An evaluation model of structural complexity in educational systems

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Introduction

Structural complexity was identified as a component of organisational structure (Hall, 1996; Hall, Haas, & Johnson, 1967) and has been under examination since the 1960s (Hage, 1965; Maguire et al., 2003; Wilson, 2003) as an element of the structural organisational subsystem compared to the two other structural characteristics, centralisation and formalisation.

Complexity as a construct in the field of Organizational Theory is presented by scholars who studied organizations in the post – weberian era. Theorists and researchers, who were solely based on the characteristics of Weber’s bureaucratic organization, added it as a new characteristic in the bureaucratic organizational structure. Both scholars of the 1960’s and 1970’s (Hage, 1965; Hage & Aiken, 1967; Hall et al., 1967; Pugh et al, 1968; Blau & Schoenherr, 1971; Dewar & Hage, 1978; Hall, 1996), and those who came later, and studied in the field of business (Hsu & Marsh, 1983; Child, 1973) and public administration organizations (Wilson, 2003; Maguire et al., 2003; Maguire, 1997; Langworthy, 1986), refer to complexity as a structural and at other times as an organizational characteristic or dimension.

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without at the same time commenting on the distinction between the two adjectival definitions given to it from time to time. In fact, even in the cases that it is referred to as an organizational variable, this is examined – with few variations - based on the SC criteria, as presented in Hage’s Axiomatic Theory (1965) and in the research of Hall & Aiken (1967) and Hall (1996). In this way, an impression is informally given that structure and organization have identical meanings or that one complex structure is enough for the behavior of an organization to be also characterized as complex. Lastly, does it suffice to check whether structure in an organization is complex or not to call an organization or a system as such?

From the definitions given from time to time to structural complexity, one can see a direct connection of it with organizational size – its enlargement and expansion – and for this reason its dimensions have been determined and measured in all cases quantitatively. Many case studies supported empirically the significance of size in the formation of organizational structure (Blau, 1970; Blau & Schoenherr, 1971; Child, 1972;1973). Hage (1965:294) refers that “the complexity, or specialization, in an organization is measured by the number of occupational specialties included and the length of training required by each. The greater the number of occupations and the longer the period of training required, the more complex the organization”. Price (1968) gave a definition similar to that of Hage, placing emphasis on the complexity of knowledge: complexity may be defined as the degree of knowledge required to produce output of a system. The degree of complexity of an organization can be measured by the degree of education of its members. The higher the education, the higher the complexity” (26).

Hall (1996) and Hall & Aiken (1967) embrace Hage’s definition on complexity, but make a more thorough analysis of the dimensions defining it, which may be interpreted with measurable indicators. Thus, Hall (1967:906 ; 1996:53) mentions the horizontal
and vertical differentiation and the spatial dispersion as elements of complexity. Hall (1996:53) argues that horizontal differentiation refers to the ways the tasks performed by the organization are subdivided”. He continues that “Vertical, or hierarchical differentiation is a less complicated matter than horizontal differentiation. Research into vertical dimension has used straightforward indicators of the depth of the hierarchy”(1996:55), the number of levels in the deepest single division” and the “mean number of levels for the organization as a whole (total number of levels in all divisions/number of divisions) as their indicators (1967:906).

Hall (1996:56) describes the final element in complexity, spatial dispersion or differentiation, as that “can actually be a form of horizontal or vertical differentiation. That is, activities and personnel can be dispersed in space, according to either horizontal or vertical functions by the separation of power centers or tasks”.

It has been established from these first theorists that complexity refers to basic elements of the bureaucratic model and creates in fact a composite form of specific characteristics of the weberian theory of organizations: of the division of labor, of specialization and of the hierarchy of power. These three SC dimensions have been used in all the spectrum of research up to this day giving them different measurements depending on the nature of the organization, industry or company under examination (Wilson, 2003 ; Maguire, 1997; Maguire et al., 2003 ; Langworthy, 1986 ; Hsu & Marsh, 1983 ; Child, 1973). Structural Complexity was in no case examined systematically, not only as an enumeration of the elements forming and diversifying it but as a study of the connections formed amongst these elements.

Lastly, the recent study by Wilson (2003) on U.S municipal police organizations has been subversive. It came to the conclusion – through confirmatory factor analysis – that the four most common and most widely acceptable dimensions of complexity do not form one factor, and therefore do not form the interpretation of SC. In particular, he
states “the confirmatory factor analysis of structural complexity empirically supported Maguire’s (1997) contention that complexity is not unidimensional and should not be treated as such. …spatial, occupational, hierarchical and functional differentiation were not indicative of a common, underlying construct. Therefore, …is not appropriate for organizational scholars to create a ‘scale of complexity’ for use in their studies. A single, common factor does not determine these differentiation variables” (292). This conclusion explains to a degree the incompatibility of complexity dimensions when related to other organizational dimensions (Hsu, Marsh & Mannari, 1983; Child, 1972; 1973). This creates, therefore, in relation to all that has been mentioned above, an intense doubt as to the way in which structural and organizational complexity has been defined and measured to this day.

Structural complexity has been commonly linked to the size or the expansion of an organization in a relationship of ‘cause-effect’. Blau and his associates have been the major proponents of size as the primary cause of complexity. Hsu, Marsh & Mannari (1983) refer to a series of studies they have undertaken where they have also found consistently strong and positive relationships between organizational size and various components of complexity (Blau & Schoenherr, 1971; Blau 1970). Although substantial relationships between size and complexity have been found in many studies in different samples of organizations (Meyer, 1972; Pugh et al., 1968; Child, 1972) the issue of causality remain controversial (Scott, 1975; Kimberly, 1976). For example, Hall (1972) after reviewing recent literature, takes a very different view of the role of size “there are no ‘laws’ regarding size and other organizational characteristics….Size, which related to some important characteristics, is not as important as other factors in understanding the form organization take. When size (and growth) is taken in conjunction with technological and environmental factors, predictions regarding organizational structures and processes can be made” (139). Child and Mansfield (1972)
found that size has a much closer relationship to the aspects of structure measured than technology.

In the field of Educational Administration, the study of school structure has been very limited. The on-line search under the key-word 'school structure', using search engines such as Swetswise and Ingenta (that concentrate the plenitude of relevant scientific journals) only produced seven articles out of 18,777,158 references in the field of Education. (Ready, Lee & Welner, 2004; Sinden, Hoy & Sweetland, 2004; Hoy, 2003; Yu, Leithwood & Jantzi, 2002; Hoy & Sweetland, 2001; Harper, 2000; Hoy & Sweetland, 2000). None of the above considers structural complexity as a component of educational organisations’ structure.

At the same time, transferring and applying the criteria that measure structural complexity in businesses to educational organisations and schools specifically, appears somewhat problematic. That is because the evaluation of the division of labour, is a basic criterion of horizontal differentiation: namely, the enumeration of the occupational specialties in an organisation, the positions, job-titles and the length of training (degree of education) of the employees. Applying these criteria as such on educational systems –on primary education especially- would lead us to the oversimplified conclusion that not only schools are not complex organisations but also that their capacity to become such is limited. In primary education the logic of specialisation is from non-existent to very limited (e.g. in Greece and Cyprus), while the description of the teacher’s post has in centuries remained the same in many educational systems, despite the changes in its content. Clearly, the appearance of new specialisations among the teaching staff, as well as the new postings in the administrative mechanism of education, constitutes elements of horizontal differentiation of the educational systems. To what degree however are we entitled to assume that elementary schools do not have equally or more complex structures compared to other schools, due to this deficiency?
Summing up the theory and research on SC, we conclude the following:

1. Structural complexity was examined (in contrast to its definition), as a simple and usual phenomenon. It was limited to conventional enumerations; it was limited schematically and became identified in many cases with the chart of a company or organization.

2. All the research mentioned above make large-scale quantitative measurements in order to generalize and mainly compare amongst the various types of organizations, having as ulterior purpose its establishment as a new dimension of organizational structure. There are no ethnographic studies and qualitative pieces of research, which could bring forward qualitative measurements and relations amongst the various structural component units. At the same time, they solely deal with the formal dimension of an organization, by-passing the informal secret (or hidden) structural aspect of it.

3. Lastly, what characterizes the way of controlling complexity is a deterministic reasoning. The study of SC is subject in all cases to the laws of determinism, a “cause-effect” reasoning, which mainly aims at splitting the structure to its components, examine them individually in order to be able to understand and relate it to other dimensions of the organization. It is a scientific approach, which fails to bring out the dynamic and polymorphous relations, which the organizational structures may put forward. This restrictive viewpoint might be one of the reasons that dealing with structures is today considered by many as outdated, while structural changes and restructuring are considered of limited significance (first order change) (Fullan, 1991).

4. Finally, recording or measuring structural complexity in school(s) organisations becomes impossible, as there are no criteria for evaluating the complexity in the
structure of schools or educational organisations, while the characterisation ‘complex’ is typically used arbitrarily or replacing the term ‘complicated’ (Wheatley, 2003). Meanwhile, the planning and functioning of educational organisations that differentiates them from business organisations, intensifies the inability to apply the quantitative measurement criteria of structural complexity in the field of education.

For these reasons, structural complexity is examined ethnographically and it is controlled as to its three dimensions (and not as to the criteria used to measure it) on a centralised bureaucratic system, as the one in Cyprus, and two cases of public elementary schools. In their effort to respond to the sudden changes in their environment (the presence of economic immigrants – transition from a single-culture to a multicultural condition), the schools under examination, get reconstructed differentiating in this was three basic elements of their bureaucratic structure – centralization, formalization and structural complexity. This article aims at presenting the changes that take place as to the third characteristic of the school structure, and create an assessment model for structural complexity adjusted to the field of education and in school structures especially.

**Methodology**

In doctoral study (Papaioannou, 2007), structural complexity is investigated as one of the three characteristics of educational systems structure along with centralization and formalization. More specifically, the aim of the doctoral study is to explore restructuring as a homeostatic self-regulation mechanism of school systems, operating when the latter confront important changes of their lingual-cultural homogeneity (presence of non-native speakers-NNS).
The doctoral study describes possible diffusion mechanisms of changes and of school policy at the micro- and macro-level, as well as such policy’s consequences for the system of employment, accountability, supervision and control of the educational system. In addition, it examines the direction of change and the impact of the school unit decisions on the process of educational policy-making for the function of state primary schools in NNS education. It is a holistic study of change effected by the multicultural condition at the three levels of the centralized and bureaucratic educational system of Cyprus: the macro-level, the meso-level and the micro-level of the school unit.

In a more concrete fashion, the study aspires to investigate the implications of multiculturalism for the basic functions of a school organism: the enrolment and registration, the classroom and teaching organization, the management of the curriculum and the schedule of teaching, the teaching itself, and the school management. It explores in time span whether the changes appearing at those five subsystems that constitute the basic functions of the school organism, cause at the same time changes in the three characteristics of the bureaucratic structure of schooling: centralization, formalization and structural complexity. Therefore, this research approaches restructuring as an organizational-administrative phenomenon in the light of Organizational Theory and not as an outcome of a national educational policy.

The investigation of structural complexity in two school case studies derives from the cross examination of data as:

- Content analysis of official documents of the Ministry of Education and Culture Archive: “Intercultural Education”.
- Discourse analysis of the final representatives of educational policy in Cyprus (Minister of Education and Culture and Head of Primary Education),
the General Inspector of Primary Education (1), the Superintendents (4 persons) from the particular educational districts in the jurisdiction of which the two school cases belong to, as well as the Inspectors (3 persons) that are responsible for the particular two school cases.

- Discourse analysis of headteachers, the teaching stuff and parents-members of the school boards of the two schools
- Qualitative and quantitative analysis of registries of the school year of non-native speakers’ presence in the school (1990/91 – 2001/02 for the school Frixos and 1986/87 – 2001/02 for the school Elli).
- Analysis of the personnel and parental council meetings
- Qualitative analysis of the observation sheets of daily school life and of the extra-curriculum activities of the two school for a whole year.

Basic guiding queries during the analysis process of the aforementioned data, aiming at the examination of structural complexity in the two schools, was:

A) If and in which degree the operation of the two school case studies is differentiated compared to other monocultural public primary schools and the official institutional frame that regulates the operation of all state elementary schools in Cyprus

B) Which of the changes detected and deriving from as a result of multicultural composition of pupil population in the two schools, also constitute components of structural complexity in school organisms.

For the determination of those components concerning the emergence of a complex structure in both multicultural schools, the definitions of horizontal and vertical differentiation such as spatial dispersion, as determining by Hall (1996), are exploited as a frame; however, the measurement criteria for structural complexity that have been used in quantitative studies, as show in bibliographical review of this article, are not exploited.
Lack of corresponding research in educational organizations renders case study the most appropriate methodological approach for the investigation of structural complexity. Case study give as the opportunity of an empirical investigation of a particular contemporary phenomenon within its real life context using multiple sources of evidence” (Robson, 1993:146) utilize flexibility as one of its basic characteristics (Robson, 1993:148). The necessity of a case study design for “what is going on in a novel situation” (Robson, 1993:149) renders it as the most valid methodological approach for the determination of phenomenon such as the structural complexity in educational systems.

Furthermore, it appears that the characteristics of horizontal, vertical and spatial differentiation that constitute the complexity of organisational structure as they have been studied in the field of business administration and other non-educational organisations (Wilson 2003; Maguire 2002; Langworthy, 1986; Hsu, Marsh & Mannari, 1983; Dewar & Hage, 1978; Child, 1972; 1973; Pugh et al., 1963; 1968; Hage & Aiken 1967; Blau, Heydebrand, & Stauffer, 1966), do not cover completely the cases of educational systems and school structures/organisations for two reasons:

a) The criteria can be applied only through quantitative measurements, which lead to the observation of significant deviations as well as demarcations from/as to what is evaluated as horizontal, vertical and spatial differentiation (Pugh, 2003; Wilson, 2003).

b) Even in the case when the criteria are applied on educational organisations and schools especially, their content appears to be problematic and deficient, as they do not respond sufficiently to the special nature of the personnel and the work that takes place in an educational organisation.

For the above reasons, the structural complexity of a school organisation is examined using quantitative and qualitative techniques. It is expected that qualitative
analysis will demonstrate all the elements that comprise the content of horizontal, vertical and spatial differentiation according to the definitions of the three characteristics that shape the general framework as it was set and used by the researchers in the field. Exploring the content of the three characteristics of structural complexity, give us the ability to set criteria and create an evaluation model for structural complexity in educational organisations.

**Results**

The results of the research appear to yield important information on the structural complexity of school systems and they stem from:

1. The factual analysis of every level of CES
2. The comparisons between the two case study schools, which are restructuring due to their transition from single-cultural to multicultural condition.

It would appear that multiculturalism and the consequences it has on the two public schools cause a intra-organisation polymorphology of the school structural systems. The *loose hierarchy and the indistinctness in the appliance of the [educators’] evaluation system* (Hall, 1996) mainly due to the absence of specialisation, are related to the initiatives, actions and newfangled choices that constitute the structural complexity of the two schools.

By examining all the changes brought on the basic operations of the school and education system of Cyprus due to multiculturalism, the ethnographic study collects the actions, decisions, choices as well as identifies the needs that altogether form the measurement criteria of the horizontal, vertical and special differentiation of the schools’ structure. Tables 1, 2 and 3 analytically presenting the assessment indicators for the three dimensions of structural complexity, utilise the results of the comparative
Horizontal differentiation for Hall (1996;1967) and Hage (1965) is mainly identified with the organisation’s specialisation and the degree of knowledge that has to be present to yield specific outcomes. In the multicultural schools of our case study, specialisation in managing issues of multiculturalism and teaching in multilingual environments across all levels of the administrative hierarchy of CES, is identified as an immediate astute need and at the same time as an absent condition among the teaching and administration personnel in primary education. The need for specialised skills responding to the newly formed school reality, also surfaces out of the General Inspector of Primary Education (GIPE) statements which ‘doubt’ the certification that the higher education degree has provided until today, as the single criterion for appointment and as a verification of the educators’ teaching skills, when it comes to matters of teaching in multicultural classrooms.

“The supervision of the educators who teach in parallel remedial classes should be organized differently from the way it is currently organized. Fundamentally, we should control how the educators in those schools interact with the NNS and to what degree they have the skills to respond to the specialized needs of a multilingual school population. If those skills are absent, we should find ways to acutely support and train the teaching staff”.

It is observed that the changes in the social environment not only differentiate the school’s linguistic and cultural character; they bring forward questions of specialisation in new areas, influencing concurrently the evaluation, supervision and control systems in the field of Education.

The horizontal differentiation of the school organizations’ structure is examined based on the definition provided by Hall (1996:53) as the way [in
which] such organizational tasks can be subdivided, the number of occupational specialties and the number of job-titles identified in an organization. Table 1 gathers the official (following the approval of Superintendents and the Director of Primary Education-DPE) and informal acts that the two schools have undertaken aiming at responding to the sudden and unscheduled change. As it emerges from the cross analysis of data, these acts shape the three forms of specialization that make up the criteria of horizontal differentiation that the structure of educational organizations presents under the influence of the change that multiculturalism brings in education.

Table 1. Evaluation Criteria of horizontal differentiation of school structures

<table>
<thead>
<tr>
<th>Actions of schools</th>
<th>Criteria of horizontal differentiation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Specialization of professional roles – new job titles</strong></td>
<td>A. Specialization of professional roles – new job titles</td>
</tr>
<tr>
<td>Appointment of ‘teachers for remedial teaching’. New informal specialties in elementary schools: Kindergarten teachers, teachers for children’s with special needs supporting NNS, teachers responsible for multicultural affairs, bilingual teachers, foreigner teachers, teachers for homework.</td>
<td></td>
</tr>
<tr>
<td><strong>Work specialization:</strong> Teaching in remedial/support and reception classrooms, organizing classrooms and teaching on the base of knowledgeable criterion in stand of age (tracking), needs for specific teaching skills, development of teaching tools, differentiation of teaching tools and methods, curriculum development or restructuring in micro – level</td>
<td>B. Work Specialization</td>
</tr>
<tr>
<td><strong>Knowledge Specialization:</strong> Use of multiple teaching tools, textbooks and software, need for specific criteria of teaching evaluation in multicultural classrooms, need for training in the fields of Intercultural Education, teaching Greeks as a second language and patterns of developing curriculum in micro-level. Design a new type of school (multicultural school).</td>
<td>C. Knowledge Specialization</td>
</tr>
</tbody>
</table>

From table 1 it appears that school structures present three criteria of horizontal differentiation: the *specialization of professional roles* and the existence of *new*
positions and job-titles, the specialization of the work that takes place in the school and
the knowledge demanded for responding to the new more complex environment. As to
the first criterion, the job titles and the specialization of professional’s role can be
placed in a single category. As we have already mentioned, this is due to the fact that, in
Cyprus’ primary education as well as in several other centralised bureaucratic
educational systems, the teaching staff falls under a single category, described by the
official title of the ‘teacher’s post’. It appears however that schools develop specialties
based on the needs that arise, forming in this way informal specialized job postings with
specific and distinct responsibilities. The need for knowledge specialization, as related
to the teaching of Greek as a second language, and the curriculum development or
restructuring on micro-level – seeing that the staff in all the schools deem the single-
cultural national curriculum inadequate- puts in question the sole criterion for
appointment (referring to diploma - BA) as sufficient qualification for teaching in
multicultural classrooms. The new conditions demand new skills that cannot be
acquired by the education and training educators receive for mono-lingual and national
education systems. This conclusion directly emerges from the GIPE statements and
indirectly from recognising the inability to organize teaching in the new classroom
environment, an assertion that is emphasized by all those involved in schooling
(Superintendents, Supervisors, Headmasters, teaching personnel).

Role-specialization is directly related to work specialization and the new working
regime formed by the change in the schools case study. The teaching process takes
place not only in regular mono-lingual classes where the official national curriculum
and the national textbooks guide the teaching methods and practice, but also in remedial
classrooms, individualised instruction, in mixed multilingual classes and in reception
classes where the national curriculum is deemed insufficient. The new organization in
multiple groups based on the criteria of the students’ level of knowledge and their
spoken language, has each time different requirements from the teacher, as the national textbook and the national curriculum become inapplicable and inefficient provisions.

Finally, the work specialization, that consists an *inner condition* emerging due to the school’s multilingualism and is not among the educator’s direct aims (as it would happen in the case an innovative or intervention program was designed and practiced by the teachers themselves), brings forward the need for specialized knowledge, which is directly related to the school’s new needs. Specialized knowledge concerns the management of multiculturalism, teaching Greek as a second language, developing a curriculum on a micro-level and bilingual teaching.

It can be observed that the three criteria of the horizontal differentiation of the school structure appear to be directly interconnected, which allows us to place them under the same factor.

Hall (1996:55) describes the vertical differentiation of organizations as the observed differentiation in hierarchy, the vertical allocation of positions of authority, the depth of hierarchy that the organization appears to have and the total number of hierarchy levels combined with the authority allocated in each. Apart from the formal positions of authority in the administrative mechanism, the expansion of levels and the presence of new positions of power could emerge through phenomena of “internal” distribution of power. The ‘dual ladder’ mechanism can be described as such a phenomenon. As Hall (1996:55-56) assesses, it concerns organizations that have arrangements, which allow the occupational and numerical promotion of the personnel within the description of the same job-title, without an actual change in their work or an increase in authority. In this case, the individuals acquire a wage increase without an active change in the nature of their work and their authority status.

Vertical differentiation as a formalized decision to create new administrative or other institutional bodies in CES is absent in the study of public elementary schools in
the light of the transition to the multicultural condition. To a large extent this is due to the debureaucratization and semi-autonomous function of the two school units, resulting from their homeostatic self-regulatory action and not from decisions coming from the ‘center’ (Papaioannou, 2007). The absence of the creation of new institutional bodies by CES, (e.g. Committee of Intercultural Education) as a central institutional body, is balanced by the direct action the school themselves take responding to the change, which results to the transfer of power to the bottom of the system. Table 2, presents the criteria for vertical differentiation in the structure of CES and the case study schools.

Table 2. Evaluation Criteria of vertical differentiation of school structures

<table>
<thead>
<tr>
<th>Actions of schools</th>
<th>Criteria of vertical differentiation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>New Hierarchical lines of power:</strong></td>
<td>A. New lines of power</td>
</tr>
<tr>
<td>Constitution of a Inter-ministerial Committee Design of Multicultural Committee</td>
<td></td>
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<tr>
<td><strong>Informal ‘dual ladder’ jobs</strong></td>
<td>B. Informal - ‘dual ladder’ jobs</td>
</tr>
<tr>
<td>Informal promotion of a teacher as an assistant headteacher (from the headteacher of school), teacher responsible for the multicultural issues of school (flow of information and specific regulations).</td>
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</tbody>
</table>

As it is observed, vertical differentiation is especially limited. This is due more to the absence of specific action by the Ministry of Education for the formation of a Committee or a Department of Intercultural Education that would clearly create new positions in the system hierarchy and in the multicultural schools as well. The absence of new lines of authority as a characteristic of structural complexity combines with the contradictory phenomena of debureaucratization and the semi-autonomous forms that the two schools of the centralized CES appear to have.
On a national level, the constitution of an Inter-ministerial Committee (Archive of “Intercultural Education”, decision no. 46.201, 11/6/1997) appears as a new line of authority; from 1997 –2002 it determined issues related to the provision and utilization of Additional Teaching Hours (ATH) in School(s) of Non-Native Speakers (SNNS). Representatives of the Ministry of Education, the Programming Office, the Ministry of Finances and the Office of Public Administration and Personnel comprise this Committee. As a collective body, it is a new and of limited duration line of authority, because its members’ power includes the right of decision-making, and it does not appear to have a pure consultative role (Saitis 1992:23). The formation of a Inter-ministerial Committee as a CES initiative, to gain the approval of benefits pack from the state budget, is a common act, and does not concern only the case of official approval for the funding of ATH that is provided to SNNS schools. In the case however of the particular committee, it appears that the activity of institutional non-educational authorities is expanding to decisions that concern the educational and instructive work of the school: representatives of financial and other services of the State who participate in the committee, draw up a document in which they suggest how should remedial teaching hours be distributed and evaluated as well as methods to distribute NNS students in the remedial teaching classrooms. Determining educational criteria for the organization, distribution and utilization of ATH determined centrally by the Committee for the activity of the schools, elevates it to a new line of power.

The planning of the Committee of Intercultural Education appears as a new hierarchical line. It regards an act that up until 2003, -the final year of data collection- had the form of a political design. It is referred to as a need for programming, in the statements of Nicosia’s Superintendents, Inspectors and the headmaster of the school Frixos, who appears to be informally participating in its planning.
What is interesting to observe is the existence of informal-non-institutional positions of power within the school organizations, as a criterion of vertical differentiation in their structure. Two acts can be discerned in schools that constitute dual ladder mechanisms. The first case concerns the teacher’s “promotion” to the position of assistant headteacher of the school, from the headmaster himself. This decision was taken because of the inability of the Cyprus Educational Service Commission (CESC) to centrally fill the vacancy of the assistant, due to educators denying to be placed in the aforementioned school. The decision of selecting the teacher to cover for the job of Assistant Headteacher was accompanied by a reduction of his teaching hours, so that he would be able to respond to his dual commitment as a teacher and a manager, for which the headteacher took sole and full responsibility. Similarly, older SNNS educators with experience in managing the condition of multiculturalism are appointed responsible for multicultural matters, holding responsibility for the programs that regard students who are NNS, the adjustment of new colleagues in the school’s operational particularities and the collection and flow of information on issues of multiculturalism.

Both dual ladder cases differ from the way in which Hall (1996) describes this mechanism. The educators’ new positions set them apart from the body of the teaching personnel, placing them informally on a higher posting through internal arrangements that take place within the school basis. However, the nature of their work and their authority status do not remain the same. Their workload increases as they continue to perform their teaching activities on top of their new responsibilities, while simultaneously they are recognized as persons with a higher status than the teachers’ association. In the case of school organizations it would appear that this vertical form of differentiation signifies the promotion of the educators on a higher posting through
intra-organizational arrangements expanding at the same time the work and the role of those individuals.

The third dimension of SC - the spatial expansion of the organizational structure - presents the most significant diversities in the educational institutions, compared to other public institutions and the private sector. According to Hall (1996:56), spatial expansion of the organizational structure signifies that “activities and personnel can be dispersed in space, according to either horizontal or vertical functions, by separation of power centers or tasks”. The spatial expansion is thus affiliated to the horizontal and vertical differentiation of the institution, and refers to the spatial expansion of specialization and positions of hierarchy. Researchers of the private sector (Hsu, March & Mannari, 1983; Child, 1972; 1973; Pugh, Hickson, Hinings & Turner, 1968) and of the public organizations (Hassell, Zhao & Maguire, 2003; Maguire, Shin, Zhao & Hassell, 2003; Wilson 2003; Maguire, 2002), view the spatial expansion in the same manner. The spatial expansion of the organizational structure in the case of the private sector, takes a more complex and differentiated form, with regards to the criteria determined, in the case of school organizations (Table 3).

The ethnographic study of the spatial dispersion of the educational organizations shows that we can interpret spatial expansion not only in the physical dimension of space – operational, geographical, population and building dispersion – but in the abstract dimension of space as well. The complexity of work and of the teaching organization and the population expansion that occurs in schools, are responsible for geographical – population and building dispersion, phenomena of the physical dimension of space. The aforementioned researches study spatial dispersion exclusively in its physical-external dimension. The educational structures present an internal dispersion, which consists of the expansion of the power of the individuals, and the
content differentiation of professional roles. These two criteria shape the abstract
dimension of space.
Table 3. Evaluation Criteria of Spatial Dispersion of School Structures

<table>
<thead>
<tr>
<th>Actions of schools</th>
<th>Criteria of spatial dispersion and internal differentiation</th>
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<tbody>
<tr>
<td><strong>Building dispersion</strong></td>
<td></td>
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<tr>
<td>Creation of new teaching rooms for remedial teaching and organization of support groups</td>
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<tr>
<td><strong>Operational dispersion</strong></td>
<td></td>
</tr>
<tr>
<td>Parallel education, daily use of two languages, multiple use of teaching rooms; all-day and extra-curriculum use of school grounds</td>
<td></td>
</tr>
<tr>
<td><strong>Geographical dispersion</strong></td>
<td></td>
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<tr>
<td>Transfer of NNS in other schools of the same educational region; dispersion of the multi-cultural phenomenon</td>
<td></td>
</tr>
<tr>
<td><strong>Population dispersion – differentiation</strong></td>
<td></td>
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<tr>
<td>Increase of foreign language students, teaching personnel, and diversity in these two groups</td>
<td></td>
</tr>
</tbody>
</table>

**Differentiation of power in non-educational institutional bodies**

Educational decision making by non-educational agents; (organization of classrooms, duration of remedial teaching, number of NNS per group, evaluation of language skills and of the apportionment allocation additional teaching hours

**Differentiation of the power of headteacher’s role**

Shapes multicultural educational policy, legislates arbitrarily, replaces institutional bodies, takes decisions free-willingly, deviates the institutional framework, take decision on political issues, takes social action and creates a network of donators and sponsors.

**Diversification of the teacher’s role**

Contributes in the creation of educational political measures for the multicultural student body, decides the abolition of certain curriculum lessons, takes social action and expands the teaching role.

**Differentiation of parental council’s and local agents role**

Formation of educational political measures concerning the course of study of NNS, intense social action – volunteering, participation in the decision making process of the school on organization and teaching matters, personnel hiring, creation of a network of contacts with local agents, creation of contractual relationships and aggregation of sponsors.

**Differentiation of student’s role**

Bilingual Pupils engage in translation, when necessary, and help the integration of NNS (co-operative achievement). They support the teaching process and take actions to help the financial actions of the school.
The population dispersion or differentiations are incorporated within the criteria of structural ‘physical’ dispersion. That is to say, size is not considered an independent variable (as in afore-mentioned researches), but is amalgamated in the criteria of spatial structural expansion. Scholars of Organizational Theory consider the size of the organization an independent variable compared to Structural Complexity, and reach the conclusion that “as organizations grow, they become more complex” ((Blau & Scott, 1962; Blau, Heydebrand, & Stauffer, 1966; Blau, 1970; Blau, & Schoenherr, 1971). Research in the educational institutions, however, shows that population expansion is not consistent with the complexity of the institution. Between two schools – the range of changes and the SC criteria which the smaller in population school (Frixos) presents, is greater than those which occur in the second school (Elli), which also happens to present steady population growth. In contrast, what appear to determine the degree of SC are the qualitative characteristics of the school and the degree of diversity within its pupil population and all of its operational levels. This conclusion leads us to the decision not to examine the population expansion as an independent variable, but to consider it a criterion in the factor of spatial dispersion. Population expansion evaluates the degree of change in the school population.

To conclude, with regards to the criteria of the internal expansion of the structural subsystem, given the abstract interpretation of space, we discern that the people and the roles involved in the operation of SNNS - first and foremost the director’s role- take action on different fields, which either do not belong to the formal description of their role (expansion of power), either construe new fields of action, which in the majority of cases, are in clash with the conventional concept of their role (expansion of role dimensions). The expansion of power is
characteristic in the case of the headteacher’ role, as leaders of schools under research enjoy a high degree of autonomy for a range of decisions, which do not belong to their jurisdiction. The new fields of power (enrollment, co-education, curriculum development and teaching tools for teaching in NNS, arrangement of remedial classrooms) are needs which result from multiculturalism, institutional voids, and the established frame’s inability to enforce certain cases of decision making. All these factors determine the director’s autonomous action. The need for immediate decision making, due to constant and sudden changes which take place in school, projects headteachers, who legislate arbitrarily, replace institutional bodies (CESC), and decide free willingly. Meanwhile, headteachers also broaden their social and political action – despite the fact that they are not permitted to participate in Mass Media debates over conflict resolution, and to develop arguments for a socio-cultural policy, headteachers do so, due to immigrants presence in the area.

The enlargement of the content of professional roles is discerned in all the people involved in the operation of the school. The parents determine the content of political decisions of the Ministry of Education, take intense social action, take part in the school policy, and engage in contractual relationships with local agents and donors. The educational faculty, beyond the broadening of their educational role due to the specialization of their work, demonstrates social and volunteer action and makes decision making for the informal cancellation of particular lessons of the national curriculum. In addition, students are used in the support of teaching and the integration of new immigrant pupils, as well as in actions regarding the finding of funds for the coverage of school needs.

The study of internal abstract spatial dispersion of the organization, provides significant information regarding the role of persons, and their participation
in the decision making processes, the degree of power they possess or/ and enforce
and the implementation of the established framework which determines their
jurisdictions and the basic operations of the school.

Table 4 encompasses the dimensions and the criteria of the model which
evaluate structural complexity.

Table 4. The Evaluation Model of Structural Complexity in Educational
Organizations

<table>
<thead>
<tr>
<th>Dimension of structural complexity</th>
<th>Structural complexity criteria</th>
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<tr>
<td><strong>Horizontal differentiation</strong></td>
<td>1. Specialization of professional roles – new job titles</td>
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<td>2. Work specialization</td>
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<td>3. Knowledge specialization</td>
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<td><strong>Vertical differentiation</strong></td>
<td>4. New lines of power</td>
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<td>5. Informal, ‘dual ladder’ job</td>
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<tr>
<td><strong>Spatial dispersion and internal differentiation</strong></td>
<td><strong>Physical dimension of space –external dispersion</strong></td>
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<td></td>
<td>6. Building dispersion</td>
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<td>7. Operational dispersion</td>
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<td>8. Geographical dispersion</td>
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<td><strong>Abstract dimension of space-internal differentiation</strong></td>
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<td></td>
<td>10. Expansion of the jurisdictions and the power of the employees involved in the educational process</td>
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<td></td>
<td>11. Expansion of the professional roles and institutional bodies involved in educational process.</td>
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The comparative study of the criteria of horizontal and vertical diversification
and of the spatial dispersion reveals the relation of structural complexity to the other
two basic characteristics of bureaucracy: centralization and formalization. Diagram 1 demonstrates the relation between the three dimensions of school structure: centralization, formalization and structural complexity.

*Diagram 1. Correlation of the three structural characteristics in educational organizations.*

From the aforementioned analysis, we conclude that as the SC of the school structure increases, the degree of centralization is limited. The central supervision and control system is restricted and the bureaucratic accountability system is replaced by a market-public accountability system. Meanwhile, the increase of SC brings forth the deviation and diversification of the current formal institutional framework. The new emerging multifarious realities can not be covered by the current rules and regulations, which demand new immediate regulations, and as a result, parts of the institutional framework are automatically cancelled.
Conclusions

The ethnographic study demonstrates that the structural complexity of educational organizations is a phenomenon that occurs even in centralized bureaucratic educational systems. The two school case studies present evidence of a complex structure, even if they function within a centralized context, in which it is assumed that everything is determined by the pyramid of hierarchy, while meanwhile the operation of different types of schools (i.e. music, sport and multicultural schools e.t.c.) doesn’t consist a reality for the Cypriot education. This conclusion, in combination with the significance of qualitative and informal characteristics which the school structures present – in juxtaposition to the significance which determines the size of an educational or school system- makes the study of SC significant in the understanding of the operation of educational organizations.

The context which the three dimensions of SC assume during the study of educational organizations is presented differentiated in comparison to the space of public organizations and companies. We notice phenomena as the interdependence of structural elements and the adaptability of school structures to the environmental changes. The aforementioned properties lead us to the basic principles of the Complexity Theory, “while he doubts about the meaning of objective reality placing emphasis on the meaning of the relation and the rejection of determinism” (Tsoukas, 1999:15). The in depth study of the structural subsystem demonstrates that besides the interpretive context of the three dimensions of SC, further properties appear, which appertain to the schools characteristics of a complex adaptive or dynamic system (CAS):
1. **Interconnectiveness:** The interdependence consists a property of CAS, “results from the interaction between the components or interdependent agents of a system – which are interacting with each other in a great many ways – and is manifested at the level of the system itself” (Cilliers, 1998: 2-3; Stacey, 1996; Waldrop, 1993:11). The criteria of SC reveal a relation of interdependence within each dimension and between the three dimensions. For instance, the specialized knowledge that is needed for the management of the new multicultural situation, brings forth the specialization of the task, forms new specialized work posts, but simultaneously creates new informal work posts in the school hierarchy (i.e. head of multicultural education matters and sub-director). In addition, the specialization of the teachers’ and the administrative executives’ role in matters of routine multicultural management (horizontal differentiation), does not exist independently of the expansion of the faculty’s role and the exertion of power in emerging fields (spatial dispersion).

2. **Emergence and sensitivity to initial conditions:** Kaufman considers the property of emergence primal to the understanding of the behavior of CAS: The complex whole, in a complementary non-mystical sense, can often exhibit collective properties, “emergent” features that are lawful in their own right” (Kauffman, 1996: vii-viii). The emergence, as property of CAS, deals with new behaviors and interactive forms of dependence, and thus creates novel evolving patterns. The interactive equilibrium amongst the system’s agents, shapes emerging patterns that function in order (Seel, 1999).

Emergence is defined as the “process by which patterns or global – level structures arise from the interactive local – level processes. This ‘structure’ or ‘pattern’
cannot be understood or predicted from the behavior or properties of the component units alone” (Mihata, 1977: 31); however, a holistic - systematic approach and study of the system is required.

The emergence appears as a property which characterizes the new structure which forms the case study schools. The study of SC in school systems presents a more complex framework of criteria, from those which the quantitative measurements taken from public organizations and companies, refer to. The new reality (presence of NNS), which destabilizes the usual operation of the school, gives birth to new needs, new fields of action, new tactics and decisions, and leads the members of the school to cultivate new models of school government: in essence, the current reality emits a new self-organizing structure. We are dealing with a ‘circular structure’, determined by multiple elements in an interdependence relationship, giving the impression of a tumult movement. The changes and decisions are not presented in the hierarchical levels of the educational system, but in a horizontal dimension, which, for the most part, moves within the micro level of the school unit.

Thus, recursive symmetries appear: a turbulence may form small repeated tumults within other tumults (Tsoukas & Hatch, 2001:998). The changes which occur within the three dimensions of SC attribute to the system the impression of a nest, because the factors of the changes consist themselves complicated systems (Seel, 1992:2). This circular structure of the school systems creates the non-linearities (Holland, 1995:5), which characterize the relationship between cause and effect. Thus, insignificant causes can create significant results and consequences to the system (Tsoukas & Hatch, 2001:988).
3. **Self-organization:** The emergence and self organization are the two basic interdependent behavioral characteristics of complex systems. Wheatley (1999:21) claims that the notion of self-organization does not imply the absence or the abolishment of hierarchy, but a distinct use of it. Self organization as a systematic behavior gives the opportunity to a complex system to behave in a new way, distinct from the previous one (Tsoukas & Hatch, 2001:989). The two case study schools demonstrate that the majority of structural differentiations that occur, regard the horizontal and spatial dispersion of the organization, and are less associated with the presence of new lines of power in the hierarchy of the system (limited vertical differentiation). The differentiations of this sort, occur for the most part within the micro level of the school unit, and simultaneously constitute non institutionalized / informal decisions. These actions arise from the initiative of the stakeholders, as an act of self-organization of the school unit. Consequently, the specialization of work, the content of professional roles and the dispersion of power in all of its forms, constitute a homeostatic self-regulation mechanism (Papaioannou, 2007). Schools change, present a more complex structural dimension as a result of a self-organizational action. This organizational pattern, with its volatile organic structures (Wheatley, 2003:52), is a consequence of the schools’ autonomous actions, and exemplifies the behavior of school organizations, as complex adaptive systems and as learning communities.

To conclude, the study of SC in the field of education is significant, because it gives us the opportunity to study the particular operation and behavior of the educational organizations, as organic systems, and to evaluate the degree to which
they behave as CAS. The deeper knowledge of the behavior of the learning adaptive communities is beyond any doubt a condition for the educational policy reforms and long-term improvement programs in the field of education.

Αναφορές


