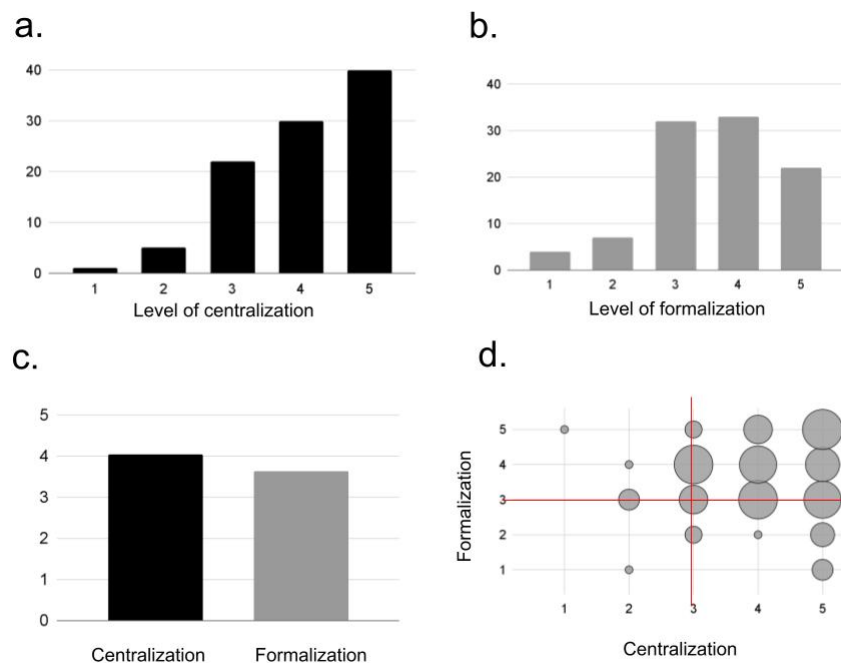


FIGURE 2. Comparison of the answers to the first two questions in the surveys. a) Distribution of answers (1 - low, 5 - high) level of centralization and b) formalization for n=98. c) average of centralization and formalization. d) plot demonstrating the density of combined answers. The size of the circles represent the amount of respondents in a particular combination of centralization and formalization.

Due to the delicate situation of the school, the questions were designed to be as simple as possible, leaving out any suggestion that could imply a direct opinion about the school.

Figure 2 shows the answers to the questions related to centralization and formalization at ISH. On a scale from 1 (the lowest) to 5 (the highest), the average of all answers was 4.1 for centralization and 3.6 for formalization (figure 2c). The standard deviations are 0.97 and 1.04 respectively. A more detailed account of the answers can be seen in the frequency histogram depicted in figures 2a and 2b. While the averages may seem similar (especially with the given standard deviation) the frequency distribution shows more detail about the answers of each of the staff members.

Figure 2d shows the combination of answers for each respondent represented in a plane. The highest combination of responses corresponds to (5, 5) - highest centralization and formalization - with 13 answers in total. As can be seen in Figure 2d, most of the answers fall in the quadrant of higher centralization and higher formalization. This would be classified as a mechanistic structure (Daft, 2010 p. 275) or a machine-like organization (Burton, Obel and DeSanctis, 2011 p.169). Note that the answers summarized in Figure 2 account for the self-perception of individuals only, and do not necessarily represent the reality of the functioning of the organization. However, it is difficult to fully assess the extent of centralization and formalization in such a heterogeneous organization. Indeed, from personal conversations with a few of the respondents I learned that the experience of these two dimensions can be diametrically different depending on one's position and authority in the school. For example, while teachers may be part of larger decision-making that involves students, the situation is different for support staff members, whose tasks are of a different nature.

## **4.2 Emergent structure**

The next part of the survey aimed to obtain information about the relationships between administrators, support staff and teachers. The first question asked

respondents to identify the people to whom they would go for support related to their work. From a list of names they wrote down all the members of the ISH community from whom they sought help. Although this question was not limited by any time period (it could easily change depending on the projects and tasks that are at hand), it gives a general idea of the support network that arises from these interactions.

#### 4.2.1 Support network

The answers to these questions were digitalized and imported to a network analysing and visualizing software (Gephi).

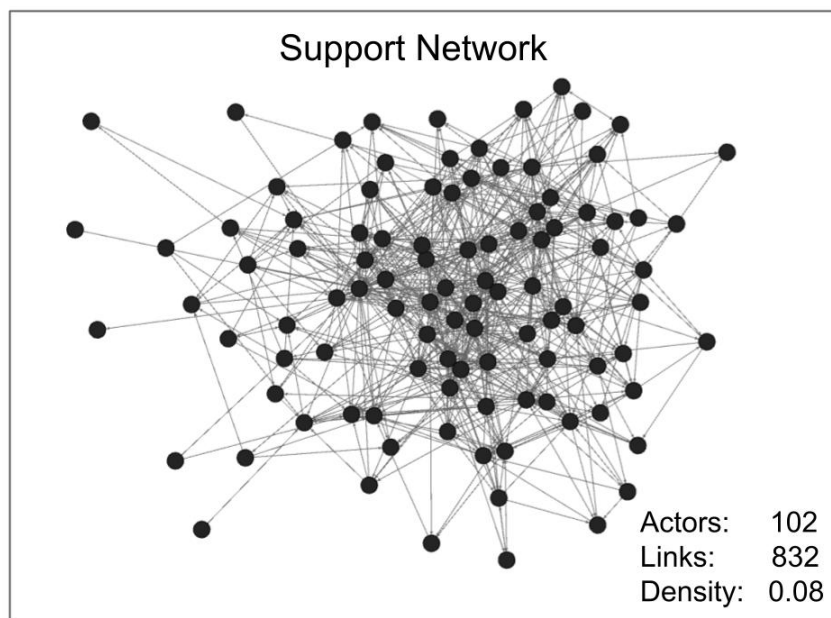


FIGURE 3. Graph representing the support network structure. Each node represents an actor in the school. Links are directed and represent actors seeking support from others.

Figure 3 shows the resultant support network. The graph shows 102 nodes and 832 links, or edges. Note that even if 2 actors didn't respond to the survey, their nodes still appear in the graph, as there were other people who "tagged" them in their answers. The layout of the graph was made using the Yifan Hu multi-level algorithm (Hu, 2006). All other network graphs in this report are also displayed using the Yifan Hu algorithm.

It is easy to obtain the average degree (number of links per node) by dividing the links by the nodes. The average degree for this network is 8.2. The network density is one of the most common measurements in networks (Yang, Keller and Zheng, 2017). It reflects the amount of existing connections compared to all the possible connections. As the network becomes larger, the possibilities for each node also increase and the total possible connections increase exponentially. This is why, even for a set amount of connections per node, the density decreases as a function of size. For this network, the density is 0.08.

#### 4.2.2 Network centrality

The centrality in a network is a measure aimed to show which nodes, or actors, possess relative advantages to other nodes depending on the definition of the links within the network. Centrality measures are some of the most common indicators for the importance of a node in a particular network. There are many measures of centrality, some of the most common include: degree centrality and betweenness centrality (Yang, Keller and Zheng, 2017). *Degree centrality* is one of the simplest measures of centrality. It simply measures the amount of links that an actor or node has. *In-degree centrality* counts the connections directed towards an actor and *out-degree centrality* counts the connections from an actor. *Betweenness centrality* aims to measure the extent to which an actor facilitates connections between other actors in the network. In technical terms, betweenness centrality measures the amount of times a particular node appears as part of the most direct path between all nodes in the network. Thus, actors with high betweenness centrality are the "middle men" in the network, and therefore have more access to resources than actors with low betweenness centrality. Even if an actor has a small degree centrality, they can still have a high betweenness centrality. The actor has a big influence in the network because they can control the flow of information.

Figure 4 shows the same graph as figure 3, the support network, except that the nodes have been coloured according to the department that the actors belong to: administration, support staff and teachers. In figure 4a the size of the nodes represent in-degree centrality. Figure 4c is the same as 4a but zoomed in. As

we can see, there appears to be a few nodes with higher levels of centrality. This becomes particularly evident for actors in the administration department.

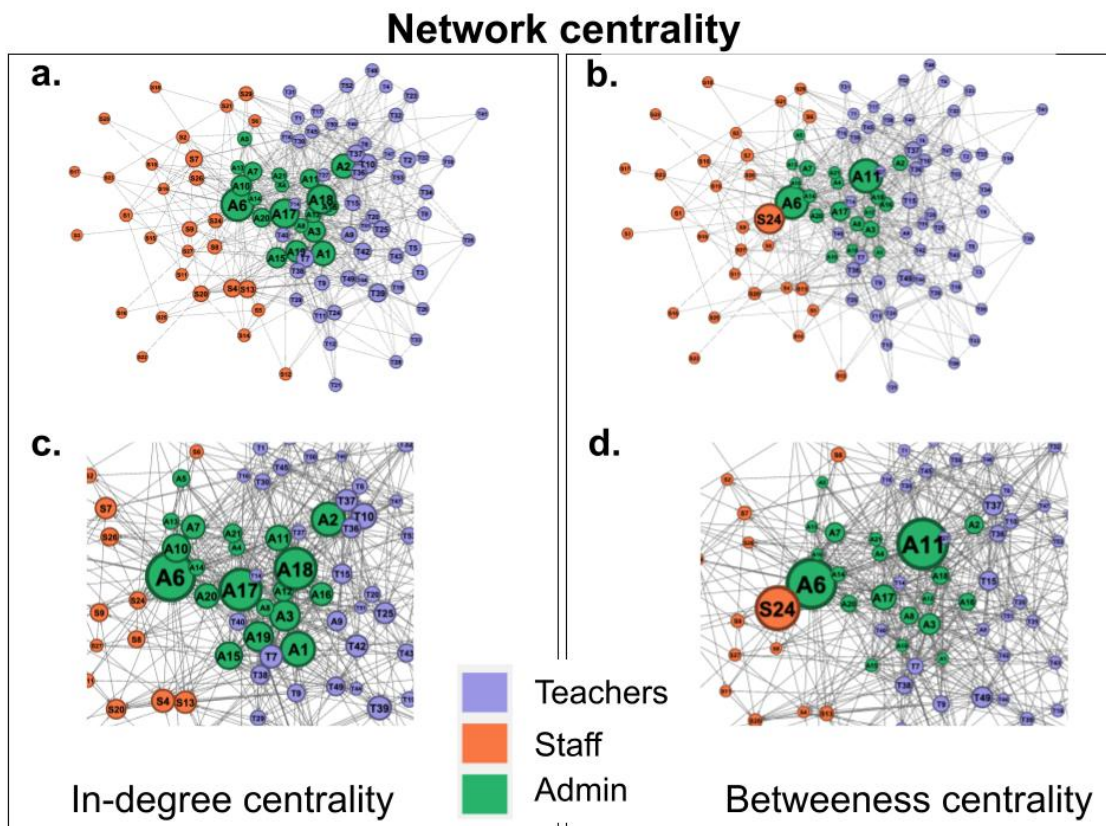


FIGURE 4. Network centrality represented by node size. The colour of nodes represents the departments. a. and c. In-degree centrality and b. and d. betweenness centrality.

Indeed, actors labelled as A6 (the operations manager), A17 (the IT manager) or A18 (the primary school assistant) have high in-degree centrality, meaning that many members of the community rely on them for support related to their work. Figure 4b and 4d are the same support network graph except that the size of the nodes represents the level of betweenness centrality. Here we can see that, although the operations manager (A6) is still one of the largest nodes, two other nodes appear, namely S24 (the daytime duty guard in primary school) and A11 (the school nurse). While the school nurse is part of the administration department (labelled in green) and it's no surprise that actors in that department have high levels of centrality. The S24 node emerges in the graph as a highly central person. Indeed, to conduct this investigation, the researcher asked for help from staff members to collect surveys. One of the actors that helped the

most was precisely S24. This is an example of the importance of knowledge in social network interactions.

While the above measures and figures measure centrality as a function of individual nodes, the *centralization* of a network indicates the degree to which a particular network is highly centralized or not. The network centralization is a measure of the overall graph. In technical terms, it measures the difference between the node with the highest in-degree centrality in the network and the rest of the nodes (Freeman, 1978).

### 4.2.3 Instrumental and expressive networks

The links, or ties, are a foundational concept in social networks. Ties are classified based on their function. Instrumental ties account for relationships that directly affect how employees carry out their work. These may include asking for support or advice directly related to better perform in the organization. It can also include seeking expertise, for example, on how to implement a new unit in a classroom. On the other hand, expressive ties represent the affective aspects of relationships, such as social and emotional support, friendship or trust. These are not directly related to better performance on the job but may affect it indirectly (Moolenaar, 2012; Rodway, J. and Daly, A.J., 2018).

In the present investigation we aimed to portray both instrumental and expressive ties between all employees at ISH. Gathering data related to instrumental ties involved asking the questions "to whom to you go for support?" and "to whom to you go to for advice related to your work?" Since expressive ties are inherently more personal (and therefore controversial), I decided to ask only one question: "to whom do you go to for more personal matters?" The data was compiled and new networks were created.

Figure 5 shows a comparison between instrumental (advice seeking) and expressive (personal support) networks at ISH.

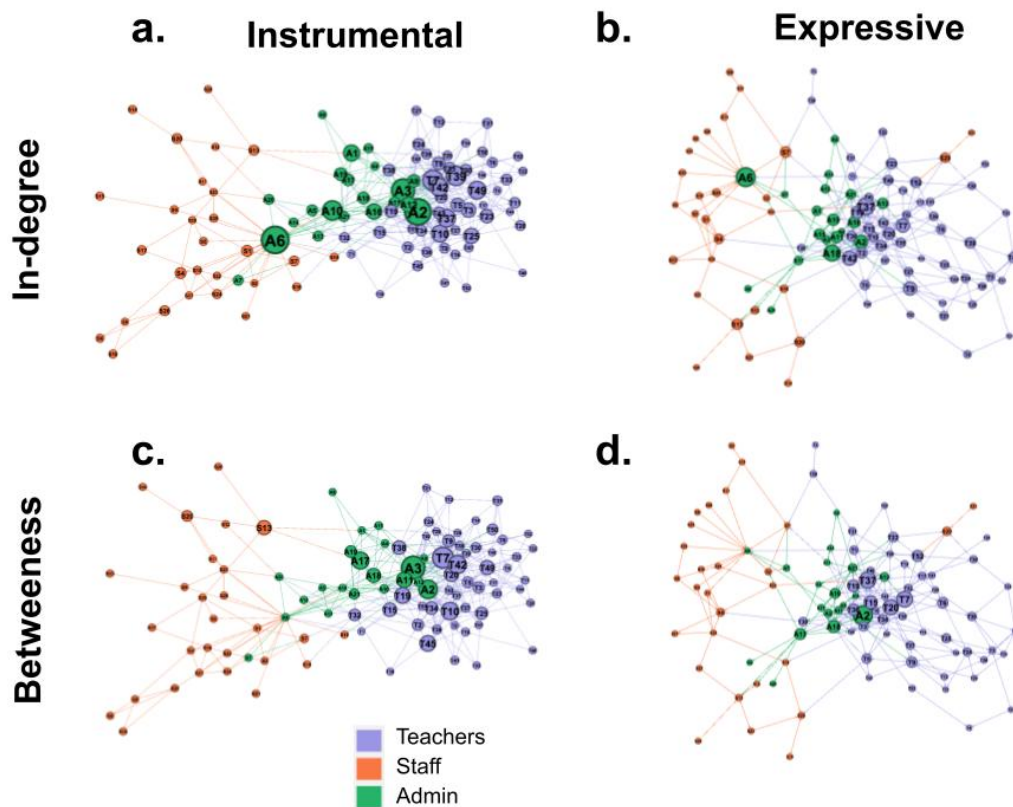


FIGURE 5. Instrumental and expressive networks and levels of centrality.

Figures 5a and 5c represent the networks formed with instrumental ties and 5b and 5d the network formed with expressive ties. Figure 5 also shows a comparison between different levels of centrality in these two types of network: in-degree centrality (figs. 5a and 5b) and betweenness centrality (figs. 5c and 5d). Even though the support network in figure 4 is built from what can be considered instrumental ties, there are small differences between the two instrumental networks. Figures 5a and 5c show two nodes with high centrality for the advice network: A2 and A3. These two nodes represent the two principals at the school, primary and secondary, respectively. A6 continues to be a prominent node with high in-degree centrality in the advice network and this is not surprising. The operations manager is in charge of supervising the whole of the maintenance and support staff.

A summary of network properties for all support, advice and personal networks for each department can be found in Table 3.

TABLE 3. Network properties for instrumental and expressive networks by departments. Network properties include the average degree, the network density and the average path length.

<b>Support network</b>					
	Nodes	Edges	Degree	Density	Path length
<i>Whole</i>	102	832	8.157	0.081	2.987
<i>Administration</i>	21	156	7.429	0.371	1.709
<i>Teachers</i>	52	277	5.327	0.104	2.853
<i>Staff</i>	29	43	1.483	0.053	1.901
<b>Advice network</b>					
	Nodes	Edges	Degree	Density	Path length
<i>Whole</i>	102	409	4.011	0.041	3.550
<i>Administration</i>	21	61	2.905	0.145	2.255
<i>Teachers</i>	52	203	3.904	0.077	3.551
<i>Staff</i>	29	30	1.034	0.037	1.189
<b>Personal network</b>					
	Nodes	Edges	Degree	Density	Path length
<i>Whole</i>	102	293	2.873	0.028	3.959
<i>Administration</i>	21	35	1.667	0.083	2.738
<i>Teachers</i>	52	149	2.865	0.056	4.192
<i>Staff</i>	29	28	0.966	0.034	1.691

All quantities, such as the average degree, density or average path length, were obtained by separating the networks by departments. This means that only ties within the department are considered for determining those quantities. A clear pattern that can be seen in Table 3 is that the number of edges for each of the networks decreases from support to advice to personal. This is not surprising considering that it is usually easier to ask for support than to ask for specific advice. In addition, asking for personal advice requires more emotional effort (this is also not including the fact that respondents are less likely to respond to questions that reveal their personal interactions). Similarly, the network density is higher for the support network than the advice or personal networks. In addition, the administration sub-network is consistently more dense than the teachers or the staff network. This is both because the administration network contains a smaller number of nodes and, generally, members in the administration network are more connected between each other because their tasks directly depend on one another.



### 4.3 Network communities

One of the main interests of social network analysis is cohesion- specifically, identifying sub-groups with larger cohesion levels than the whole network (Yang, Keller and Zheng, 2017). A cohesive subgroup will typically consist of a set of nodes that are more densely connected than those in other sub-groups. This can represent a group of colleagues who collaborate frequently, or a group of friends that socialize regularly within the organization. In social network analysis these sub-groups are often referred to as cliques or communities.

Departmentalization is a way to divide employees into divisions according to the tasks and jobs performed. However, such a division may not actually result in the intended interactions, as it overlooks the importance of social relationships. A network analysis perspective can reveal the sub-groups in the organization. There are various algorithms for community detection in social networks.

#### Formal and emergent communities

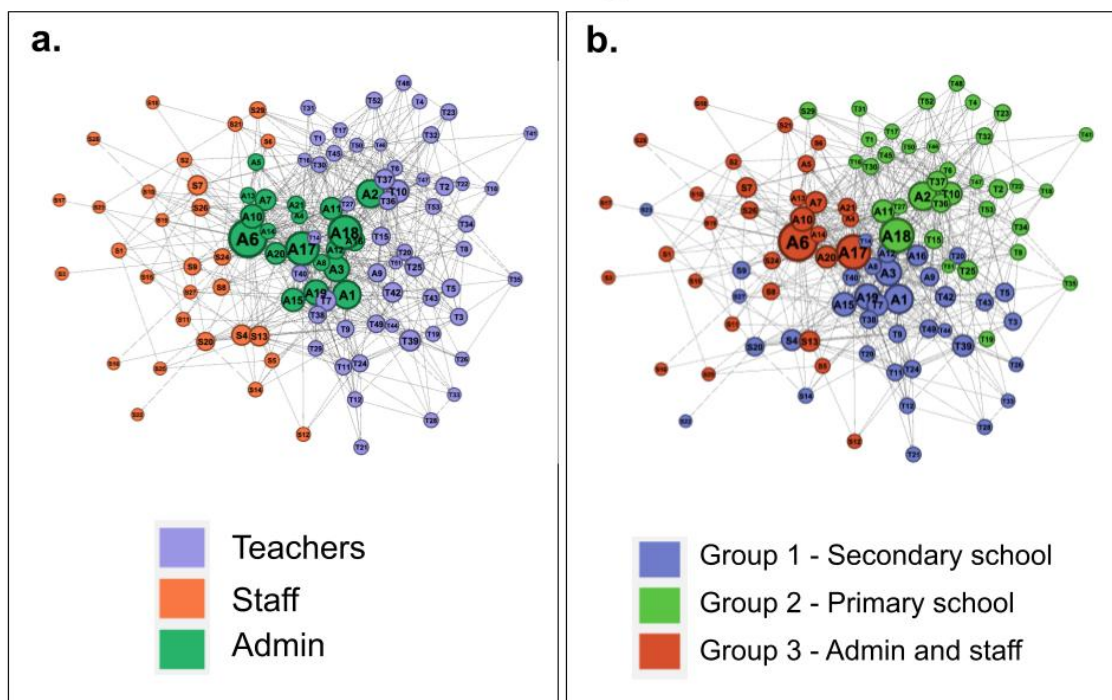


FIGURE 6. Comparison between two different network partitions in the support network. a) partition based on predefined formal departments, and b) partition based on modularity class with resolution threshold of 1.5. Node size is determined by in-degree centrality.

Figure 6 shows a comparison between partitions based on the formal departmentalization of ISH (6a), and the emergent sub-groups of the network (6b).

The resolution threshold was set to define three groups with similar size. The result (Figure 6b) is a representation of the actual working relationships at ISH. Most notably, we can see that the school has been divided into the primary campus, the secondary campus and a mix of administrators and staff members. The international school of Havana is divided into two different campuses and the algorithm is able to detect this physical distinction.

Another interesting feature arising from the detection of communities in the network is that the officially defined functional departments (teachers, staff and admin) are now intermixed within three emergent sub-groups (primary, secondary, and admin and staff). Indeed, while teachers mostly interact with each other, they also need the support of staff and administration to perform their jobs. Thus, we see that their involvement within their divisions (a separation made even more distinct by different geographic locations) is actually more salient than their functional role.

A further division in the support network can be made using the modularity algorithm with a lower threshold of 1, leading to the emergence of even smaller sub-communities.

### Network communities

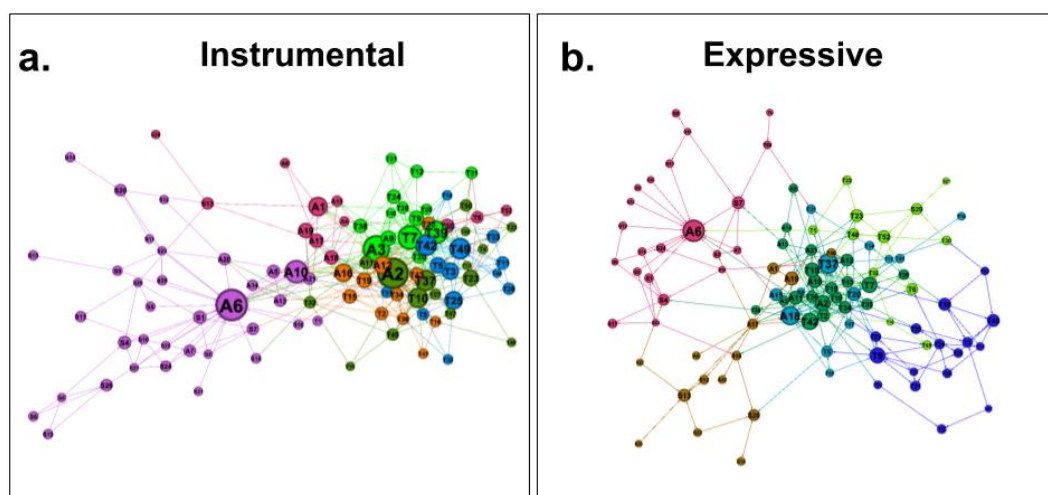


FIGURE 7. Emergent network communities as detected by modularity for instrumental (a) and expressive (b) networks. Modularity class with resolution threshold of 1.

Figure 7 represents the result of the sub-division of the advice and the personal networks. Figure 7a shows a distinct community of staff (shown in pink) led by the operations manager (node A6). It can be seen that the school's business manager belongs to this community too (node A10). Most of the IT department makes another community represented in red (nodes A1, A19, A17, etc), and most of the teachers that have close relationships with the school director form yet another community depicted in orange (Figure 7a). The rest is divided into three subgroups of teachers, one led by the secondary principal (A3), the other one led by the primary principal (A2) and a third emergent teacher group (represented in blue).

The expressive (personal support) network (Figure 7b) is also subdivided into various groups that are different from the instrumental (advice) network. As expected, here there are no clear distinctions based on formal positions in the organization. Indeed, expressive relationships are formed based on emotional closeness, friendship and trust. However, it can be seen that subgroups are positioned in specific areas of the graph indicating that these personal relationships are more likely to develop based on physical proximity. Over time, it is the expressive relationships that will sustain for the longer time. It is therefore important for educational administrators to take into account the development of these types of relationships when making decisions about staff distribution across departments.

#### **4.4 Relations between the formal and emergent structures**

While the formal structure of a school can be regarded as the explicit result of deliberate decisions aimed to maximize the organization's effectiveness, the informal, or social-relationships, structures develop as patterned interactions between the actors in the organization. Therefore, both structures coexist in the organization and may complement each other by providing information that would, otherwise, not be available. Through social network analysis we are able to make connections and explore possibilities for further areas of investigation that may help the organization better achieve their goals.

#### 4.4.1 Organization structures

Figure 1 and figure 4a show two different structures of the organization of ISH. Figure 1 shows the formal organization chart: a structure created from a deliberate and intentional design that makes explicit the authority relationships between employees as well as the division of labour into departments. On the other hand, figure 4a represents the pattern of help-seeking interactions of all employees at ISH and the division by departments (shown with different colours). Figure 8 shows a comparison between the formal and the emergent structure of the school. The figure is colour-coded to show correspondence between departments. Thus, both figures identify the division by departments with the same colours.

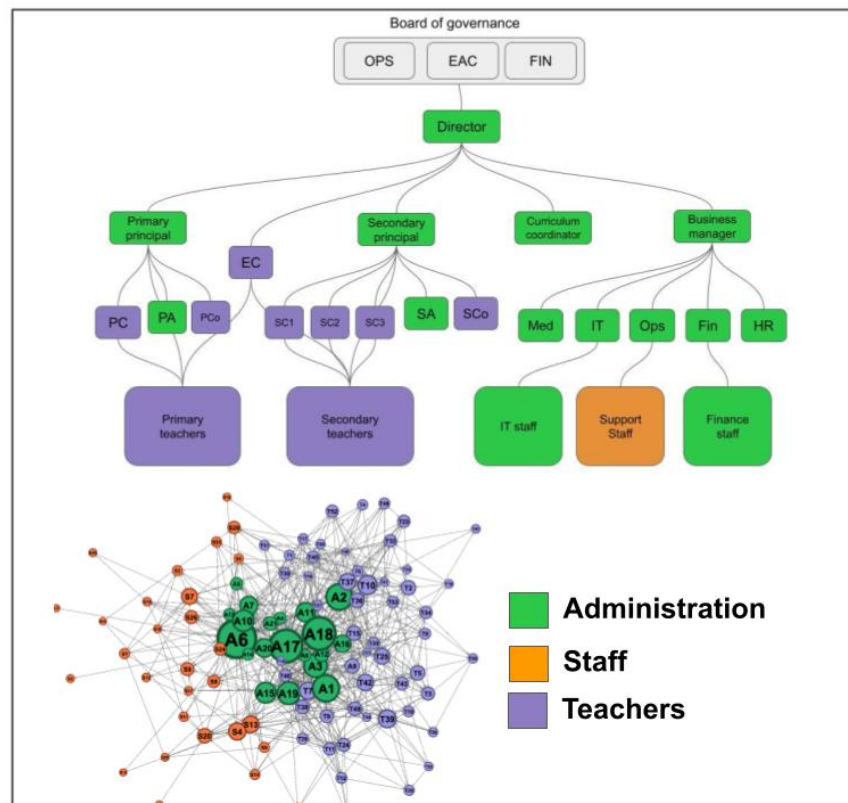


FIGURE 8. Comparison between the organizational chart and the support network structure divided by departments. The node size represents in-degree centrality.

While the formal organizational chart depicts a hierarchy of vertical authority (who has authority over whom), the social network graph shows an operational hierarchy. Indeed, the administration team (shown in green) appears in the

middle of the graph (according to the Yifan Hu algorithm), meaning that their position in the organization is more central - actors from the administration department have important links to actors in other departments and also have a highly dense network of connections between themselves. The organizational chart depicts top-down relationships, whereas the support network is constructed based on actors seeking support.

The network is able to better represent the social structure of the school; each employee is part of the organization. It also represents the natural division of work and the responsibilities of actors by segregating, for example, the support staff on one side and the teachers on the other side. In addition, while the formal organizational chart shows the school director as the most central actor in the school structure, the social network reveals other actors that are more central. Furthermore, some actors with high levels of centrality in the social network are not directly represented in the formal organizational chart. This is the case, for example, of node S24 in figure 4b, who is shown to have a high betweenness centrality, whereas in the organization chart the same node is clustered in the "support staff" box (see figure 8).

Moreover, the actor with the highest in-degree centrality in each of the networks that were analysed is the operations manager (node A6). While this actor is also part of the formal organizational chart (Ops in Figure 8), the relative importance of that actor is missing there. When conducting the surveys, one of the comments that I heard from a member of the IT department regarding this situation was: "If any of us in the IT department were to suddenly disappear from the school network, it would be a problem but the school would continue to operate. Probably, it would be fine for a week. However, if you remove the operations manager from the network, the school would collapse in a matter of minutes."

The comparison between the formal organizational chart and the support network suggests the organizational chart misses much information about the functioning of the school. It would be interesting to create a new formal organizational chart based on centrality, or to redefine roles in the organizational chart base on importance as reflected by the network representation.

#### 4.4.2 Perception of centralization and formalization in the networks

All employees at the school were asked about their opinion regarding the levels of centralization and the levels of formalization at ISH. Centralization of authority refers to the extent to which decision-making in a school is concentrated in the hands of a few or shared among staff (Hoy and Miskel, 2008). In a highly centralized school, most of the non-routine decisions are made by the top managers, i.e. the director and the principals. In contrast, low centralization implies that employees play a bigger role in the decision-making process. Formalization measures the extent to which rules, policies, job descriptions and documentation dictate the behaviour of the employees.

Figure 2 shows the results to the answers in the survey related to centralization and formalization. One of the objectives of this study was to find correlations between the employees' perception of centralization and formalization at ISH and actual network properties. A full exploration of this relationship lies beyond the scope of this investigation. However, social network analysis may be useful in exploring these kinds of ideas.

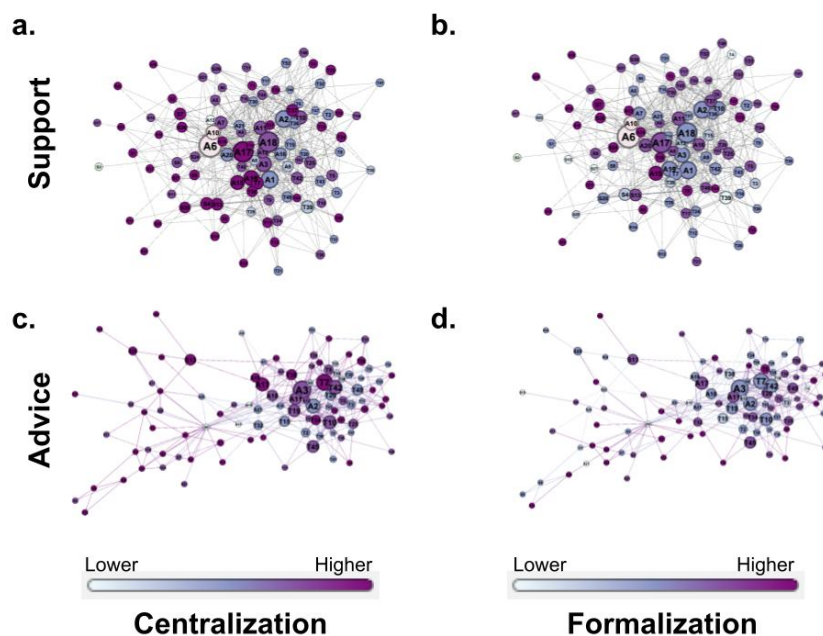


FIGURE 9. Actors' perception of centralization and formalization of ISH and their network positions for both the support and advice networks.

Figure 9 shows all the actors' answers to these two questions as a function of their position in the support and the advice networks. A darker colour represents higher levels of centralization and formalization. The node size was set to in-degree centrality.

Although it is difficult to see correlations in the networks displaying perception of formalization, a small correlation can be seen between the position of nodes and the level of centralization in both the support and advice networks. A close inspection of figure 9a and 9b show that the darkest nodes tend to be positioned towards the left and slightly lighter nodes to the right.

As it was shown in figure 4 and figure 5, the position of nodes is directly related to the department they belong to in the school. Thus, the networks show that there is a tendency for support staff to have a higher perception of centralization.

#### **4.4.3 Formal centralization and network centralization**

We now explore the correlation between employees' perception of centralization and network centralization. Network centralization is a whole network measure that takes into account the difference between in-degree centrality between the highest and the lowest values. Network centralization ranges from 0 to 1. A highly centralized network (value of 1) would be one where one node has an in-degree centrality equal to the network size and all other nodes would have none (they would have an out-degree of one). On the contrary, values close to 0 would indicate that all nodes have the same value of in-degree centrality (by definition, if all nodes have the same centrality, the centralization is zero). Network centralization was calculated using equation 1 (Freeman, 1978). Table 4 shows the network centralization for the support and advice networks separated by emergent communities as in Figure 6b. To obtain these values, we first partitioned the network using modularity. Then we obtained the in-degree values of all nodes and calculated centralization using equation 1.

Perception of centralization was calculated by taking the average response of the emergent community to the first question in the survey and dividing it by the maximum (five in this case). We did this to better compare the results of perception of centralization and the network centralization since both values lie between 0 and 1.

TABLE 4. Whole-school network centralization for emergent communities, as defined by modularity. Centralization was calculated using equation 1 for both the support and advice network. Perception of centralization was calculated by dividing the average response to perception of centralization by the maximum number.

	<b>Centralization in support</b>	<b>Centralization in advice</b>	<b>Perception of centralization</b>
<i>Admin and staff</i>	0.66	0.63	0.87
<i>Primary</i>	0.45	0.58	0.75
<i>Secondary</i>	0.41	0.42	0.81

Table 4 shows clear patterns in the results. Centralization for both the support and advice network is highest in the admin and staff group, followed by primary and lastly by secondary. Perception of centralization is also highest for the admin and staff group. However, it is lowest in the primary group. Comparing primary and secondary, this would mean that despite the fact that primary is more centralized, employees in primary believe it is less centralized compared to the secondary ones.

It is also interesting to note the clear correspondence between the staff perception of the centralization and the actual levels of centralization in the network. Indeed, as can be seen in figure 6b, the admin and staff group contain one node with a very high level of in-degree centrality (A6 - the operations manager) while the rest of the nodes are comparatively small. In the primary and secondary networks there are more nodes with higher levels of in-degree centrality and therefore the centralization is lower.

There may be many reasons for these correlations, and this could be a topic for further study.



## 5 DISCUSSION AND EVALUATION

### 5.1 Overview of results

In this investigation we have examined the relationships between the formal and the informal structures within a school environment. The investigation was conducted as a case study at the International School of Havana. We used a saturation survey with a 97% response rate (out of 102 employees, 99 answered the surveys). The surveys gathered information regarding both the respondents' perception of the formal structure of the school (measured by its levels of centralization and formalization), and the relationships-based structure. Regarding the formal structure we found that, on average, employees consider the school to have a slightly high level of formalization (average of 3.6 on a scale of 1-5), and an even higher level of centralization (average 4 on a scale of 1-5). Higher levels of formalization and centralization suggest that the school operates mostly as a mechanical structure (Daft, 2010; Burton, Obel and DeSanctis, 2011).

To determine the social-relationships structure of the school we asked all employees to identify the key actors that they sought for advice and support- both work-related and personal. We then used social network analysis and theory to investigate various aspects of the emergent social structure of the school (Yang, Keller and Zheng, 2017). With network graphs of the three social structures (advice, support and personal), we were able to display the formal departmentalization of the organization onto the networks. We also used two measures of centrality (in-degree and betweenness centrality), to identify individuals with higher influence in the organization and to calculate the overall centralization of the network.

Through a community detection algorithm, we were also able to identify emergent functional units in the school that exist in a large part due to the school's being divided into two campuses, but are not represented in the formal structure. Community detection algorithms also allowed us to find groups in the school with a higher density of connections.

Finally, we compared the results of the formal and emergent structures. First we were able to represent the answers of the survey - the perception of centralization and formalization - as a network map.

We calculated the network centralization for the emergent communities (primary, secondary and admin) and compared it to the levels of perception of centralization. We found that the perception of formal centralization in the organization is directly correlated with the centralization of the network communities. Indeed, higher levels of perception of centralization in school groups coincided with higher levels of centralization of their corresponding networks.

Overall, we've successfully achieved the objectives of obtaining network maps of the social relationships within the school and implemented a methodology that can serve to identify and measure the social capital in the school (Leana and Pil, 2006; Daly *et al.*, 2014). We were able to directly use network properties to empirically measure key structural components such as centralization and compare these to the perception of employees.

## **5.2 Implications of the results**

In designing the formal structure of schools, many school administrators focus their time and resources in defining and re-defining the work positions in the organization; in defining the formal structure of hierarchies; in dividing the work in pre-defined departments; and in developing clear policies and job descriptions with the hope that this pre-determined design will bring the expected results and success of the school. Unfortunately, while the intentions of administrators are in the right place, they often lack information about how the work within the school is *actually* achieved. What needs more attention is to better understand the informal organization, which emerges as a result of relationships between employees that try to attend to both their professional and personal needs.

Schools are learning spaces and learning can be considered to be a social process (Wenger, 2018). As such, understanding schools from a social-

relationships perspective can help administrators make better decisions to achieve their goals. While personal characteristics of individual actors in schools may be important, the emergent activity that results from relationships between these actors may be equally, or even more, important (Rodway, J. and Daly, A.J., 2018). As Rodway and Daly point out "the real work of schools is comprised of the constellations of different types of interactions that take place between everyone (i.e., administrators, teachers, students, support staff, community members) across a variety of settings" (2018).

Additionally, adopting a perspective based on the resources that can be exchanged through interactions and relationships, or the social capital within the school, can positively impact the functioning of the school, as it has been empirically shown by various studies (Leana and Pil, 2006; Moolenaar, Slegers and Daly, 2012; Daly *et al.*, 2014).

Social network analysis can add one more tool in the school administrator's toolbox. By using social network analysis, we were able to map the structure of ISH according to the exchange of resources through social relationships. We investigated network resources such as support to better achieve individuals' job tasks, work-related support and personal advice. Our results shed light, for instance, on individual network actors that have high levels of influence in providing these resources to other members of the organization. Interestingly, while the staffing structure is designed to achieve explicit school goals, the position of certain members of the organization who hold key positions in the school don't necessarily possess much influence compared to other actors in the organization as revealed through centrality measures in the network analysis. Identifying these key actors through social network analysis can help managers better design strategies to achieve objectives.

### **5.2.1 Defining formal positions based on informal influence**

Schools often organize and coordinate the jobs that need to be accomplished by dividing the work into departments. Often, the departments are managed or led by a coordinator or head of department. By assessing the level of influence

of actors in the social networks, these key positions can be identified more easily and can help bring formalization to what otherwise is already occurring. For example, a teacher that is often sought for advice and support could naturally occupy a key position in the formal structure. Having access to the information provided by social network analysis can thus play an important role in defining roles within the organization.

Currently at ISH a new position for one of the secondary coordinators was sought. The network map clearly shows teachers who are natural leaders in the department. By having access to this information, administrators could directly target those individuals to apply for the position. In the end, one member with high in-degree centrality in the secondary school applied and got the job.

### **5.2.2 Diffusion of innovation**

Schools regularly try to adopt new initiatives to improve their performance. Examples may include the introduction of a new technology, such as the use of new software for facilitation of instruction, new assessment technologies such as MAP testing, or even just a needed review and assessment of organizational practices, such as review of assessment standards and benchmarks in the report cards. Oftentimes, these initiatives are implemented with a top-down strategy: the administrators or managers higher up in the formal structure dictate what needs to be done and all teachers are required to adopt the new initiatives. Many times, despite the value that the initiatives bring, a poor implementation strategy can delay or even impede the innovations from being adopted.

The classical theory of diffusion of innovation by Everett Rogers (2010) aims to explain how new innovations are adopted by a community of people. Rogers identifies five main elements that influence the spread of a new idea: 1. the idea itself; 2. the adopters of the idea; 3. the communication channels; 4. the time taken for the adoption; and 5. the social system in which diffusion occurs. Combining these elements with a thorough knowledge of the social structure in the school can help facilitate these new innovations to be adopted efficiently and effectively. Indeed, identifying the key actors with higher levels of in-degree cen-

trality and betweenness centrality and deliberately bringing them on board, can enhance and speed up adoptions of new innovations by all members in the school.

During the academic year 2021-2022, ISH introduced a new innovation for assessment: MAP testing. MAP testing (measure of academic progress) is a computerized adaptive test that measures student's progress over time in core subjects. A top administrator in the school had the responsibility of introducing this idea to teachers, training them in understanding how to interpret the results and developing plans based on the results. These trainings occurred during faculty meetings where the administrator spoke directly with the teachers. However, after a few months and after the second implementation of MAP tests in the school, teachers are still confused and look at this innovation with hesitance. Using social network analysis, and the results of this investigation, an alternative strategy for introducing this innovation would have been to first target the actors with higher centrality in the teacher advice network, get them on board with the idea and fully train them in recognizing the value of this initiative. Then, a broader introduction to all faculty could have been implemented. However, adhering to high formalization, and hoping that a single individual could achieve the implementation of this initiative without consideration of the social structure, lead to the results that we are experiencing today.

Finally, another example of the value of knowledge in the informal social structure at ISH is the current investigation. In order to collect network data, all employees had to be contacted in person and the surveys were responded to by hand. Completing the surveys in a relatively small amount of time could only happen with the support of key actors in the network. These were the guards of the school. I sought their help to collect surveys that were given to employees and this resulted a very efficient strategy. After analysing the data, I confirmed what my intuition indicated: that both these guards have a high degree of betweenness centrality.

### 5.2.3 Nurturing networks for better school performance

There is growing evidence that points at the relationship between social capital and school performance (Leana and Pil, 2006; Moolenaar, Slegers and Daly, 2012; Daly *et al.*, 2014). In effect, higher social capital in schools provides teachers with more access to resources such as information, knowledge, support and advice. Dense teacher networks around work-related advice supports more innovative school environments, that in turn lead to higher student achievement (Moolenaar, Slegers and Daly, 2012). A natural question, from a network perspective for administrators is then how to create environments that foster collaboration and enhance social interactions. The results in this thesis can help in setting a reference point for increasing network density within the school workspace. Since this study was based on the analysis of only one set of data to construct the network, this may help to set a baseline for future investigations.

The results of this study have implications for future decisions regarding work structures and allocation of resources. For instance, by uncovering the importance of social capital, which can be measured through network analysis, administrators can intentionally create work spaces where teachers can benefit in sharing social resources. This could be achieved, for example, by considering the importance of creating common spaces for teachers to interact during breaks or lunch, or by planning for teacher offices to be close to each other to foment social interaction.

The present study also reflects the importance of dedicating resources for teachers to want to interact with other teachers, for example by creating more staff parties, or simply by providing coffee in faculty lounges. It would be interesting to implement these initiatives and conduct the study again in order to see how the social network of employees develops. Most importantly, precise measurements of school success need to be defined in order to establish causality between the school's social capital and overall achievement of its objectives.

#### 5.2.4 Network theory: explanatory and outcome variables

Constructing network maps in schools, in particular, can lead to different and new levels of understanding and predicting phenomena that occur within the organization. Borgatti et al. (2018) classify network analysis as applied or basic. Applied studies consist of creating a network and calculating certain metrics to describe the structure of the whole network, or the characteristics of individuals. The results are interpreted and serve as a base for further action. All the applications mentioned above can serve this purpose, for example, creating a network map to find individuals with greater influence to then implementing a change in the school. An applied study can also involve creating a network map to determine whole network quantities such as centralization or density as a reference for further interventions. Applied studies, such as the present investigation, are univariate meaning that the variables measured are not necessarily correlated to each other (Borgatti, Everett and Johnson, 2018). Instead, those correlations are assumed to exist or are previously determined. For example, we assume that actors with higher in-degree centrality will have more influence in the organization.

On the other hand, basic research studies are multivariate and correlative. They aim to describe how particular variables change as a function of others. In particular, the objective is to understand a dependent variable (or the outcomes) as a result of a causal process based on the independent (or explanatory) variables. Network analysis helps in generating variables that will be correlated, either as independent, or explanatory, or as dependent, or outcome, variables. Studies that use network measures as independent variables seek to create a network theory of whichever outcome variable we choose. For example, for the above-mentioned applications, this investigation could be used to construct network theories of formalization of roles (in the case of assigning formal roles to actors with high in-degree centrality in the advice network). Another example of this type is using the network structure, such as density of connections between teachers, to improve student performance; this would be a network theory of student performance.

Network characteristics can also be used as dependent variables. This is the case, for example, in a formulation of the present study in trying to explore whole network properties as a function of the formal structure of the school. Part of the investigation of the present study aimed to find a correlation between the perception of centralized decision-making in the school and a network measure of centralization. According to Borgatti et al. (2018) this would be classified as an employee perception of decision-making theory of network centralization. By separating the network into subgroups with higher density, we were able to compare the results of the survey concerning perceptions of centralization and formalization, to structural elements of the network such as centralization. We found that the perception of employees, especially the support staff, effectively predicted the network centralization.

Previous studies have established the direct relationship between network properties, such as cohesion, and student performance (Leana and Pil, 2006; Pil and Leana, 2009; Moolenaar, Slegers and Daly, 2012). A theoretical perspective using social network analysis can help schools identify sets of independent variables that may affect such network properties, like cohesion. Part of the motivation of conducting the present study was, precisely, to investigate these correlations. In particular, we were interested in finding the effects of formal organizational structure on network structure. While we were able to fully map the network structure at ISH, such correlations between the formal organizational structure and its effect on the behaviour of the organization would require further studies. Those studies could be achieved through comparisons with other schools, for example. Another alternative would be to actively change the formal structure by adding formal heads of departments, for example, and see the effects of such an initiative on network properties, such as cohesion. In fact, two years ago the administration at ISH decided to dissolve the heads of departments. Regardless of the motivation of the decision, it would have been very interesting to conduct this investigation before the decision was made and compare it to the current results.



### **5.3 Reliability and limitations of the study**

The present study aims to explore social network analysis as an opportunity for administrators to obtain different types of data for decision-making. In particular, it aimed to construct support, advice and personal networks at the International School of Havana and to investigate relationships between the structure of the networks and the formal organizational structure of ISH. While the objectives of the investigation were fulfilled, there are limitations in the study and the methodology that are worth mentioning.

#### **5.3.1 Exploratory case study**

Part of the motivation to conduct the present research was to investigate the causal relationships between deliberate and intentional design of organizational structure and the behaviour of the organization as measured through the formation of emergent patterns displayed in the social networks. However, identifying correlations may not be possible in the current investigation as it was inevitably designed as an exploratory case study ('Exploratory Case Study', 2010; Ojasalo, Moilanend and Ritalahti, 2020). An exploratory case study usually studies particular phenomena characterized by a lack of preliminary research. It aims to collect sufficient information for a hypothesis involving causal relationships to be constructed. Exploratory case studies are conducted as a preliminary step for explanatory studies. As such, considering the motivations for conducting this research, the results are limited by the nature of the methodology used. Nonetheless, this exploratory investigation may inform further studies where clear independent and dependent variables are identified. For instance, an interesting area for future research is exploring the effects of removing network actors with high centrality. This is particularly relevant in an organization such as ISH, where the turnover rate is significantly high.

### 5.3.2 Data collection

Social network analysis requires the collection of a full set of data. Rather than selecting samples in the population to generalize the results, network analysis can only be performed if data pertaining to all, if not most, actors within a specified boundary is collected. An obvious challenge that arises with data collection for network analysis is the non-anonymity of the responses. While we spoke directly to each of the 102 respondents and ensured that the data was going to be treated confidentially and used for research purposes only, the degree of reliability of the responses remains to be an issue. For this reason, during this investigation we may have not only encountered unintentional self-reported bias but also we may have gotten deliberate answers that do not fully correspond to reality. This could be because of not fully trusting the motivation of the study and also because of the delicate situation that the school has been going through in the last couple of years. However, since the nature of this study is exploratory and generic, not obtaining fully reliable data doesn't interfere with the results obtained. Further studies requiring collection of network data at ISH would need to be more focused and with a more detailed goal. By disclosing the specific purpose, for example to monitor the organizational behaviour towards the introduction of a new technology, respondents will feel more secure and will provide with more reliable data.

Data collection for this study was divided into two sections. The first one intended to obtain information rating employees' perceptions of how centralized decision-making is at the school, and to assess the levels of formalization too. Since part of the goal of the investigation was to investigate correlations between the formal structure and the emergent network properties, the answers to the full survey, including the evaluation of centralization and formalization was non-anonymous. For this reason, the questions pertaining perception of centralization and formalization were deliberately designed to be as simple as possible and framed in a less intrusive way. Respondents were thus provided with statements with definitions of formalization and centralization and were asked to rank the school according to those statements. Finding these two dimensions of organizational structure through this kind of questions may, indeed, not provide a full and accurate assessment of the levels of centralization and formalization

of the school. However, as an exploratory case study, this investigation aimed to measure employee's perception on these dimensions rather than measuring the dimensions themselves. Rather than asking respondents to rate the school according to a statement on centralization and formalization, an alternative to the questions asked would be a more actionable way. In future investigations we could ask instead: "When making non-routine decisions pertaining to your work, how often do you consult with someone else?" for centralization. Or "To what extent do the school policies, rules and job descriptions guide your day-to-day work?" for formalization.

The second part of the survey aimed to gather relational data to construct the social networks. As in any survey, much of the limitations occur due to the data being self-reported and can thus lead to self-reported data bias. That means that the respondents answer the questions and for most of the time it cannot be independently verifiable. In future investigations, questions can be more specific and by doing so the responses can be assessed for validity. For instance, in creating an information flow network (a network that represents how information is transmitted in the school), a specific question can be "Whom do you talk to about work related matters on a daily basis?" Adding frequency (on a daily basis) can help respondents have easier access to their memory and the data can be independently verified. Indeed, if person x says that they speak to person y on a daily basis, this can be verified by confirming whether the responses of person y match those of x. Responses that are not confirmed in this way can be discarded.

Other types of bias may hinder the reliability of our results. Social desirability bias may have played an important role in the answers of a few individuals. Social desirability bias relates to respondents answering the questions in a manner that may seem positive by others. Due to this bias, some of the respondents may have identified actors in their answers with whom they already have a formal relationship. This could have been the case for many staff members who reported, for example, their boss as one of the persons that they go to for more personal related advice. This bias could have direct effect on the centrality measures of certain individuals such as the operations manager. In addition, this type of bias could have influenced a few respondents to answer with more

than 25 other actors that they seek for work-related support, for example. An alternative to avoid this kind of problem would be either to limit the amount of targets that a particular respondent can answer to, for example, five or ten. Alternatively, the questions can be framed more specifically including time. For example, the question related to support can be reframed to "Whom do you turn for work-related advice *at least once a week?*"

Further research that involves construction of social networks in the school will need to take into account the above-mentioned potential issues. In order to implement an action type of research, or research aimed at finding causal relationships between network properties and other school phenomena (for example student achievement), surveys will need to be specifically and carefully crafted to achieve the purposes of the investigation. In addition, while the current study included all employees at ISH, future studies can focus on subsets of the entire population. By doing so, the research can focus on relationships between teachers or between teachers and admin, for example.

#### **5.4 Conclusion**

The potential of social network analysis perspective for understanding the "hidden" structures of schools has been recognized by a growing number of research studies. In the present investigation we conducted an exploratory case study to map the formal and informal, or relationships-based, structures of ISH. Our intentions for performing the investigation are varied. On one side, this research serves to start investigating causal relationships between a formal and deliberate school structure and its corresponding behaviour. Ultimately, the intention of school administrators is to provide the context and environment for students to succeed at school (measurements or indicators of student success is by itself another topic of discussion beyond the scope of this investigation). For this reason it is important for school administrators to understand the implications and consequences of their actions in deliberately defining the ways in which work is to be divided and coordinated to better achieve the organizational goals. Through a social network analysis, this investigation sets the foundations to approach the above-mentioned challenge for administrators. First, school

formalization and the assignment of formal roles may be considered as an independent variable in formulating a formalization theory of network cohesion, for example (Borgatti and Ofem, 2010). This approach would aim to try to increase network density and decrease network centralization as a function of deliberate organizational decisions. Moreover, once that relationship has been established, we may then move to build a network theory of student success, where now the independent variable would be related to network quantities such as density or centralization and would try to unravel a causal link between these variables and student success.

The current investigation was successful in implementing the social network methodology to create support, advice and personal maps of organizational behaviour. In addition, network measures related to those maps were successfully obtained and compared to the formal structure of the school. This study brings a new perspective of school structure and performance. If a network approach to analysing school performance is broadly adopted, this new perspective can yield insights that advance and that may even alter our perceptions regarding teaching and learning.

Finally, a new perspective based on social networks can uncover new, and previously hidden, leverage areas to improve school performance. If the theory and assumptions discussed in this investigation are correct, simple school changes such as creating inviting staff rooms or providing teachers with coffee could have, in the long run, deep and beneficial consequences for the community.

## 6 FUTURE RESEARCH

The results of the current study suggest new areas for future research. These include considering ways to address centralization/decentralization in the school, investigating the evolution of social networks, conducting comparative studies with other schools, expanding the research of social networks to include students, parents and board members, and including network analysis to a systems thinking perspective of organizational change.

### 6.1 Distributed Leadership

Our research found that the perception amongst employees of ISH regarding the centralization of decision-making is high. The network analysis supported this notion, too. High levels of centralization around decision-making in schools can bring challenges. One of the most evident one is the resulting effect of lack of teacher empowerment. In addition, an organization with high levels of centralization (in the network sense) risks having structural holes if influential actors decide to move on. Finally, there is growing evidence that in a fast changing and complex environment, more adaptive models of management are needed. Distributed leadership is a concept that has received growing attention in recent years (Spillane, Halverson and Diamond, 2001; Leithwood *et al.*, 2007; Harris, 2008; Bolden, 2011). Distributed leadership, according to Spillane et al., is based on "distributed cognition that is largely concerned with sources and patterns of influence that occur within organizations" (Spillane, Halverson and Diamond, 2001). In addition, empirical studies have shown the relationship between schools that show higher levels of distributed leadership with higher student performance (Harris, 2008). This would, thus, be a natural pathway for future explorations that aim to directly impact or influence aspects related to formal notions of leadership and ways to achieve decentralized decision-making.

## 6.2 Comparative studies

The current investigation used the International School of Havana as a case-study organization. Due to the nature of an exploratory case study, the results obtained in this investigation are limited. In order to better understand causal relationships, further investigations could be carried out in different schools. For example the same methodology could be implemented in two other international schools in Havana, for instance the Spanish and French schools. By gathering data from these two schools, we could more easily find correlations between network measures and school performance.

Other possibilities include redefining the samples to be studied. For example, future studies could include other organizational actors such as students, parents and board members. In addition, further studies could use a social network analysis to investigate the relationships between individuals in the organization to ideas of assessment, the school's mission, to develop socio-emotional support programs or to assess teachers' effectiveness in the classroom.

## 6.3 Network dynamics

The structure of networks depends on specific situations that occur in time. In the current research we mapped the network structure of ISH at this particular moment in time. These moments, and the resulting network, are in turn influenced by specific factors occurring right now, for example particular tasks to be performed in school. To better understand the informal structures of the school we need to turn our attention to how networks are formed over time (Cordeiro *et al.*, 2018). Understanding the dynamics of networks, the behaviour of how and in what conditions different connections are formed, can help administrators make better decisions aimed to foster network cohesion in schools and, therefore, better school performance.

## 6.4 Systems thinking

From a systems thinking perspective, this study opens up a new realm of possibilities for future research, as it allows the researcher to see and explore new leverage points. Systems thinking is a holistic approach to understanding phenomena that focuses on the relationships between the system's parts and how systems work over time and within the context of larger, more complex, systems. In the words of Peter Senge, Systems thinking is "...a discipline for seeing wholes. It is a framework for seeing interrelationships rather than things, for seeing patterns of change rather than static 'snapshots'. It is a set of general principles... it is also a set of specific tools and techniques" (Senge, 1990, p.68). In her influential article, Donella Meadows (1997) discusses system leverage points. Leverage points are those areas in a system in which a small perturbation can create a big systemic change. Leverage points are the "silver bullets", or the "magic potions" for creating sustainable change. Identifying these great areas of influence is not an easy task. In her article, Meadows lists a few candidates for leverage in systems from the least influential to the most influential. Introducing a social network perspective sheds new light into possibilities for leverage areas. For example, in this study we have hypothesized that simple actions that would foster communication and interaction between employees, such as having more staff gatherings or even more coffee in the faculty lounge, can have big impacts on a systemic level. Most importantly, Meadows notes, the number-two area for systemic change is the mind-set, or paradigm, out of which systems arise. Our investigation opens a new perspective for the management of schools that is fundamentally grounded in different assumptions from the ones that create formal structures. We can argue that by uncovering informal emergent structures, we contribute to developing a new awareness for management. The final and most influential leverage point, according to Meadows, is the power to transcend paradigms- that is, *"to keep oneself unattached in the arena of paradigms, to stay flexible, to realize that no paradigm is 'true', that every one, including the one that sweetly shapes your own worldview, is a tremendously limited understanding of an immense and amazing universe that is far beyond human comprehension"* (Meadows, 1997). Our investigation, according to this statement, is thus just one small grain of salt that may serve to remind us about the complexity of human organizations and life in general.



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## APPENDICES

### Appendix 1. The survey (English version)



Dear member of the ISH community,

The following is a voluntary questionnaire to explore the relationships between the formal structure of ISH and how it influences the social relationships within the school.

This is part of an investigation that I'm conducting as part of a master's degree in Educational Leadership that I'm pursuing at the Tampere University of Applied Sciences in Finland.

The social, or relationships-based, structure of schools is an important, and often overlooked, element for student achievement and overall school functioning. In this study I aim to quantify the formal, or "bureaucratic", and the informal, or "relationships-based", structure of ISH. The analysis will be done through a methodology called social network analysis. The results will allow us to see the school from a different perspective and to propose areas for school improvement.

Due to the nature of the analysis, the data collected cannot be completely anonymous. However, no names will be used in any part of the research; instead, numbers will be allocated to different actors. Data will be strictly confidential (only the researcher will have access to it) and will be used for research purposes only. The overall results of the study and possible areas for improvement will be shared with the ISH community.

In order to have valid results, one of the biggest parts of the success of this investigation relies on collecting honest answers from most, if not all, members of the community. This is why I appreciate your participation and your answers to the following questionnaire.

Thank you in advance for your support!

---

To answer the first and last questions you will need a list with the names and numbers of all staff members. Please check it. Please write as clearly as possible.

1. What's your own number in the list?

*"Centralization of authority is the locus of control for organizational decision making; it is the degree to which employees participate in decision making. High centralization means that decisions are concentrated at the top in the hands of a few, whereas low centralization indicates that the authority for making decisions is diffuse and shared among many." (Hoy, 2001)*

2. In your opinion, the level of centralization of ISH is:  
(1- very low; 5 - very high)

*"Formalization pertains to the amount of written documentation in the organization and the extent to which it is followed. Documentation includes procedures, job descriptions, regulations, and policy manuals. These written documents describe behavior and activities." (Daft, 2010)*

3. In your opinion, the level of formalization at ISH is:  
(1- very low; 5 - very high)

In the following section you will be asked to identify specific people in the school by a letter and number and the frequency with which you interact with them. Answer with as many people as you like.

The frequency can be: very often (3), quite often (2), sometimes (1).

**Your answers should be written in the form: person - frequency.** For example T54-3 means that you interact with person T54 very often. An answer S7-1 means you interact with person S7 sometimes only.

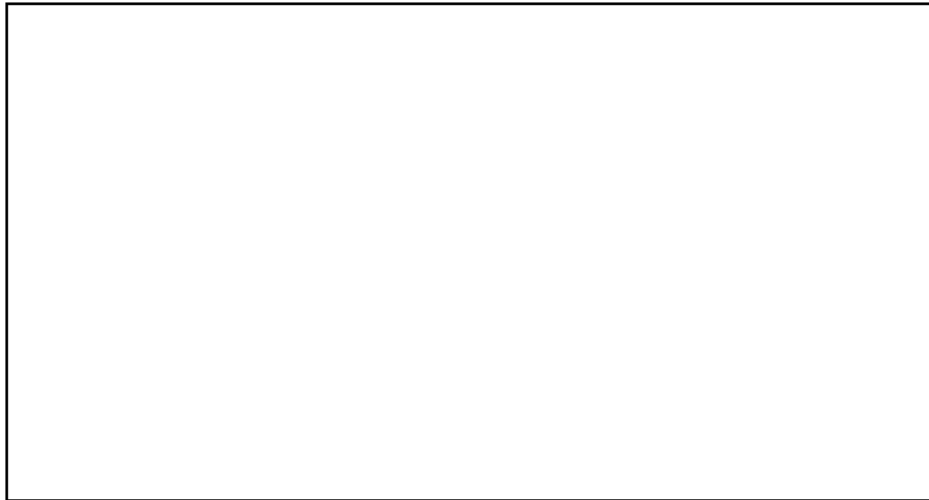
4. Whom do you turn to for support related to your work (any kind of help that you seek to better achieve your work)?

--

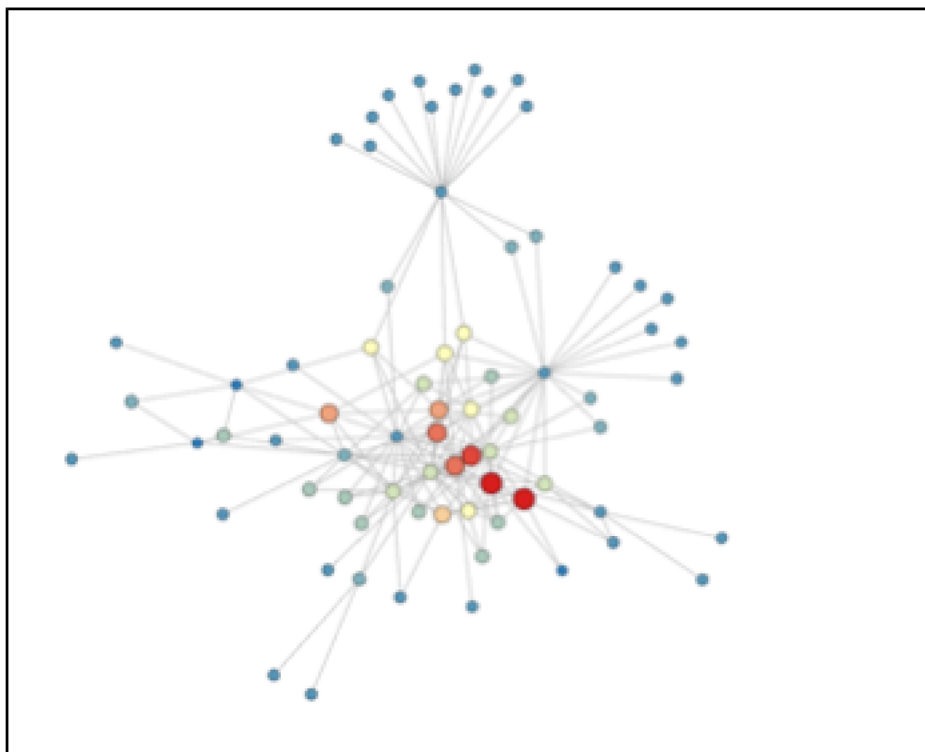
5. Whom do you go to for work-related advice?

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6. Whom do you go to for guidance on more personal matters?



This is an example of the representation of a social network. The example below represents what we have so far for the ISH network.





## Appendix 2. An example of answers

To answer the first and last questions you will need a list with the names and numbers of all staff members. Please check it. Please write as clearly as possible.

1. What's your own number in the list?

T50

*"Centralization of authority is the locus of control for organizational decision making; it is the degree to which employees participate in decision making. High centralization means that decisions are concentrated at the top in the hands of a few, whereas low centralization indicates that the authority for making decisions is diffuse and shared among many." (Hoy, 2001)*

2. In your opinion, the level of centralization of ISH is:  
(1- very low; 5 - very high)

5

*"Formalization pertains to the amount of written documentation in the organization. Documentation includes procedures, job descriptions, regulations, and policy manuals. These written documents describe behavior and activities." (Daft, 2010)*

3. In your opinion, the level of formalization at ISH is:  
(1- very low; 5 - very high)

4

In the following section you will be asked to identify specific people in the school by a letter and number and the frequency with which you interact with them. Answer with as many people as you like.

The frequency can be: very often (3), quite often (2), sometimes (1).  
**Your answers should be written in the form: person - frequency.** For example T54-3 means that you interact with person T54 very often. An answer S7-1 means you interact with person S7 sometimes only.

4. Whom do you turn to for support related to your work (any kind of help that you seek to better achieve your work)?

A3-3	A-17-2
A2-3	A-11-2
A6-2	
A10-2	
T4-1	
T22-1	
T31-1	

5. Whom do you go to for work-related advice?

T4-3
T31-3
T22-2
T35-1

