1. INTRODUCTION

In Italy, in the early ‘60s, the exponential increase in “student population” brought a significant lack of schools: its urgency was a political and social issue comparable to the one of housing. To guarantee the mandatory education, a large number of new classrooms had to be realised in a short slot of time and with very low budget.

A public programming was started and coordinated by the Ministry of Education (with the establishment of a special “Department for School Building”) with the aim to introduce a systematic use of “no-traditional” construction techniques. The new pedagogical concept of the school building, a “flexible and expandable space”, was a breeding ground for applying the themes of dimensional standardization and industrialization of the construction elements.
Thus, since the proposal of the “School Development Plan” (established from the Fanfani administration for the decade 1959-1969) up to the programming acts of the ‘60s and ‘70s, the rethinking of the school space developed through the partition of the traditional reinforced concrete frame, the combination of structural light elements, up to the pioneering applications of synthetic materials (alloys and polymers).

The experience reveals, thus, an “Italian way” to industrialization, that was based on the “styling” of structural components or on the overlay of the standard process of industrialization to the national construction and manufacturing tradition.

2. STATE OF ART

The literature on school buildings focuses on typological and distributive aspects, exploring in depth the relationship between the school space and the development of pedagogy and neglecting the relationship with the constructive aspects. The debate that crowds the period literature (1960-1980), with a number of studies on the relationship between the evolution of school space and the application of industrialized construction systems, happened not only far from the emerging architectural culture but also in considerable delay in terms of technological innovation. So, anachronistic and “professional”, the whole story was so far neglected both by the history of architecture as by the technology. This fact brought, today, an evident historiographical gap and, facing the current issue of maintenance and conservation of the school building heritage, a clear lack of basic knowledge.

3. METODOLOGY

General goal of this study was therefore to provide (in the history of construction) a “story of facts and works”: a specific and operative contribution to the knowledge of the buildings and (consequently) to their proper management and valorisation.

The study started in 2009 with the scouting of the Archive “Experimental School (1950-1975)” of the Ministry of Education and, thence, it approaches to a number of other archival sources (including the remarkable collection dedicated to educational buildings of the Historical Archive of the Milan Triennale).

The Archive “Experimental School (1950-1975)” allowed to reconstruct in detail the political economic and legal planning. The Historical Archive of the Milan Triennale disclosed, instead, the role of economic and promotional
conducted the review of the period references. And a series of specific analyses on the archival exploration, was
Furthermore, with the aim to frame the story in the cultural debate of his
time and in the European scene, in parallel to the archival exploration, was conducted the review of the period references. And a series of specific analyses and surveys on existing works.

4. OUTCOMES

Our “story” discloses some general outlines (basic for any intervention on existing school buildings).

In 1958, the Fanfani administration enacted the bill for the “School Development Plan”, a ten-year plan for a broad program of subsidised projects. The Plan has never become an active tool (because it was frozen by a political debate), while the “accrued” funds were used to support two following legislative acts that, between 1961 and 1962, marked the start of a “season” for the special programme of the Ministry of Education for the construction of new schools.

To introduce civil society to the plans of the Ministry of Education, strictly addressed to the systematic realisation of “prefabricated schools”, a series of promotional events were launched.


Among them, the “Competition for the study of industrial elements for the construction of primary schools” represented the first and most concrete approach to the subject. [2].

The call, launched during the exhibition period (October 1960) and defined in agreement with the Ministry of Education and the newly established Italian Prefabrication Association (AIP) provided two lines of the competition: the first dealt with the proposal of “individual building elements”; the second with the design of a “system of combined elements”.

The aim of the competition – which was not followed by any realisations - was to see the “state of the art” in industrialised construction in Italy and an essay on the development opportunities offered by public planning following the financial acts of the “Development Plan”.

The advertising purposes were clearly declared: together with the drawings edifici e (consequentemente) alla loro corretta gestione e valorizzazione. L'esplorazione delle fonti archivistiche complementari (archivi privati di progettisti e imprese e soprattutto l'Archivio Storico dell'Ufficio Italiano Brevetti e Marchi) ha permesso di verificare, le concrete ricadute sul mercato edilizio nelle specificità delle singole occasioni progettuali e realizzative. Alla consultazione degli archivi si è aggiunta la rassegna della bibliografia d’epoca, utile inquadramento la vicenda nel dibattito culturale del suo tempo e nel panorama europeo, e una serie di puntuali analisi e sondaggi sulle opere esistenti.

4. RISULTATI

Rileggendo alcuni episodi di questa puntuale “cronaca” di fatti e opere, è possibile ricostruire un quadro generale (di riferimenti per un qualsiasi intervento sulle opere esistenti). Nel 1958, il Governo Fanfani vara il disegno di legge per il “Piano di Sviluppo della Scuola”, un piano decennale per un vasto programma di realizzazioni sovvenzionate. Il Piano non diventerà mai uno strumento attuativo (perché bloccato da un asse di dibattito politico) mentre i fondi “accantonati” saranno impiegati in due successive provvedimenti legislativi che, tra il 1961 e il 1962, segneranno l’avvio della “stagione” degli appalti concorsi banditi dal MPI per la costruzione delle nuove scuole. La programmazione del MPI, verso l’introduzione sistematica della costruzione industrializzata nel settore dell’edilizia scolastica, è anticipata da una serie di manifestazioni promozionali.

Nel 1960 la Triennale di Milano, inaugura la sua XII edizione con una mostra a tema: “La Casa e la Scuola” – e bandisce una serie di concorsi dedicati all’edilizia scolastica industrializzata. Tra le iniziative collaterali all’esposizione, il “Concorso per lo studio di elementi industrializzati per l’edilizia scolastica di ordine elementare” rappresenta il primo e più concreto avvicinamento al tema [2]. Il bando, lanciato durante il periodo dell’esposizione (settembre 1969) e definito in accordo con il MPI e la neostituita Associazione Italiana Prefabbricazione (AIP), prevede due modalità di competizione: la prima riguarda la proposta di elementi costruttivi “singoli” (isolazioni costruttive in genere processo di industrializzazione. The exploration of additional archival sources (private archives of designers, companies and, especially, the Historical Archive of the Italian Patent and Trademark Office) allowed to verify, the factual impact of the industrialized systems on the construction market, through specificity of the single project. Furthermore, with the aim to frame the story in the cultural debate of his
and the economic estimates, the participants in the competition had to send the Triennale a number of “models” of significant nodes of the building systems. Moreover, Pier Luigi Nervi was appointed as president of the jury, composed of officials of the MPI and the Ministry of Public Works, and Nervi’s fame in those years was a guarantee of the quality of the competition in the public eye. Among the participating companies, the first section of the competition was more successful: the “individual elements”, in fact, constituted a safe product even on the traditional construction market.

In this respect the proposal submitted by the Aldo Secco company of Treviso – a project by architects Franco Albini and Franca Helg – was original. A “transparent wall module” made up of different elements, variously assembled. Openable windows, shading devices, lighting fixtures and fittings, were designed to be combined in a basic object used either as module of an entirely prefabricated building system, or as a “unified” component of a building built with traditional techniques.

The elements of the structure (later patented by the company, in 1963, as “infisso monoblocco”) were framed vertically by two false galvanised steel frames, designed with the twofold function of “coupling” and of “subframe”, for the possible insertion of this element in the traditional masonry. In this regard, the section the vertical uprights had “a zone for the dimensional tolerance of the internal strain of the masonry”. This area, saturated with a cast, made it possible to fix the frame, absorbing the imperfections of the handicraft construction.

This prototype (suitable for a general process of industrialisation, such as a traditional construction site) then introduced a second subject of experimentation, directly connected with the wall breakdown in unified elements: the design of the coupling. In this sense, the project presented to the competition by the architects BBPR for a “system enabling the conjunction according to different angles of two or more prefabricated panels” was original.

The invention was related to the design of a special connecting element composed of a tubular vertical stud, framed by gripping aluminium devices, extruded to hold the heads of the panels. The joint system not only allowed nine possibilities of aggregation between the panels according to different angles, for the realisation of a planimetric “continuum” of the school space but, moreover, by exploiting the possibility of using extrusion moulding, the assembly node was transformed by the architects into a design object. Similarly, the patent filed by the Roman firm Tecnosider, by the architect Pietro
Barucci, presented a node of assembly, made by coupling four aluminium profiles with the twofold function of structural pillar and of connection element between the panels.

All these prototypes were applied for the first time in 1962, when the Ministry of Education awarded the contracts for the construction of over 300 industrialised schools. Thus, between 1962 and 1965, the prefabricated schools were spread in 35 provinces of the national territory. (Only in the municipality of Rome the Ministry awarded the contracts for the construction of 60 schools).

In a strongly oriented context to keep the experiences of prefabrication in the flow of traditional construction, only two companies - F.E.A.L. SALVIT - dared to market original prefabrication systems, closer to European industrialisation trends.

**Figure 1.** Feal VAR/M3, assembly of a primary school in Valpizzone, Milan 1960 (ASTriennale).

**Figure 2.** CLASP System - Gnecchi Ruscone, prototype of a primary school in Biella, 1961-1962 (ASCASVA, Gnecchi Ruscone).
In both cases, the (Italian style) entrepreneurial adventure was launched with the commercialisation of an economic and craft invention and then developed thanks to the technical and creative skills of the same inventors.

The SALVIt system, invented by Umberto Isman and supported by many patents filed between 1939 and 1963, was based on the combination of a lightweight metallic structure with a number of self-supporting modular panels in asbestos concrete, “combinable in infinite ways”.

Economic and versatile, the Isman-SALVIt system represented the interests of many Milanese designers, who offered unique variations of it. Among the most significant was the prototype of “kindergarten SALVIt” signed by Andrea Desertori. With the design of a new element, the “corner pillar”, Disertori determined the possibility of combining panels positioned at a number of different angles, for the realisation of “pavilion classrooms”. The Feal system VAR / M3, instead, patented by the engineer Giovanni Varlonga, was composed of lightweight elements (aluminium-wall panels, window frames, radiators ThermoVAR), combined with a standardised supporting steel structure. The commercialisation of the single components (even and especially in the traditional construction market) was profitable enough to support the production costs of the steel structure, ensuring the economic sustainability of the system.

Moreover, an efficient logistic organisation (with two production centres located in Milan and Pomezia and a series of “assembly centres” spread throughout the national territory) allowed the company to realise, between 1962 and 1968, 154 new schools (1,807 classrooms).

Despite the large number of new schools built in the early 60s, the demand for classrooms increased again in 1963, when the establishment of mandatory secondary education led to a sudden rise in “school population” and urgently required the implementation of new school buildings.

So the systems produced in Italy were accompanied by the attempt to import foreign construction systems (in use since the post-war years). Among these there was steady importation of the English model C.L.A.S.P., a light prefabrication system. The operation was directed by the Milanese architect Francesco Gnecchi Ruscone for the UK Brookhouse Ltd group and aimed to replicate the industrial logistics experienced in England.

The scheme involved the implication of a main enterprise (the UK company Brookhouse Ltd) for the production and the assembly of the supporting structure in steel, while a series of satellite factories locally provide the other components (window frames, wall-panels).

Between 1961 and 1962, Gnecchi Ruscone thus realised two elementary
schools in the towns of Biella and Buccinasco as prototypes of a “pilot scheme”: the operation brought Brookhouse Ltd to sign an agreement with the Ministry of Education for the construction of numerous school buildings throughout the national territory.

During the construction of these two schools, still based on the English model (with steel frames and large infill windows), Gnechi Ruscone started a rapid review of the construction details and, supporting the capacity of local factories, the system transformed itself gradually, until it assumed an increasingly masonry character.

On 28 July 1967, the first five years of public planning were concluded (with the construction of over 300 buildings throughout the national territory). A new law provided for the allocation of 1,580,000 million lire for school construction (from which 25 million was dedicated to experimental industrialised buildings) and the publication of “new and updated” technical norms.

The procedural renewal and, above all, the financial programming of the law, led to a reorganisation of production through the involvement of new investors.

Thus, Montecatini Edison launched, with a substantial investment in the construction sector, the “Systems design for the school building”. With the advice of two architects Cesare Pea and Luigi Pellegrin, nine subsidiaries firms of the group were involved to realise prototypes of new building systems. According to the criteria of the technical standards, the prototypes covered a number of building systems, consisted of reinforced concrete elements. The designers, who assist companies in the definition of the production process, characterised the design of components as design objects.

Figure 3. Pellegrin-Benini system, Concetto Marchesi School in Pisa, primary school in Lucca, 1970-1975 (CSAC, Pellegrin).
In this respect, the prototype developed by the Benini firm, through the design of Pellegrin, stood out. Patented by Celestino Benini (owner of the company), the system was composed of a series of assemblable elements in reinforced concrete, completed by in-situ casting.

The patent was the result of a long work on the constructive components which, between 1970 and 1975 engaged Pellegrin for a number of different project of school buildings.

The “enterprise designer” and the “building designer” were both personified by the architect and thus determined the reciprocal adaptation between the definition of industrialised elements and the design of the individual building. Thus, in the “Benini primary schools” (15 buildings simultaneously realised in 450 days), the architectural choice used to define the space, characterised only by the distribution of light, was transferred in the essentiality of the design of the beams section, shaped as “U” to anchor the panels.

Following the pioneering experience of Montecatini, the involvement of the major industrial groups and financial companies in the school building sector, was consolidated in the second half of the ’70s, following the enactment, on August 5, 1975, of a new law.

Substantiated by a funding of more than 1,800 billion for a five-year period (1975-1980), this law ratified the control of the Regions on planning for school construction and the concession works. Thus, the Ministry increasingly lost control over national planning; meanwhile financial companies conquered a more and more important role in the building process.

The many “workshops”, involved in the building process until the early ’70s, suddenly faded away: in general terms, the production process lost its original manufacturing character, and turned to anonymity.
Only few industrial groups, with the economic potential to become “concessionary”, decided to invest again, with technical creativity, over the last five years of planning.

Among these, the firm RDB experimented and developed the Q7 system, while the Valdadige enterprise, with the advice of the architects Gino Valle and Giorgio Macola, attempted the commercialisation of its PTK system.

The Q7 system was promoted through the publication of the series “RDB information handbooks” addressed to designers and customers with “the purpose of providing primary indications about components and about dimensional coordination”. The creative contribution turned on promotion and stylization of a system of construction that was efficient in performance.

Alongside the RDB handbooks, Valdadige published a similar “tool”. For clients and designers, the Valdadige handbook presented an abacus of project types and the infinite possibility of combinations between building elements. So, while the lists and handbook gradually replaced the executive project, in the concreteness of the construction site, Valdadige’s schools testified as the planning of the ‘70s was far from the actual technical and productive capacity of the country.

The organic nature of Italian programming did not make it possible to write off the cost of production of the PTK system (based on the assembly of elegant heavy components in reinforced concrete).

Thus, the company filed a patent for a “new” building system obtained by the combination of a traditional reinforced-concrete frame structure with a series of prefabricated wall panels in reinforced brick (original product of the traditional catalogue Valdadige).

Thus, the experimentation, frozen in Italy by financial and political trends, was extended beyond national borders, with pioneering experiences...
In 2010, the City of Rome, without any knowledge of the cultural interest of
its heritage of the buildings. [3].

Today, the close link between the project of building systems and individual constructive occasion, highlights the need to address “case by case” (through knowledge of the facts and of the works) maintenance and exploitation of the heritage of the buildings. [3].

In this sense, we report an applied research. Among the schools built with the contracts awarded by the Ministry of Education in 1962, the primary school in via Lemonia in Rome was the larger realization: the original project of the building involved the construction of 30 “units-classroom”, services and common areas. Entirely of wood, it was realised by using the Pasotti P63 system designed by architects Conte and Fiore, awarded the Compasso d’Oro in 1965 and it has been in use for over 40 years.

In 2010, the City of Rome, without any knowledge of the cultural interest of the building, started the process for the demolition.

Under the second strategy, the designers carried out an important test (the only large-scale one) for research initiated in Italy on the introduction of plastic materials (construction systems consisting of printed elements in reinforced resins) in the building sector.

Within the projects of the programme “PSP Programme”, the MVR company called Luigi Pellegrin to design a new building system. He invented a construction system for single plane buildings, entirely made up of fibreglass elements, reinforced with steel profiles.

The components were all produced by the firm at its factory in Italy and shipped by air to the construction site in Saudi Arabia, where the very light “pieces” (about 50 kg per sq. m) were easily mounted, despite very low mechanisation and unskilled labour.

5. CONCLUSIONS

Although the school building sector represented, in Italy, the most concrete attempt to launch a general process of industrialization of the construction systems (for extension of time and number of works), the fragmentation of the planning horizon forced to small-scale production.

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With the sinking of the Plan, the school landed (prefabricated) in Saudi Arabia, where in the second half of the 70s (following the rise of the petrodollar) a plan for mass education was started.

In Arabia, Italian companies explored two ways for the export of its products. On the one hand, there was commercialisation of systems already tested in Italy and modified according to different environmental needs. On the other, the testing of “alternative” technologies, that at the time in Italy still hadn’t found the conditions for their actual application.

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In 2010, the City of Rome, without any knowledge of the cultural interest of the building, started the process for the demolition.
Unfortunately, it was not possible to preserve the building, despite reports of sensitized citizens by the interest historical and technical of the significant work. The construction site of the demolition was a unique chance to verify the craftsmanship of Italian industrialized construction and the occasion to run a proper process of identifying and disposal of asbestos-cement panels (completely ignored by the administration).

6. REFERENCES


7. ARCHIVES

Between the most important sources: Historical Archive of Ministry of Education, “Experimental School (1950-1975)”; Archivio Centrale dello Stato, Ministry of Education; Triennale di Milano Historical Archive; Italian Patent and Trademark Office