



## Invited paper

# Institutions and facility mergers in the Italian education system: Models and case studies

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## ABSTRACT

In recent years, across Europe, the economic crisis has resulted in an increased pressure on education systems. Notably, Italy has been one of the countries that has experienced the most severe reduction in public expenditure in the education sector. In the described conditions, Italian governmental institutions have started to perform rationalisation actions, aimed at modifying the current configuration of the existing facilities offering educational services (either by entirely closing and merging some of them, or by downsizing or transferring capacities), in order to increase the affordability of the system while still providing a required minimum service level. These strategic choices may have a lasting impact; therefore, there is a need for appropriate decision support tools capable of assisting planners. For this reason, after a description of the context and a review of the current literature, this paper presents two novel mathematical models for addressing rationalisation decisions in the Italian education system. The usability of such models is tested by means of real-world case studies, offering interesting insights.

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## 1. Introduction

In the current economic climate, characterised by growing cuts to public expenditure, public services (e.g., healthcare, policing, public administration) have undergone significant transformations [23]. Such changes have been generally oriented to reduce administrative, managerial and operational burden and costs, through downsizing and merging processes. In this context, an increasing pressure on education systems occurred, due to a combination of effects [25]. Indeed, on one hand, poor economic conditions and high unemployment figures have boosted the demand for education, with young people and adults trying to get additional qualifications in order to become more employable or to delay their entry in a depressed labour market. On the other hand, austerity measures resulted in an overall decrease in the public spending in education in many European countries. In 2011, remarkable reductions were registered in Greece, Hungary and Romania (around 17%), with ones observed in Slovakia, the United Kingdom (precisely, in England and Northern Ireland) and Iceland (around 5%); in

2012, strong cuts were reported in Latvia (almost 9%) and Cyprus, Italy and Croatia (about 7%) [10]. In particular, in Italy, there has been a reduction in spending on education quantifiable in 8 billion Euros across three years, from 2009 to 2012 [17]; however, education still accounts for 6.8% of the public budget and 3.59% of total GDP [9]. These measures have resulted in several consequences, such as the non-renewal of expiring temporary contracts for non-tenured teaching and administrative staff and the subsequent merger of schools and university departments [26]. Indeed, both local and central government institutions have started to perform rationalisation actions, aimed at modifying the current configuration of the existing facilities offering educational services (by entirely closing some of them, or by downsizing or transferring capacities), in order to increase the affordability of the system while still providing a required service level.

These decisions may have a strategic value given their long-term impact, and should be planned by taking into account different perspectives. Indeed, while the planning authorities would be interested in the improvement of financial sustainability, users will be damaged by the loss of educational facilities (as, for instance, students will have to travel farther for accessing schools or academic sites). Therefore, to effectively solve this kind of problems, appropriate models can support decision makers to find trade-off solutions between two inherently conflicting goals: the

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maximisation of the benefit due to the rationalisation action (taking into account planner perspective) and the minimisation of the damage due to the action itself (taking into account user perspective).

In this work, after a review of the extant literature, we present two novel mathematical models for addressing reorganisation decisions concerning different levels of Italian education system. Though representing an adaptation of frameworks from the very well established classes of facility location and districting problems, these models constitute a novel attempt to solve rationalisation problems in a public sector scenario, also taking into account the specific structure of education systems. In particular, the first model is oriented to identify, within a region, the set of school facilities that, if merged together in a cluster (and, therefore, sharing management and administration service), could improve the efficiency of the system. The second model, focused on the higher education context, is aimed at identifying, in a given region, the set of academic sites to be closed and/or downsized in order to reduce inefficiencies. Both the models have been tested on real-world case studies, in order to show their capabilities in tackling such kinds of problems.

The paper is organised as follows. In the next Section, a brief description of the current Italian education context is provided; then, a literature review about models and methods proposed to deal with rationalisation problems, with a special focus on educational applications, is presented. In Section 4, a common notation to describe a general model for dealing with rationalization problems is introduced; then in section 5 and 6 two mathematical models, concerning the reorganisation of the Italian education system at different levels, are presented and applied to two real case studies. Finally, conclusions and directions for further research are drawn.

## 2. Features and trends of the Italian education system

The Italian educational system is organised as follows:

- Pre-primary education, for children between 3 and 6 years of age;
- Primary education (lasting 5 years), for children between 6 and 11 years of age;
- Lower secondary education (lasting 3 years), for children between 11 and 14 years of age;
- Upper secondary education (lasting 3, 4 or 5 years depending on the specific qualification), for students from 14 years of age;
- Higher education (lasting 3 years for Bachelor degrees plus 2 years for Master's degrees), for students from 19 years of age.

While in the past the organisation was highly centralised, in recent years a general decentralisation process involving each level of the system was implemented. In this framework, central government has exclusive competence on general issues (including, for instance, minimum standards to be guaranteed throughout the country), while local authorities (municipalities, provinces and/or regions) are responsible for planning, organisational and delivery aspects within their respective boundaries [11,13].

Despite the initial intentions, considering the current context of economic austerity and its political consequences in terms of remarkable cuts to public expenditure, local institutions have enjoyed to a limited extent the advantages related to the implementation of decentralisation processes. In this context governmental institutions and authorities have introduced criteria and requirements to drive the rationalisation of the educational institutions with the objective of obtaining economies of scale (through the closure, and/or the merging of education facilities) and of optimally exploiting available reserves of capacity at existing

facilities. Similar initiatives have been also encouraged and stimulated by offering financial subsidies and incentives.

In particular, at lower levels of the education system (pre-primary, primary and lower secondary schools) single schools were obliged to form clusters with a minimum students' population of 1000, with the exception of some special cases (schools located in particular areas, such as islands or mountain areas). This merging strategy allows rationalising administrative and management offices and staff, coherently to the cited policies of reduction of public expenditure. In practice, this process should be implemented by grouping schools in clusters, and letting each cluster being managed through the definition of a single cluster centre, providing shared administrative and managerial services.

At a higher level, as a consequence of the implementation of the Bologna Process [19] and as an attempt to cope with the increased demand for higher education occurred in industrialised countries [24], in Italy there has been a strong increase in the number of university sites and degree programmes. From 1995 to 2009, the total number of institutions rose from 60 to 86; in the same period, while the number of cities hosting main academic sites increased from 45 to 57, the number of cities hosting detached (off-main campus) university sites doubled, increasing from 93 to 185. It has to be highlighted that the degree of autonomy of Italian Higher Education institutions is still quite low, if compared to similar countries; moreover, Italian universities are still massively publicly subsidised, as 80% of resources are coming from central and regional government transfers. Also, competition among universities appears to be quite low, as one of the peculiarities of the Italian University system is represented by the so-called *legal value of academic qualifications*, providing public recognition of degrees (for instance, for the access to professional careers) regardless of the specific awarding institution (and of its prestige). For this reason the above-mentioned rise in the number of academic institutions was not driven by market forces, rather due to *splits* or creation of *decentralised* campuses from existing universities. In many cases, faculty staff of the newly created institutions were just transferred from the 'parent' organisation (either permanently or temporarily, on a shared employment basis).

Some recent analyses performed by the Italian Ministry of University [6] revealed that the growth of the supply produced a system characterised by a high percentage of degree programmes attracting demand levels much lower than target values fixed by central government. The affordability of such a system has been largely questioned also given the cited application of austerity measures. In this context, rationalisation strategies have been considered. Taking into account that the mobility of students across Italian regions is quite low, as around 80% of the students choose to study in their home region [4], there is a common agreement on the fact that rationalisation strategies have to be defined at a regional level, by shutting down degree programmes (and, potentially, entire sites) not attracting enough students and considering the possibility of merging institutions.

The above-mentioned phenomena illustrate that rationalisation strategies are being actively pursued at every level in the Italian education system. Of course, while these decisions could improve the financial sustainability of the system, users could be negatively affected by them (as, for instance, students will have to travel farther for accessing schools or academic sites); therefore, the feasibility of these strategies should be carefully evaluated through the use of appropriate scenario planning and decision support methodologies, in order to maximise benefits and contain the worsening of the service level within acceptable limits. The following section provides a brief analysis of the extant literature that could support the development of these methodologies.

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