

EXPLORATION OF
SUSTAINABILITY
IN BUILDING PROCESS
IN CHINA

– A Comparison with the Italian Context





**POLITECNICO
DI TORINO**

Faculty of Architecture
CONSTRUCTION CITY
ARCHITETTURA COSTRUZIONE CITTA'

Candidate
WEI JIALIN

Supervisors
BONINO MICHELE
NIGRA MARIANNA

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Abstract

“Sustainable building” was proposed by Dr. Charles Cabot in 1993 to illustrate the responsibility of the construction industry in the process of achieving sustainable development. It refers to the building that is planned with a sustainable development concept, including building materials, the size of building, the integration of building within urban areas, etc. It refers more profoundly to the functional, economic, social-cultural and ecological factors which related to these we mentioned before. As for “building process”, it comprises the entire life cycle of building from project research, building analysis, programming, to the

concept generation, detailed design and finally building construction and after all testing and maintaining.

As far as the development of China’s construction projects is concerned, in recent years, China’s economic construction has developed rapidly, especially in the context of the country’s policy of expansion of domestic infrastructure to stimulate economic growth, the building companies have received rare opportunities for development. Many construction companies have become bigger and stronger under this favorable policy, and have been greatly expanded in terms of market possession and field development. However, it can’t be denied that the project management of building projects is still affected by the traditional management system and has not adapted to the new economic development environment. The rapid development of the economy and the management mechanism of the construction market have created conflicts which is not easy to be coordinated. Therefore, the problem of implementing modern project management throughout the building process becomes more and more important.

This work is trying to find a more refined way to make the building process “sustainable” so that to fix this crucial problem of China. By making comparison with the Italian project, generally speaking making comparison between Chinese and European projects, summing-up different roles of participants within the building process, especially how can different decision makers influence the final result. This analysis helps to find the current problem inside the Chinese building process and provide a kind of solution respect to what Italians did. Sustainable development is a distant goal for China to achieve, this discussion would be one of the paving stones.

Background

Process in general and sustainable process in general
Context of European's and China's building process

“Architecture” as a complex term involves subjects such as economic, social and humanity. “Building process” as one of its concrete translations mainly focuses on the process from architectural drawings to the completion of the building project, which contains firstly the early tendering, brief constitute, architectural design, then the mid-term construction, capital placement, and post-project review as well as user feedback, etc. It is crucial to the result of a project not only how the design and construction are but also how the participants’ cooperation with each other. A successful project can give positive impact on society while being presented, which is related to the optimal configuration of building functions, the integration of architectural styles and surrounding areas, and the rational use of construction materials, thus leading to the “sustainability” of construction projects. The broad meaning of the term “sustainability” is to meet the needs of the contemporary without compromising the needs of future generations. Sustainability in construction can be expressed in the development of a rational brief, material selection taking into account economic and their performance, project manager's labor distribution and feedback as well as adjustment after construction.

As far as the several decision makers and information flow within the processes, in <Building as a process>, D.A.Turin focus the attention on how to optimize the cooperation among different project participates and how they can better play their roles in the future. Four simplified tables are provided to illustrate the four kinds of possible building processes - "One-off", "Component", "Model" and "Process".

Conventions of the figure:

Horizontal scale - The main stages of the building process

Vertical scale - Five main parties involved in the process

The length of each block - purely conventional and not related to the importance or duration of a particular stage

The depth of the block - a rough indication of the relative intensity of activity, involvement or concern of a given participant in a given stage

Block with dot - the participant who carries the sole or major responsibility for that particular stage

Arrows - communications and flow of information between participants at each stage (vertical) and between stages for the same or different participants (horizontal)

Arrows entering a dotted block - 'reporting to' or 'authorising' other participant mainly responsible for that stage

Arrows leaving dotted blocks - 'issuing instructions to' or 'authorising' other participants and/or stages

1.ONE OFF

A traditional set-up approach, characterized by the maximum fragmentation of the responsibilities between participants and by the sequential intervention of the participants in the different stages. This approach is still frequently used in the building activity of most European countries. During the process, for each operation, a new "team" is set up on an ad hoc basis. On one hand, this "team" is spontaneously built up for better cooperation, while in author's opinion, this coincidental group of members is neither encouraged nor permitted by codes.

2.COMPONENT

An approach that the manufacturer plays a more dominant role, it is said to be "the one most strongly favoured by government policy". The professionals and manufacturers share most of the responsibilities with an unique general standard premade for every participants which deemed to be the only permanent link between stages and participants. This need of convention leads to some limitations for example the present production techniques and the variety of results which the user or the client is likely to expect. With the higher freedom of choice of combination of components, architects show more interests on it while drawing the maximum benefits of mass production.

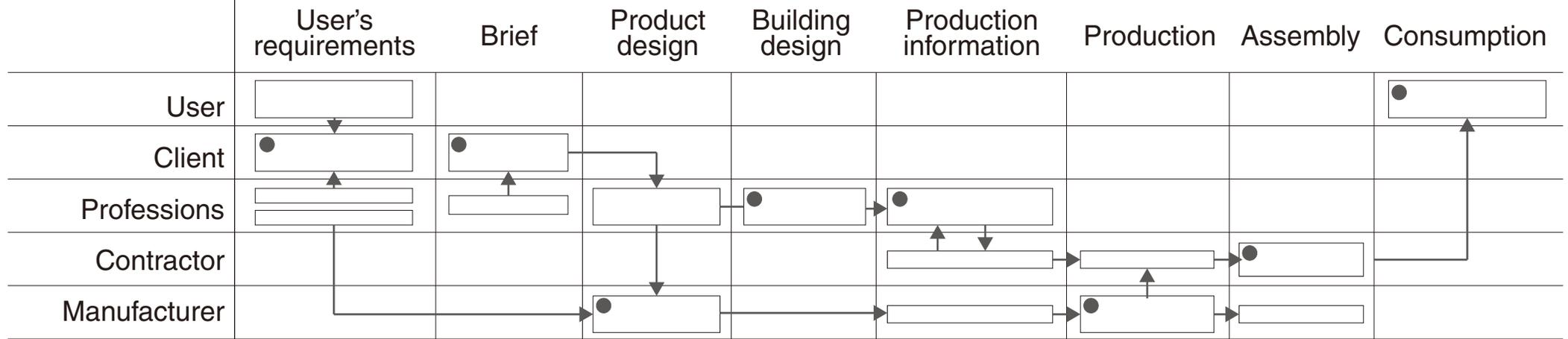
3.MODEL

"It presupposes a certain degree of repetitiveness, without which the notion of model would not be applicable." Model approach runs more like the pattern of industrial production, which the characteristic and price of the final product are known and decided before the client and user are identified. Within this approach, contractors have most of the responsibility of overall stages. The final product is standardized in the component approach standardization applies to the parts. While in this way the operation would be more coherent under the single overall policy and the price with product is more coherent as well from the client's point of view. But the variety becomes lower in this "industrialized builders" way of production, because more kinds of models means more kinds of risks which probably leads to lose money.

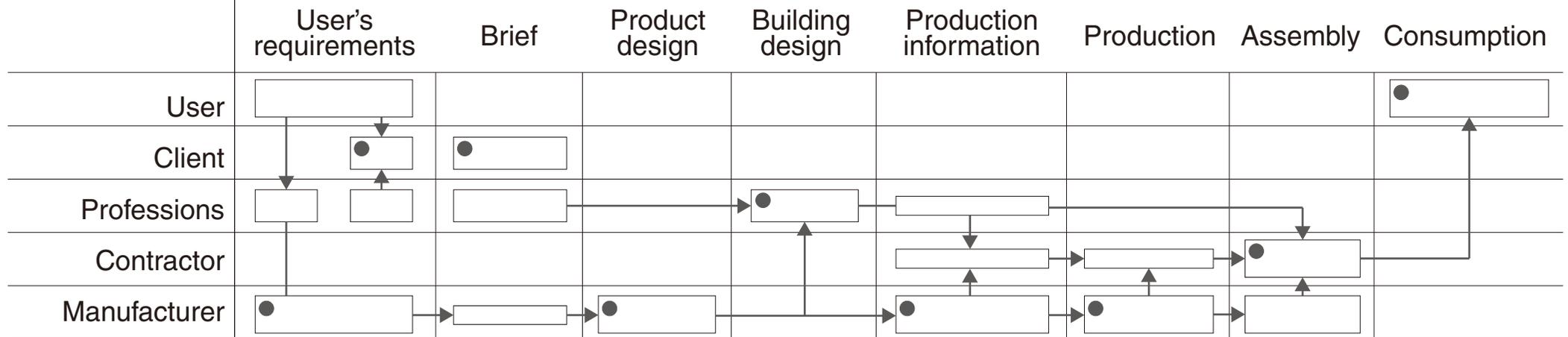
4.PROCESS

As a kind of updated approach of the previous three, "...It differs from

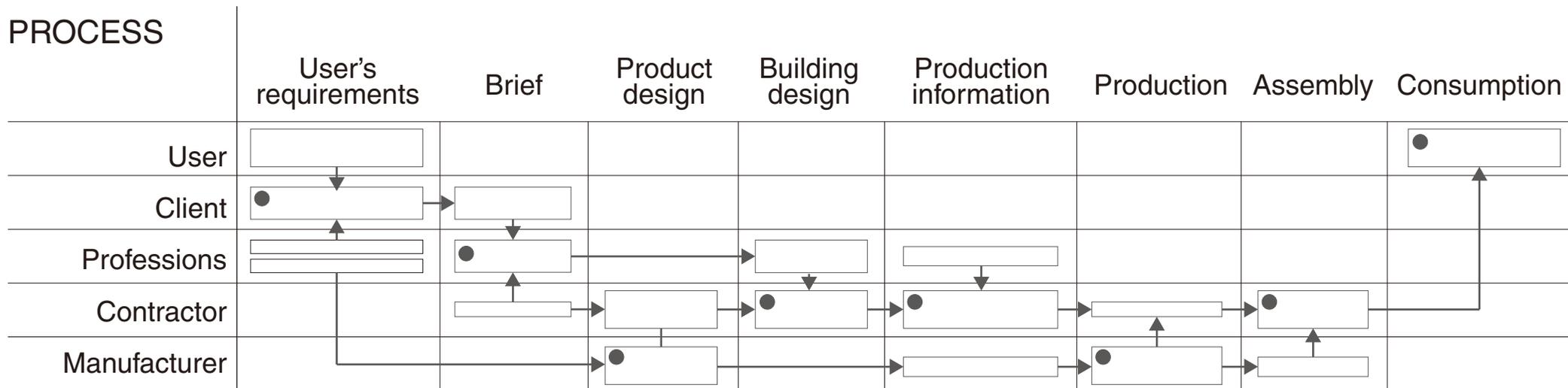
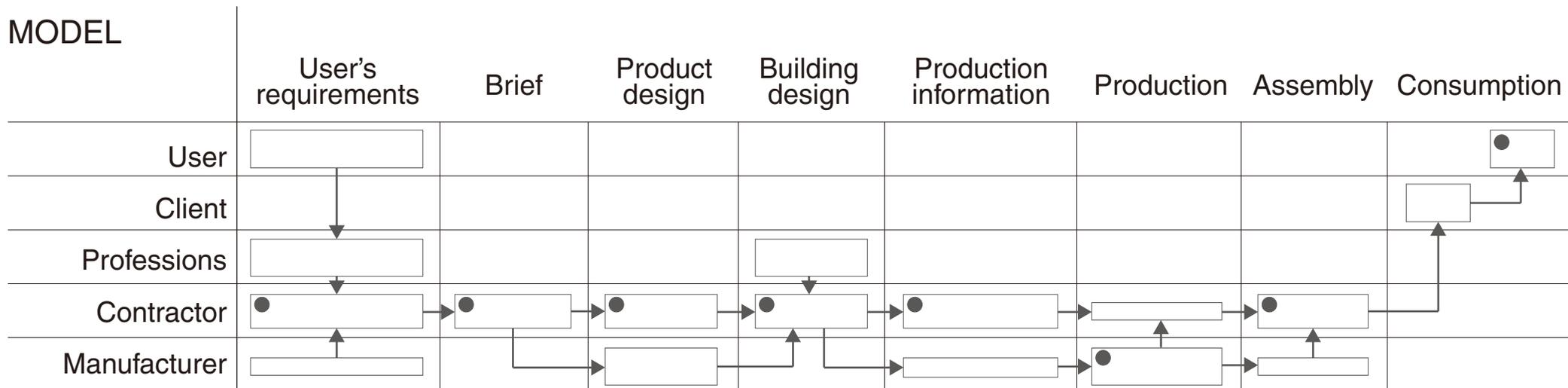
ONE OFF



COMPONENT



Figures: D.A. Turin <Building as a Process>



Figures: D.A. Turin <Building as a Process>

the one-off approach because the team is established before actual design starts: it differs from the component approach for the same reason and also because it does not require the establishment and acceptance of a generalized set of conventions: it differs more significantly from the model approach because it offers a permanent team but not a standard product...”

These are four particular approaches presenting the European building activity situation. China’s building activity mode is developing and can be expressed by stages.

1. Unit self-operated mode (Early years after founding of the country)

- The construction unit is self-supported.
- Design, construction strength is weak.

2. Soviet model (1935-1965)

- Learning from the Soviet model, A(government), B(designer), C (construction) tripartite, managed by their respective authorities
- The construction unit is responsible for the specific management of the whole process.
- Design, manufacturing, and construction tasks are issued by the competent government authorities
- The problems in the project construction are directly coordinated and resolved by the relevant government departments.

3. Engineering command method

- Management construction and management production functions are separated.

- The headquarters is responsible for design, procurement, and construction management.

- After the project is completed, it will be handed over to the production management organization for operation.

4. Project management model (After the reform and opening up)

- In the early 1980s, the general contracting and project management work began.

- In September 1984, the State Council issued <the Interim Provisions on Several Issues Concerning the Reform of the Construction Industry and Capital Construction Management System> (Country [1984] No. 123)

- In December 1984, the State Planning Commission and the Ministry of Construction jointly issued a notice on <the issuance of the Interim Measures for Engineering Contracting Companies> (Country[1984] No. 2301)

Problem

Brief introduction of problems within current China's building process

Due to the long-term influence of traditional planned economic management system, China's construction enterprises are still at a relatively low level. There are many problems, which are highlighted in the unreasonable management, unscientific organization, low economic efficiency and backward management methods, and low quality of personnel. Classified in two parts.

1.STATUS OF MANAGEMENT MODEL

One of the outstanding status problem of China's construction project management is that the management model is unreasonable. The management mode of China's construction projects still has a strong planning economy color, replacing administrative management methods with administrative and rigid instructions, which is particularly evident in large domestic enterprises.

In terms of construction period, it is manifested that it does not pay enough attention to the overall planning. The various plans are unscientific, not in line with reality, and rely mainly on the experience accumulated in the past. If the project encounters a new structural situation, it will be even more unpredictable.

In terms of control, it is manifested in the lack of adequate attention to control within the enterprise, the lack of a complete control system, mainly based on experience accumulation and subjective delusions. Most of the control was replaced by inspection work. The tests only go after waiting for the task to the end. It can be done, that is to say only after-the-fact control. For the results of the inspection, no statistical analysis and quantitative calculations are performed, and only qualitative judgments are made. Ex ante control and in-process control did not get

enough attention on.

In terms of material procurement, the current procurement methods of construction companies use large-scale centralized procurement. The project received contact with the supplier and lacked a long-term stable cooperative relationship with the supplier. The procurement method lacks flexibility. The bulk purchase of materials is too large. It takes up funds and takes up space. Scrapped materials are frequently purchased, which increases procurement costs.

2. STATUS OF PERSONNEL QUALITY

The quality of China's construction enterprise team is generally low, and the structural level is not reasonable. First of all, there are not many people with higher education or above, and most of them have secondary education. Secondly, there is a tendency to focus on engineering and technical personnel but much less on management professionals. While in the absence of high-quality engineers and technicians, qualified project managers and other personnel in business management are even more scarce.

Especially for China, the construction industry is a labor-intensive industry. The level of skills of front-line operators is low, especially the quality of migrant workers needs to be improved. This has become a major factor in the quality of engineering. Because the on-site construction tasks of construction projects are mainly undertaken by agricultural workers, a considerable number of them are farmers who have just put down their hoes and went to the construction site. The education level is quite low, and most of them are not trained. This not only affects the quality of the project, but also is prone to safety

incidents.

Despite the overall situation, from the architect point of view. Generally speaking, architects in China mainly works as the designer of drawings, their ability of decision-making is quite limited after the submit of project design, most of the decision-making power is in the hand of Party A. While other countries such as Italy, architects in Italy can still control part of the project even if it is under construction, so the powers of decision-making is more balanced between Party A and Party B. Unfortunately, architect is the one who is more professional and knows more about their project, if the information can not be transformed successfully, the after all process wouldn't be express well. Hence, how can architects play a better role is one of the crucial points to make the building process more refined.

Photos

As a rapidly developing country, China has now an advanced increasing in amount of construction projects. The problem caused by this huge expansion most in common is that because of the lack of preparatory time at beginning, the brief comes out perfunctorily, which lead straightly to the meaningless modifications, waste of time. So is this kind of programming really efficient? Is this rush of building activity process do sustainable?

Thesis statement

This paper will use the method of economic analysis to compare building projects in China and Italy. Four case studies namely Ningbo Museum(A1) and Wattle School(B1) in China, and Rome Auditorium(A2) and Asilo Guastalia(B2) in Italy. Ningbo Museum and Rome Auditorium are government-sponsored public projects, and Wattle House with Asilo Guastalia are privately-owned investment projects. Throughout the comparison of four case studies, conclude the advantages and disadvantages underlie different decision making processes. Trying to find out a better building activity manage solution for China.

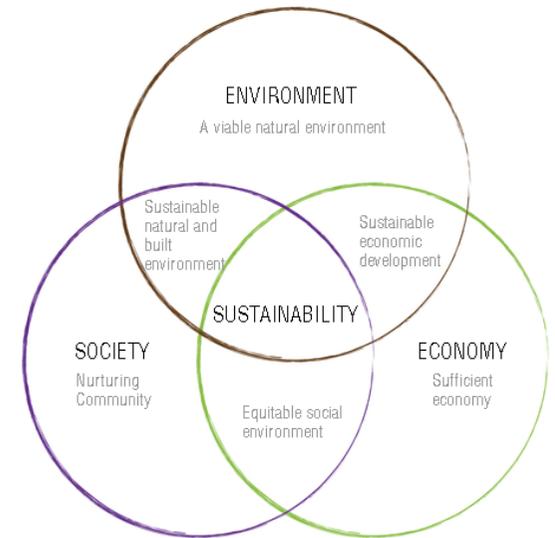
Method

Economic building process evaluation

Generally speaking, this method evaluate the final sustainable result given by the building and its process in terms of economic, environment and social aspects through the analysis of building information and their innovation.

Building as a container of spatial activity, surrounded by natural and urban context as well as other activities inside this context, have interfaces with the social economic and environmental aspects. So that buildings with higher social quality, economic sustainability and better environment effect can be seen more valuable and positive. Through the analysis of building information, understand the implications of our design decisions on the social, environmental and economic context, as well as understand the role and responsibilities as architects.

From the society point of view, taking into consideration the term of sustainability. It is defined "...the development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (Brutland report, 1987). In terms of the environment, sustainability is about the longevity of social development. In the case of limited resources on the earth, how to use these resources better and more efficiently is an important factor for achieving sustainability. In the case of building construction, the selection and use



of building materials is an important factor affecting the environment. In addition to the need to save resources, the procurement of materials should be considered in consideration of building safety factors. For the application of materials with structural strength and durability, the application of decorative materials should control radioactive elements and harmful substances such as formaldehyde, ammonia, benzene, hydrazine or the material of the gas can effectively avoid the health and safety of the user. Provide a comfortable, healthy and safe place to live, work and play.

From the architects point of view, designing a more sustainable building project is one of the social responsibility. Having sustainable innovation is also a better choice for "survive". The architectural business model has remained unchanged for decades. While other industries have been inspired by the growing popularity of start-ups in technology, architects still insist on outdated trading patterns. In a highly competitive global economy, this model is highly susceptible to changes in the real estate market and has limited growth opportunities. These realities have prompted some architectural graduates to consider alternative career paths that offer a competitive advantage in other unique skill sets.

Thus it can be seen the importance of innovation to achieve the goal of sustainable. Different from invention, innovation presents a meaning of change. "Within this context, the ability to rely on innovation conceived as design change can represent a response to the call for re-thinking the way in which we envision and design our built environment." (Nigra, 2017)

The analysis will be divided into two parts which are "building" and "process". The information will be insert into an excel which the horizontal aspects present the type of innovation, the decision-maker and the sustainability in terms of social, economic and environmental

aspects. While the vertical part is different categories and their characteristic. The "building" analysis contains the general information of the building project for example context characteristic, concept, orientation, dimension etc. The "process" analysis focus more on the project process from commissioning, financing, brief to the component production, worksite assembly, maintenance etc. The definition of the parameters used to assess the impact (Maneschi, 1998; Ruddock, 2009) was generated in terms of economic, environmental and/or social development.

Definitions of the terms used in the classification of innovations (adapted from Slaughter, 1998):

1. Incremental (score: 1)

Incremental innovation is a small change, based upon current knowledge and experience.

2. Modular (score: 2)

Modular innovation entails a significant change in concept within a component, but leaves the links to other components and systems unchanged.

3. Architectural (score: 3)

Architectural innovation involves a small change within a component, but major changes in the links to other components and systems.

4. System (score: 4)

System innovation is identified through its integration of multiple independent innovations that must work together to perform new functions or improve the facility performance as a whole.

5. Radical (score: 5)

Radical Innovation is a breakthrough in science or technology that often change the character and nature of the industry.

Definition of sustainable result:

1. Environmental

Considering emission reduction, resource generation, waste reduction, indoor environmental quality, outdoor environmental quality, embodied energy, material use.

score: -1 Environmental problems

0 No environmental change

1 Knowledge acquisition

2 Sustainability results achievement

3 Technological performances advancement

4 Resource generation

2. Social

Considering social inclusion, wealth, education, safety, cultural diversity, personal development, cultural development.

score: -1 Social problems

0 No social changes

1 Knowledge acquisition

2 Social objectives achievement

3 Social improvement

4 Extra benefit generation

3. Economic

Considering Competitive advantage (lower production cost), comparative advantage (lower price and/or improved usability) property/land value increase, reduced maintenance cost.

score: -1 Economic loss

0 No economic change

1 Savings achieved

2 New jobs created

3 Increased revenue

4 Market expansion

Definition of parameters for measuring the sustainability result:

1. Environmental

- Environmental problems_ Negative environmental impacts of the project

- No change in the environmental impact_ No change in the local natural environment during and after the project development

- Knowledge acquisition_ Knowledge acquisition related to environmental performance of the project (e.g. post-occupancy evaluation)

- Sustainability results achievement_ Achievement of the goals set during the phase of project's objectives definition

- Technological performances advancement_ Patent acquisition or generation of technological innovative systems

- Resources generation_ Generation of resources from renewables or through recycling of resources not present before the project development (e.g. energy from renewables, recycling of water, etc.)

2. Social

- Social problems_ Negative social impacts of the project

- No change in the social impact_ No change in local social relationships during and after the project development

- Knowledge acquisition_ Knowledge acquisition related to the social impact of the project (e.g. through surveys of the building users, local community or/and nationally)

- Social objectives achievement_ Achievement of social goals set during the phase of projects objectives definition

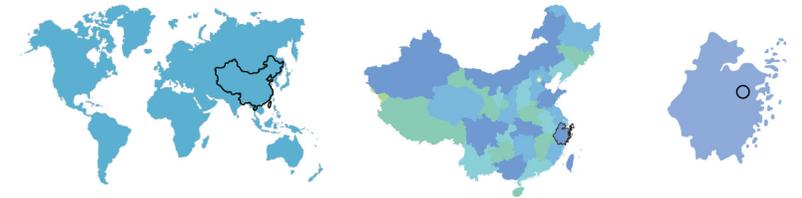
- Social Improvement_ Reduction or elimination of negative social behaviours (e.g. crime, vandalism, sectarianism, etc.)
- Social benefit generation_ Increase of positive social behaviours (e.g. strengthening of community relationships, increased volunteerism, increased social tolerance, etc.) on local or/and national level; public recognition of positive social impacts

3. Economic

- Economic Loss_ Negative revenue balance
- No economic change_ No change in local or/and national economy during and after the project development
- Savings achieved_ Reduced costs/m2 of the building construction, use and maintenance compared to similar buildings
- New jobs created_ New jobs created internally and/or in the community to provide products and/ or services for the continuous use of the building
- Increased revenue_ Increased revenue (e.g. through improved performance in building use) in comparison with similar buildings/uses
- Market expansion_ New products or services offered to a wider section of an existing market or a new demographic, psychographic or geographic market

Case study A1

NINGBO MUSEUM • NINGBO • CHINA
National capital for public • Designed by Wang Shu • 2008



Characteristics



Image source: www.tukuchina.cn ©

Context Characteristic	Urban
Concept	Local mountain shape museum in Neo-ruralism style
Orientation	North-South
Dimension	30,000 sqm
Shape	Monolithic
Floor Number	Main building of 3 floors, partial of 5 floors
Sustainability	--Hydrophobic perlite --External wall with cavities and thermal-mortar injected --Few windows on external wall --Thermal bridge blocking aluminium window frame
Architectural Charecteristic	Ningbo Museum seeks to marry 1200 years of city history to the natural environment, in accordance with Chinese tradition, it employs recycled materials with modern construction techniques, using the local practice of 'Wapan Wall' building, which gives a randomised appearance that is intentionally organic.
Structure	Long-span beams & oblique columns
Accessibility	Different access for administration staff, office entrance, freight transportation, restaurant entrance.

Commisioning

Promoter	Yin Zhou district government
Land owner	Country
Client	Ning Bo city construction investment company ¹
Designer	Amateur Architecture Studio ²
Type of bid	Competition ³
Type of work	-Building and sorrounding design inside the construction site -Building design as well as structure,water supply and drainage, electric, heating and ventilation, fire protection, interior and intellectualized design. -Project cost estimation (including building construction,equipment installation and decoration)
Builder	Zhe Jiang the second architectural group company
Expected cost	2.5 hundred million RMB
Final building property	Public museum
Building Management	Departments of Ningbo Museum & Volunteers ⁴

1. City investment company

It is a public entity, which does not have a lot of profitability, they are

public institutions or state-owned nature of the companys and achieve profitability by a way of government subsidies, it is a special market management body with a governmental property.

2. Amateur Architectural Studio

Description: It is funded by Wang Shu and his wife Lu Wenyu, the members are students of Wang in China Academy of Art university.

Previous experience: · China Art Academy, new campus of Xiangshan School, Phase II , Xiangshan, 2007
· Ceramic House, Jinhua, 2006
· China Art Academy, new campus of Xiangshan School, Hangzhou, 2004

Internal specialization: Architecture design, Urban design

3. Bid competition

Except for professional juries , this project bid competition also has citizens involved, they voted to projects in three months according to their own points of view, which is different from other competitions.

4. Departments of Ningbo Museum:

International Department
Technological Research Department
Exhibition Planning Department
Publicity and Education Department
Security and Management Department

Financing

Financing actors: Mostly from Ningbo mulniciple government and Yinzhou district government, small part of investment comes from Hong Kong philanthropic foundations and donation of Ningbo citizens.

Total budget: Approximately 2.5 hundred million

	Project name	cost(million)	Cost per sqm	attention
1	Construction cost			
1.1	Construction and equipment	94.17		Sheet 2
1.2	Pre-engineering	1.74	80 yuan/m2	Concluding:site exploration、measured and survey、planning program、Feasibility study、building design
1.3	Protection of termite	0.03	1.6 yuan/m2	
1.4	Reform of the wall	0.22	10 yuan/m2	
1.5	Construction of Civil air defense	0.22	10 yuan/m2	
1.6	Cement	0.04	2 yuan/m2	
1.7	Management cost of	3.05	3.24%	

Budget for construction cost (by designer) :

	Project name	cost(million)	Cost per sqm	attention
1	Construction cost			
1.1	Construction and equipment	94.17		Sheet 2
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1.5	Construction of Civil air defense	0.22	10 yuan/m2	
1.6	Cement	0.04	2 yuan/m2	
1.7	Management cost of construction company	3.05	3.24%	
	Total	99.48		

Program

Urban Setting	Scientific research and cultural property land ¹
Building Scope	Museums & Exhibition Facilities ²
Architectural Characteristics	Modern museum with traditional local features ³
Building Sustainability	Must meet the standard requirement ⁴
Budget	2.5 hundred million RMB
Time	Work date 2006.8 - 2008.8
	Opening date 2008.12



1. About the project site

The site is located in the district center of Yin Zhou (a district of Ningbo), near the government building. It is defined as scientific research and cultural property land after demolishing the existing 30 small villages.

2. Reason of being this type of building

Before beginning of this project, Yin Zhou district museum has already being promoted by district government. In order to achieve optimal allocation of resources, avoid the construction of two similar functions in the urban area of the cultural facilities which would cause a waste of

land. Ningbo Museum was required to design and be located to a site considering the existing district museum project. After the completion of the museum, it was named as Ningbo Museum, while adding brand of Yinzhou District Museum.

3. Characteristic of Ningbo Museum

This museum is located in a new district of Ningbo, seeks to marry 1200 years of city history to the natural environment, in accordance with Chinese tradition.

It employs recycled materials with modern construction techniques, using the local practice of 'Wapan Wall' building, where materials from buildings damaged in typhoons are reused. This gives a randomised appearance that is intentionally organic and that is underlined by the geologic form of the building, which nods to local mountains. Equally, an artificial lake to the north is dammed at the middle entrance allowing water to flow over a 'field' of cobblestones. Internally, a labyrinth of pathways connects public spaces that are flexible to accommodate ever-changing exhibitions.

4. Requirement of the design

Building, structure, Design Phase Maintenance Checklist for Water Supply and Drainage Systems, heating, ventilation and air-conditioning applications should be abide by the national standard.

Level of fire resistance and emergency: first

Level of anti-seismic: first

Lifespan: 100 years

image sources: www.meituan.com

Correspondance between requirements and final result:

1. Conflict between material using and money spending

For the builders, investment control is a difficult issue, no matter how much investment they have got, the actual operation of the investment is often exceeded.

During last construction period of Ningbo Museum about second half of 2008, the progress of the construction is relatively slow due to the control of the cost of investment.

In the late construction period, Wang Shu with his studio done lots of work on local and special practices, they first calculate and check the cost and total investment, if it is beyond the control budget, they would think about other materials or technology, constantly repeated.

For example, the ceiling below the irregular rectangular hanging pieces, the designer wanted to use bamboo composite panels, for which the first party (Ningbo mulnicipale investment company) went to the origin of Anji many times and found its bulk density, relying only on the screw buckle steel clip piece connection, the security can not be guaranteed. Especially the cost is high, bamboo composite panel was about 25000 yuan / m³, converted to each hanging on the extension of about 250 yuan per meter. For this reason they have discussed with the designer many times, considering the use of steel-type lamp built-in practice, also the complex construction cost is too high, finally they give up, later the company inadvertently found a material for producing air duct on site, which is similar to the plastic material , they immediately give this advice

image sources: photo by unknown

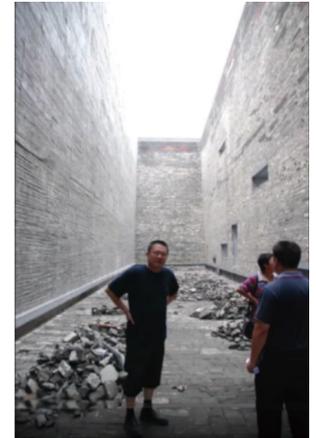
to the architect, the architect did not grasp at beginning, he commissioned the manufacturers according to the original design specifications to produce two samples, when the surface treatment with plain concrete slurry wrapped, Wang Shu was very satisfied.

This change has reduced the weight of hangings, so that the safety has been greatly improved and especially reducing the cost (each meter is only ten yuan), without affecting the overall effect.

2. Slow down of dismantling scaffolding

Ningbo Museum design has been criticized by Party City investment company that constructed using the 'Ningbo behind things' built museum inappropriate in the modern business district.

When construction is nearing completion, for fear of the public can not accept and Museum, City investment company suspended the process of dismantling the scaffolding. But after the exchange with the people of Ningbo Wang Shu, his design philosophy has been recognized, Ningbo Museum smooth opening and usher in the tens of thousands of visitors in a few days after its opening, has received praise Ningbo citizens. Eventually, City Investment Company also confirmed the design of this museum.



Component Production

Raw Material	Tiles (Wa Pan) collected from destroyed existing villages ¹
Production Type	
Producer	Local technique with high identification of Zhe Jiang Province
Production Time	50 artizens produced the tiles_ "Wa Pan" (handmade) Approximately 3 months

1. About tiles (Wa Pan)

- Why tiles?

It is said by the designer Wang Shu "Frequently, the memory both emerges from the things at present and things at distance." Before construction of this Ningbo Museum, this site is occupied by small historical villages which to the government is something out of date but to people living there is somewhere they devoted to love. Wang Shu take many times walking around, talking with the local people and in the meantime found large amount of tiles are collected by people who lived there.

- How many?

Someone working in the museum has counted every square meter is occupied by around one hundred tiles, the whole area of the tiles wall is 1300 sqm, so the number of tiles is about one million and even more.

- Who provide?

From the private acquisition

image sources: www.meituan.com

2. "Wapan Wall" technique

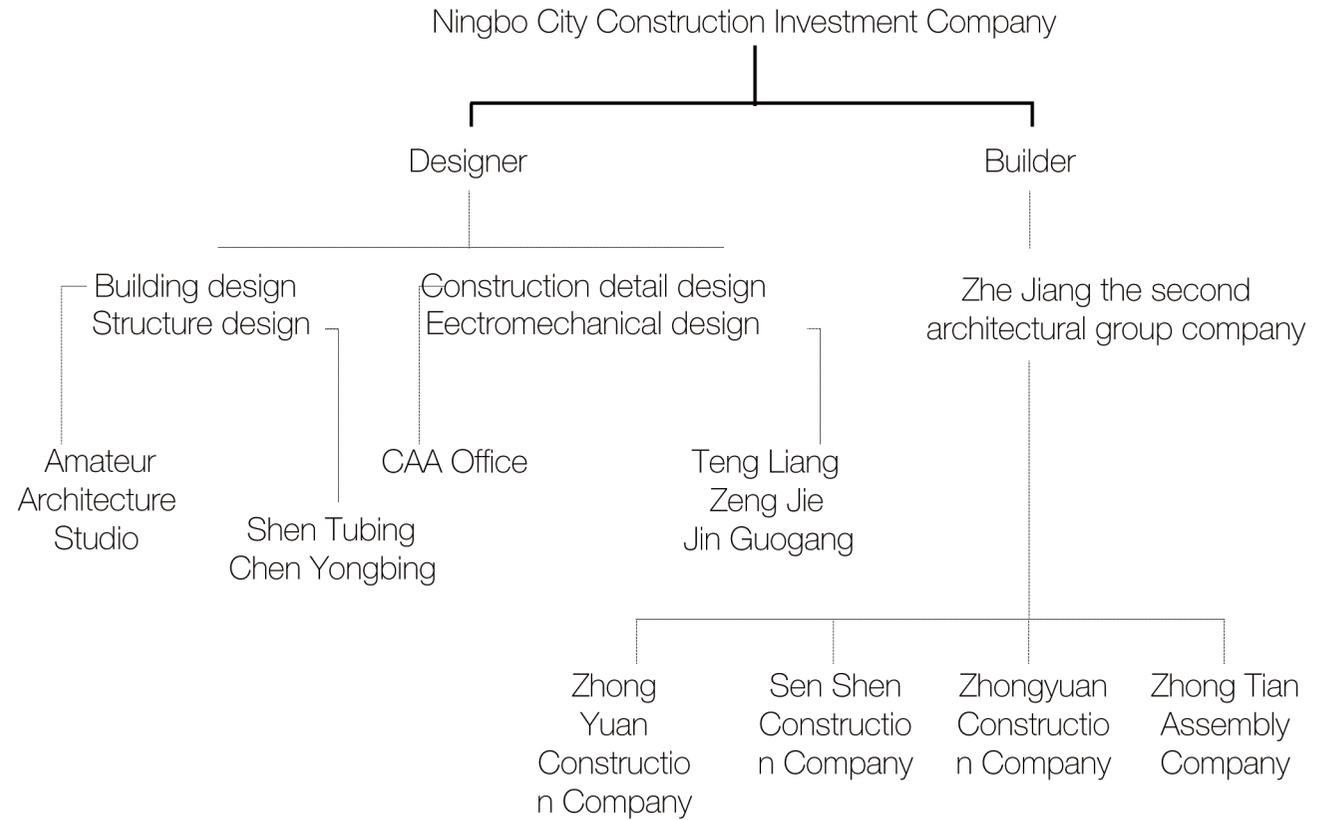
It is a unique construction technology in the coastal areas of Zhejiang Province. Due to the local typhoon, it caused the house to be damaged or collapsed after the typhoon. The local people use the broken brick and tile to build the building maintenance structure in the post-disaster reconstruction. This traditional craft, with the improvement of people's living and economic level has been out of sight, the architect to nostalgic feelings trying to introduce this local style of modern architecture to reproduce this retro process, can this process be perfectly reproduced? Is it possible to blend perfectly with modern architecture? They use two projects under construction at the time, one is Yinzhou Park five sub-room project, the other is the government functions with greening project, to carry out pre-research work. This construction type of walls has already be a Patented product which is copied by many local citizens and also be a typical characteristic of Zhe Jiang province.



Worksite & Construction

Worksite Organization Hu Jun
Worksite Management Wu Qingbing
Worksite Duration 2006.8 - 2008.8
Work Coordination Lin Mi

Human Resources Management



Worksite & Construction

Problems (Technical)

1. The foundation is located in the soft soil layer of silt (The use of drilling and grouting technology, single pile bearing capacity has meet the design requirements, settlement is uniform and stable)
2. Big amount of reinforced concrete walls with large area, the thickness of the wall is thin and steel-intensive. (Self-compacting concrete pouring)
3. The building is 144m long and no expansion joints are provided. (The use of unbonded prestressed technology to eliminate the cracks caused by temperature stress.)
4. Large area of special texture requirements of the concrete wall. (the use of natural bamboo to make the texture mold.)
5. Complex structure used, for example different shapes of external oblique column, oblique wall. (Use varies way of meatureing to make the size meet requirement.)

image sources: blog.sina.com.cn

Tests

In the construction of the Ningbo Museum, in order to build two of the most critical elements, the tile wall and concrete facade, the construction party conducted a number of different experiments.

Tile wall

For the feasibility of the wall, before the construction of the museum, the construction company conducted different tests in a few small buildings, one of which is the "Five Scattered Houses". In the project for the first time retro the process of recycle old material and reuse.

Disigners initially envisioned the structure of the wall is a very simple double wall structure, the main wall is 240mm thick, use reinforced concrete or brick. With the embedded angle iron conect a tile wall of 240 mm, not double wall with cavity. This structure is a waste of material and can not guarantee the security of high walls more than 4 meters.

After test of the "Five Scattered House", during the construction of the museum the structure of wall was changed to 120mm of thick steel concrete with 120mm of tile and leaving 120mm of cavity to complete the panels of waterproof GRC wall.

This system of construction saves material, has a very good thermal performance and energy efficiency is higher as well.



Tests

Bamboo Mouldboard Formwork Wall

The construction contractor of museum conducted some tests on the wall of another small building. These experiments include: small diameter bamboo model, large diaoo model, bamboo strip not laminated, bamboo strip laminated, wood model, connection of the bamboo texture concrete wall and other more than ten topics.

But for the construction technology between the test wall and the formal implementation there is still a great gap, mainly reflects in the standard and norms, costs and benefits. The construction side has continued to carry out a series of research work, such as to ensure the convenience of construction and to ensure that the sensory effect; such as the concrete color (because the color of concrete after pouring is easy to turn white), so they tested the different iron oxide black content test.

Ceiling

Now we can see the rectangular hanging under the ceiling was originally designed with bamboo composite material. But because of the density of this material is too high, only relying on screws and steel components can not guarantee the safety. After studying and communicating with architect, a foamed plastic coated with concrete was used. This way reduced the weight, safety is greatly improved, and only because of it, material cost had been saved more than 200 million RMB.

image sources: www.nbmuseum.cn



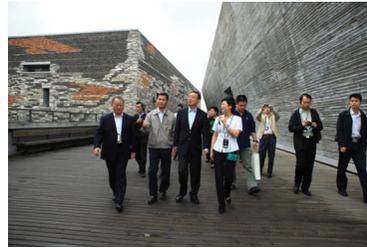
Management Control

Since its inception Ningbo Museum did continuous innovation in all aspects, improve service quality and make content more diversified. Attracting the citizen to visit, which make museum visiting as a part of their life. Ningbo Museum became "First-level National Museum" in 2012 and won the "Most innovative Museum" award in 2014.

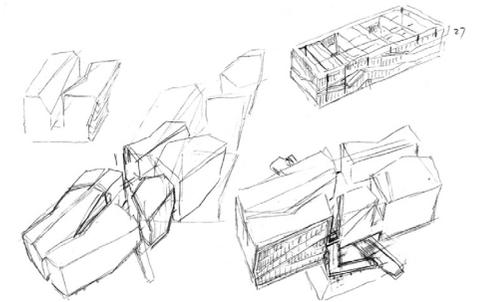
Every year museum will get funding from different entities, most part of it is from municiple government, the other part from the district government, central government and the donation. The annual funding is proximately 2 million euro. In addition to these funds, the museum hold special exhibitions to increase their income which used to maintain the daily expenses, train staffs and buy new collections.

In order to improve the quality of museum service, Ningbo Mueseum applies KPI (Key Performance Indicator) staff evaluation to evaluate staff performances. Well combined daily and yearly performance, as well as quality and quantity analysis, an overall KPI grading is applied to every wmployee and sector.

image sources: www.nbmuseum.cn



Drawing Development



The architectural design is completed by Wang Shu and Lu Wenyu. The design time was 2003-2005. After the project was identified as the project of museum in June 2005, the project was passed to the Design Institute of Landscape and Architecture China Academy of Art. In 2005, 6-2006, 6 construction design was completed and in August 2006 Ningbo Museum foundation was started.

Wang Shu

Winner of Pritzker Architecture Prize.

Dean of the School of Architectural Arts of the China Academy of Art

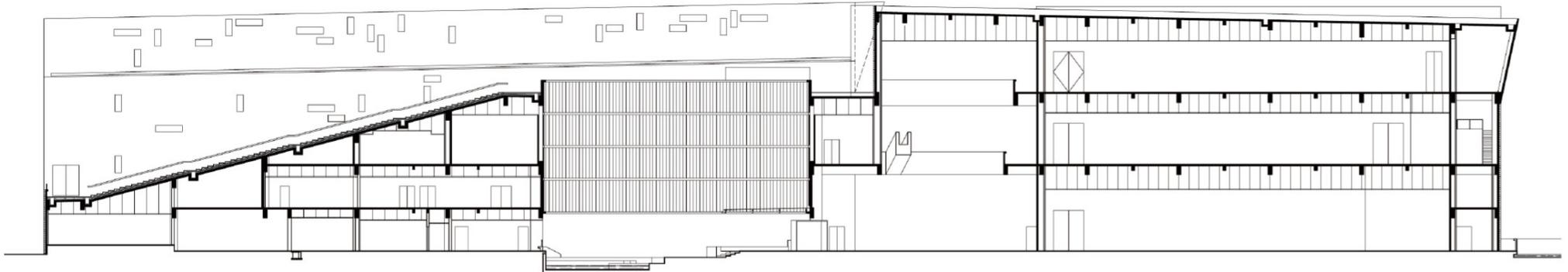
Director of the Department of Architecture and the Doctoral Supervisor

Design Institute of Landscape and Architecture China Academy of Art

Construction design qualification Class - A,

Landscape design qualification Class-A,

Architectural decoration design qualification Class - A

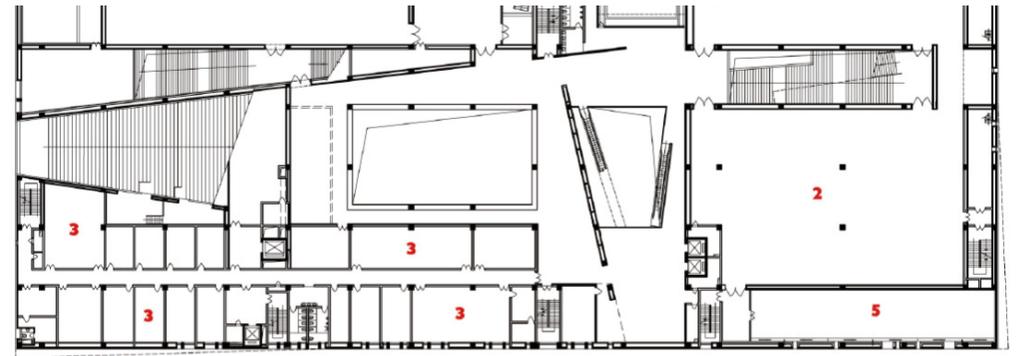


纵剖面
LONGITUDINAL SECTION

Design concept

Architectural form comes from the design concept of mountain, water and sea; use the tile wall composed by brick tiles of Dynasty Ming and Qing and bamboo texture concrete for decoration; highlight the characteristics of Jiangnan residential. At the same time, museum surrounded by the pool, represent the role of the ocean in the history of Ningbo.

image sources: 51wendang.com



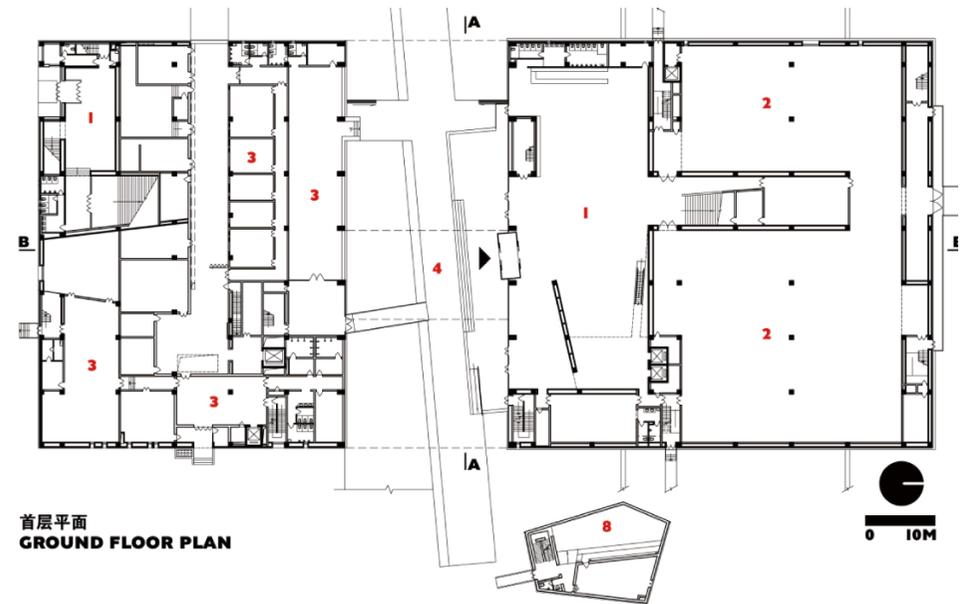
二层平面
FIRST FLOOR PLAN



基地平面
SITE PLAN



- | | | |
|--|----------------------------|-------------------------------|
| 1 主入口
MAIN ENTRANCE | 5 运货入口
STORAGE ENTRANCE | 9 自行车停放处
BICYCLE PARKING |
| 2 行政人员入口
ADMINISTRATION
ENTRANCE | 6 餐厅
RESTAURANT | 10 河流
RIVER |
| 3 次入口
SECONDARY ENTRANCE | 7 池塘
POND | 11 政府大楼
MUNICIPAL BUILDING |
| 4 办公区入口
OFFICE ENTRANCE | 8 停车场
CAR PARK | 12 广场
PLAZA |



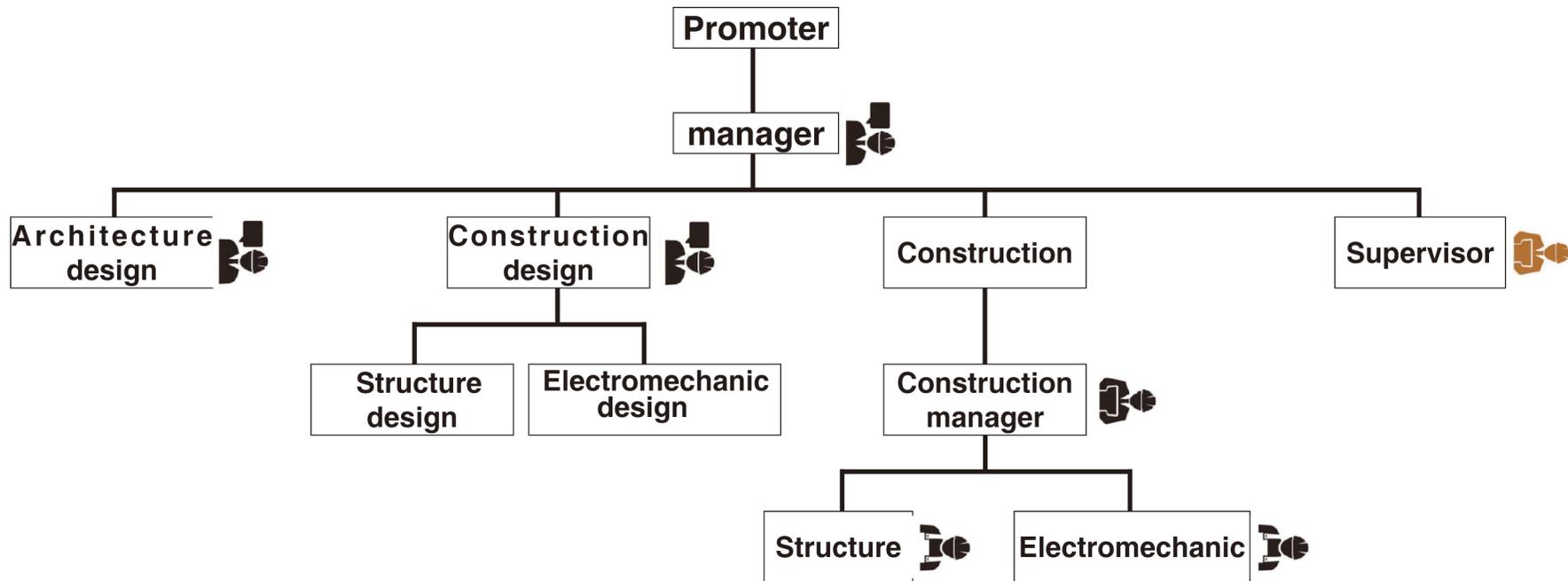
首层平面
GROUND FLOOR PLAN



- | | |
|-------------------------------|--------------------------------|
| 1 主大厅
MAIN HALL | 5 后院
COURTYARD |
| 2 展厅
EXHIBITION
GALLERY | 6 多功能厅
MULTIPURPOSE
ROOM |
| 3 办公室
EXHIBITION GALLERY | 7 自助餐厅
CAFETERIA |
| 4 入口
ENTRANCE | 8 餐厅
RESTAURANT |

image sources: 51wendang.com

Work Coordination



Promoter: Ningbo Museum& Yinzhou City Construction Investment Devp CO.,LTD

Architecture design: Amateur Architecture Studio

Construction design: The Design Institute of Landscape and Architecture
China Academy of Art

Competence: Construction design qualification Class-A
Landscape design qualification Class-A
Architectural decoration design Class-A

Structure design:Chen Yongbin etc.

Electromechanical Design: Teng Liang, Zeng Jie, Jin Guogang, etc.

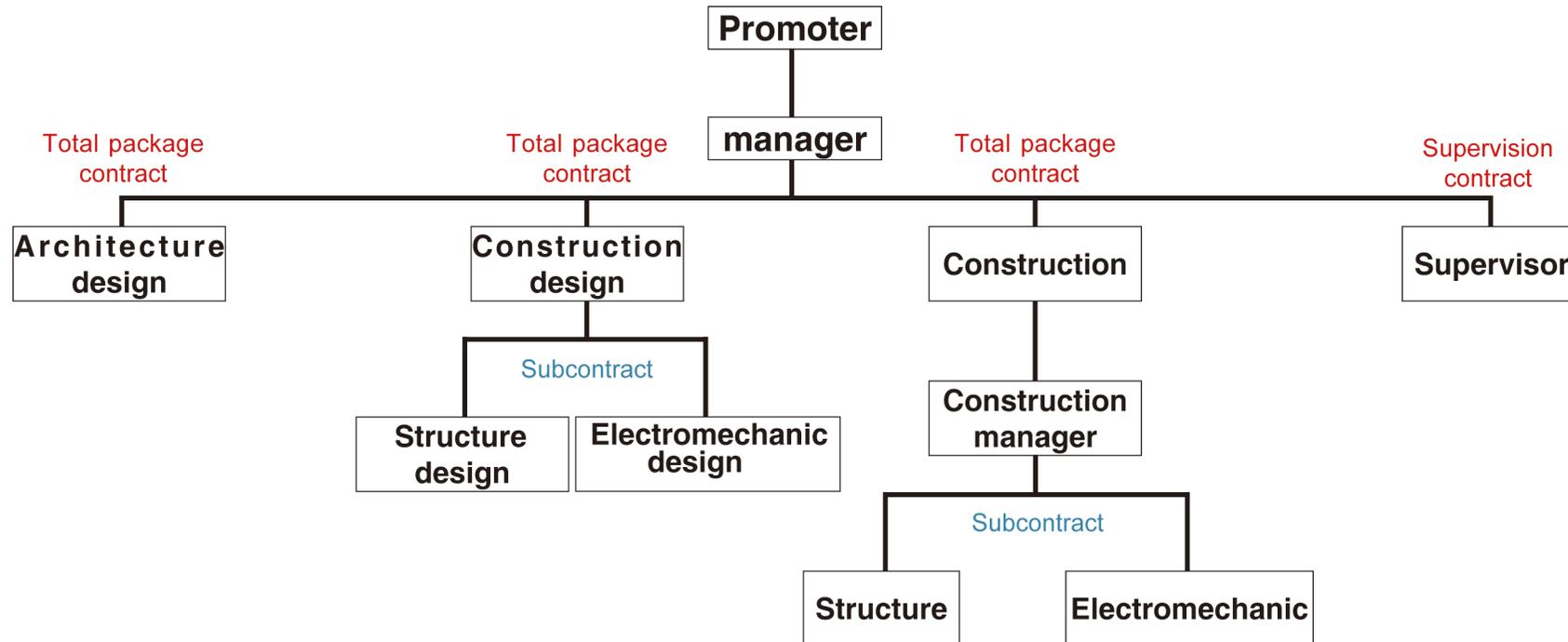
Construction: ZheJiang Provincial the second Construction Group LTD.

Project manager: Hu Jun

Supervisor : Ningbo Gaozhuan Construction Project Management Co.,LTD

Project manager: Lin Mi

Contractual Relation



The contract of construction of the Ningbo Museum is divided into three parts, one for the design contract, one for the construction contract, one for the supervision contract, among which design contract and construction contract are taken in the form of a total package.

Design contract: the content of design contract include design and construction programs and so on.

Construction contract: construction contract is the most important part, the contract agreed on the project section, the completion time, etc.

Total package contract

Construction unit (the contractor) will commission the whole process of construction of the project or a certain stage of its work to a contractor. the contract between outsourcers and contractors is called the total package contract. After the completion of the contract, the general contractor can commission a number of professional work to different professional contractors to complete, and unified coordination and supervision of their work. Under normal circumstances, the outsourcers have legal relationship only with the general contractor, not with the professional contractor. Tile wall

Maintenance & Use

Wall

In the course of the use of the museum due to the external wall will be damaged by external factors so that the need for regular inspection and replacement to ensure the integrity and beauty of the facade. There are natural factors such as acid rain, typhoon, hail and ice and melting in winter that will cause damage to the tile. Of course, there are human factors damage, so the museum every year will clean up and repair the facade and roof.



Floor

For outdoor wood flooring also requires regular maintenance and replacement, because every day there will be a large number of tourists to in the high frequency of extrusion will produce deformation and thus lose its function.



Structure

For the steel part of structure also need regular inspection and maintenance, because in Ningbo, where the region is mild and humid climate and the air contains also sea breeze. The moisture and salt in the air can cause damage to the steel structure of the building, so it is essential to coat the protective layer and clean the structural part.



image sources: h5.huitu.com : www.vcg.com

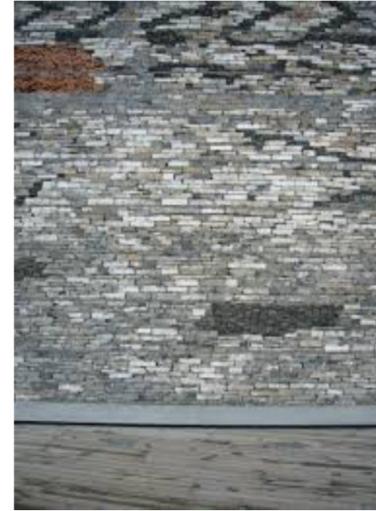
Innovation



Material and Building Component

The external walls of Museum is occupied by two different kinds of material. One is tiles which is so called Wa Pan Wall, the other is Bamboo Mouldboard Formwork Wall. Wa Pan Walls use large amount of historical tiles which is regarded as the biggest scale project after the construction of the Great Wall before the founding of People Republic of China. Tiles from different historical times which can even go back to Song dynasty. These tiles not only recall the memory of people who lived there before demolishing of the villages but also call back the memory of history of China in a big scale. It is said by Wang Shu "Frequently, the memory both emerges from the things at present and the things at distance." Bamboo Mouldboard Formwork Walls with natural texture of bamboo make the building an "organic" item which is a identificational feature of south part of China.

image sources: you.ctrip.com; blog.163.com



Volunteers involved in management of Museum

Ningbo Museum is the first museum in China which invites volunteers to help the work of management. Besides that, Ningbo Museum promoted to found the "Country museum institution of volunteers" which is the beginning of volunteers' participation of management.

Citizens voted in competition of the project

Except for professional votes, citizens can also choose the project they prefer in their own points of perception.

Sustainable items using in the Museum

Few windows are designed on some proper direction facades and low energy systems make it sustainable from technique point of view.

Case study A2

AUDITORIUM PARCO DELLA MUSICA •
ROME • ITALY
National capital for public • Designed by Renzo Piano • 1995

Characteristics



image sources: AUDITORIUM PARCO DELLA MUSICA(www.agb.it)

Context Characteristic	Rural
Concept	Musical boxes
Orientation	North-South
Dimension	55,000 sqm
Floor Number	Semi-circular layout with scarab shape volume
Sustainability	Single floor with multi level height --Special roof shape designed for water system --Local material used --Lighting systems, audio and video systems, control equipment, as well as the means of regulating and managing these installations, seen as a whole
Architectural Charecteristic	The Auditorium offers Rome a classical music venue that could reflect the city's importance and size by providing three halls of differing sizes and acoustic quality, The semi-circular layout of the halls creates a fourth space in the centre, an open-air amphitheater
Structure	(each of the three concert halls has been planned as a completely seperate unit) lightweight prefabricated sills after studies for its peculiar architectural aspects
Accessibility	A square in travertine, sloped and extended in perspective, leads to the interior, towards the amphitheatre, the true heart of the system

Commissions

Promoter	City of Rome
Land owner	City of Rome
Client	City of Rome
Designer	Renzo Piano Building Workshop, Franco Zagari, Tecnocamere, Muller-BBM
Type of bid	Commission after competition
Type of work	-Building and surrounding design inside the construction site -Building design as well as structure, water supply and drainage, electric, heating and ventilation, fire protection, interior and intellectualized design. -Project cost estimation (including building construction, equipment installation and decoration)
Final building property	Public auditorium
Building Management	SCE Project

Program

The Auditorium Parco della Musica is a multifunctional complex, built in the Parioli district of Rome, to host musical and cultural events.

The intervention is characterized by three concert halls, Santa Cecilia, Sinopoli and Petrassi which constitute the main volumes of the project, the real "harmonic boxes", gigantic musical instruments of degrading dimensions arranged in a radial pattern around an outdoor theater, la Cavea, a fourth hall with a capacity of 3000 seats that physically represents the focus of the entire project.

The surrounding space, where the buildings never exceed the height of the cavea, houses service areas, recording studios and rehearsal rooms surrounded by a 30 thousand square meter roof park, located between the banks of the Tiber river, the hill and the village Olympic.

Particular attention was paid to the choice of materials that draw from the Roman tradition: travertine slabs to cover the steps of the cavea, the foyers and the entrances; the Roman brick, handmade, to cover all vertical surfaces; the pre-oxidized lead for the shells of the rooms.

The structural complexity, the attention to detail, the elegant design in particular of the covering elements and the side panels remain a testament to the constructive richness of the intervention.

SCE Project has been involved in structural executive design and the General Works Management

Work Coordination

Renzo Piano Building Workshop, architects

Competition, 1994

Design Team: K. Fraser (architect in charge), S. Ishida (senior partner) with C. Hussey, J. Fujita and G.G. Nianchi, L. LIn, M. Palmore, E. Piazza, A. Recagno, R. Sala, C. Sapper, R.V. Truffell (partner), L. Viti, G. Lagnasco (CAD Operator)

Consultants: Ove Arup & Partners (structure and services): Muller Bbm (acoustics): Davis Langdon & Everest (cost control): F. Zagari, E. Trabella (landscape): Tecnocamere (fire prevention)

Design development, 1994-1998

Design team: S. Scarabicchi (partner in charge), D. Hart (partner), M. Varratta with S. Ishida, M. Carroli (senior partners) and M. Alvisi, W. Boley, C. Brizzolara, F. Caccavale, A. Calafati, G. Cohen, I. Cuppone, A. De Luca, M. Howard, G. Giordano, E. Suarez-Lugo, S. Tagliacame, A. Valente, H. Yamaguchi, D. D'Atri, D. Guerrisi, L. Massone, M. Ottonello, D. Simonetti (CAD Operators), D. Cavagna, S. Rossi (models).

Consultants: Studio Vitone & Associati (structure): Manens Intertecnica (services): Muller Bbm (acoustic): T. Gatehouse, Austin Italia (cost control): F. Zagari, E. Trabella (landscaping): Tecnocons (fire prevention): P.L. Cerri (graphic design)

Construction phase, 1997-2002

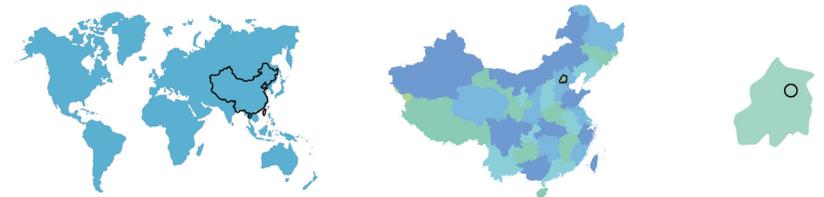
Design team: S. Scarabicchi (partner in charge) with M. Alvisi, D. Hart (partner) and P. Colonna, E. Guazzone, A. Spiezia

Consultant: Studio Vitone & Associati (structure): Manens Intertecnica (services): Muller Bbm (acoustic): Techint/Drees & Sommer (site supervision)

Case study B1

WATTLE SCHOOL • BEIJING • CHINA

Self supporting library for public • Designed by Li Xiaodong • 2011



Characteristics



image sources: 百度文库

Context	Urban
Concept	The idea of the project was to collaborate with the nature, to form a spiritual qichang (a flow of energy) that would concentrate the natural landscape.
Orientation	North-South, West-East axis
Dimension	175 sqm
Shape	Stripe shape with rectangle geometry
Floor Number	Main building of 1 floors, partial of 2 floors
Construction systems	The glass-and-steel structure of the building is softened by the addition of the sticks, with wattle from the village and double glass windows.
Internal partitions	Compound cedar boards are used to decorate the interior space. The building is one 30m long space without partition walls or furniture. The interior space is plain and simple: the main space is composed of big steps that can also be used as bookshelves.
Visual&Thermal confort	The wooden sticks covering the façade and the roof glass, quiver gently in the breeze and sunshine shoots fragmentary shadows into the interior space. And the building has totally no srpllied energy.
Sustainability	The library use 45000 wattles as facade from the local which are the most abundant natural resource in the area. And it's set at the lowest point of the building, the entrance to the library is close to the lake, and total use the indoor-outdoor architectural methods to provides comfortable environment in the library.

Commissioning

Promoter

The main architect Li Xiaodong is the promoter, he visited a friend in the village then he was impressed by the beautiful views and the lack of space for the village children to learn and read afternoon school finished. And fortunately he had a donation from Lu Qianshou Trust Fund. So he decided to build a library here. He brought the conceptual pictures to the leader of the village, and they decided to approve this project smoothly at 2011.1.

Land owner

The land owner is village committee of Beijing Huairou District, Yanxi Town, Jiaojiehe Village. It is belong to the public (multiple owners in China). And the previous use of the land is farm in the mountain.

Client

The client is the village committee of Beijing Huairou District, Yanxi Town, Jiaojiehe Village. They are friends, so the project is based on the private relationship.

Designer

The main architect is Li Xiaodong, and the whole project is designed by his team Lixiaodong Atelier. It is a university atelier, and his hierarchy is professional architecture & university professor. The little building is a practice of architecture regionalism, and the team components are Liu Yayun, Huang Chengwen, and Pan Xi.

Type of bid or job offer for the design

The job offer is based on private relationship at 2011.1, and there is no brief because it is a private building and the main architect is the promoter.

Characteristics and requirements: public benefit project with no paying for the design.

Expected cost: 1000000RMB

Type of bid or job offer for the construction

The job offer is directly call, began at 2011.3.

It is a public benefit project with no paying for the design, there's no formal drawing from some specific design institute, the builder has close cooperation with the site architecture; and the constructure price is below the market.

Construction/Builder

The construction team is Wang Hongli construction team & villager self-build; it is a private construction crop. Construction team foreman is Wang Hongli, from a civil construction team of Shandong, used to do interior decoration and film scenery. He repaired Pan Xi's small courtyard, and continued this project. The foreman Wang Hongli is responsible for all the engineering organizations. He take the responsibility to communicate with the site architect, finance officer and the coordinator; and the builders and local community workers are organized directly by the main principal.

Specialization: the cooperation with the local community, local building

company.

Type of work

The façade is made up of three layers of wattles; this natural materials can't be designed accurately, so they left the real façade view to the building period. And the site architect Liu Yayun negotiated with the building team and the finance officer, and delivered the problems to the main designer Li Xiaodong to decide.

Final building/project property

The building is owned by village committee of Beijing Huairou District.

Building management

The site architect Liu Yayun negotiated with the building team and the finance officer and and the coordinator; if the problem cannot be solved, he delivered the problems to the main designer Li Xiaodong to decided. The main principal is Wang Hongli, he taked the responsibility to communicate with the builders and local community workers are volunteering or paid to construct.

The project fee all came from donation, at beginning it was 1000000RMB, then the finance is overspent so the coordinator donated another 50000RMB herself to make the project achieve the economical balanced situation.

Capital is mainly charged by the Financing Officer Huang Chengwen, and he gives money to the constructor Wang Hongli in stages; the foreman contractor is responsible for procurement. 0.9 million RMB is

given to construction team contractor as the total package of materials, labors and procurement. The site architect often goes to the forefront of Huairou County construction materials market for procurement with the foreman contractor.

Financing

Financing Actors

The finance is national and from private donation. Construction financing is by donation from the Lu Qianshou Trust Fund for rural projects and Miss.Pan Xi private donation. The financing budget is 1000000RMB at beginning, but the real construction process is overspent, and Miss.Pan Xi private donated 50000RMB to replenish.

Management/Development financing

Huang Chengwen is the main manager of the project finance, but he has the intention that only if he owed the construction team money, they can do the work more responsibly. In this condition, the construction fund was always been delayed. This led to the serious consequence especially the final period of the project, to the last step of installing glass, the construction team got to the highest discontent point, and directly lead to the rapidly rise of cost and contradiction between the manage team and the construction team. The total cost is beyond 1 million RMB at last, and the progress is delayed for a time.

Program

Urban Setting

Existing urban plan is Zhihui Village, and the building type envisioned in the urban regulation is the building site belongs to forest land, the village committee owns it, belongs to the "unused land" category.

Site study definition

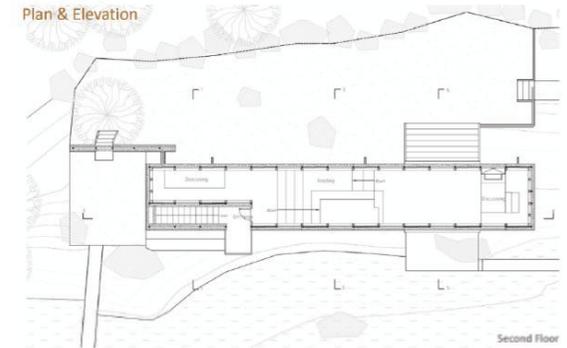
this project is really special, the architect is the project promoter, so he choose the specific site of this library near the river in the forest land area.no substitutable plan to definit the site, the lead of villager guided the main architect to walked around the forest land to let the designer himself to choose the site, and the designer selected the site at the first sight.

Building/project Scope

Type: library

Reason to chose such type: The promoter Li Xiaodong firstly started his connection with the village at a cozy courtyard gathering therewith classmates in 2010.

He was impressed by this quiet village on the outskirts of Beijing and touched by the fact that the local residents of the area, especially the kids, were short of educational resources. With money from the Lu





Qianshou Trust Fund, which had donated one million RMB for rural projects, he decided to build a non-profit library in the village to provide free books and reading space for both tourists and local residents, a building that could be a place for communication between the two groups.

Type characteristics

The Liyuan Library is the only man-made structure in Wisdom Valley, and is only accessible via a winding mountain road. It is a quiet site with water and mountains nearby. The idea of the project was to collaborate with the nature, to form a spiritual qichang (a flow of energy) that would concentrate the natural landscape. The building designed for the site would work with nature to build harmony at the location. In the finished building various factors including the water surface before the building, the plank path beside the water, the smooth layout of pebbles, and the space enclosed by stick fences integrate the library with the surrounding

image sources: photo by onsite architect

environment. Inside the library, solar glare is blocked but less direct natural light is allowed to penetrate. The library space has a strong local flavor because of the sticks that are used to clad and gave the project its name—the Liyuan Library.

And there is no alternatives explored for this project.

Architectural characteristics

The main architect offered to build the little library to the village, so there no specific requirements for the characteristics; all is decided by the architect.

Building/project Sustainability

The facade material wattle is totally natural and is collected directly from the forest. The trunks of trees and the sticks of the building are in the same color and it becomes hard to distinguish between the two.

There is no power supply to the library. This means no heating or air

conditioning in the building. But natural methods have been applied achieve both heating and cooling to a certain degree.

Set at the lowest point of the building, the entrance to the library is close to the lake. In summer, air chilled by the waters surface is introduced into the building through the entrance and naturally rises to escape it via a high opening near the roof. As the air rises it pulls hot air to either side along with it. The double-layer glass roof, with wooden sticks in between, shades the sunshine in summer and traps heated air during winter. As the heated air drops through the space it warms the room.

“Instead of merely being a tool, technology is also an idea. The aim of integrating technology into architectural space is to enable the houses to self-adjust along with the alternation of outside environment.” The Liyuan Library design, which resolves local problems with local resources, reflects the architect’s ideas about sustainability in practice.

The wooden sticks will attract nesting birds, and plants will grow attached to the mixed soil and earth of the nests. These events will effect colorful changes in the library along with the change of seasons, and integrate it even more into the village landscape. The wooden sticks come from nature and will go back to the nature.

Budget

The total cost is 1000000RMB, and the partial cost is as the hand-writing list. The real cost is 1050000RMB, the correspondence between expected and final result is 50000RMB, and this money is added by a following donation by Pan Xi.

image sources: 百度文库

Component Production

Place of production

Place of raw material: local village, collected from the local village and processed by the workers and villagers

Waste use plan: put back to the forest, the wattles is totally natural materials.

Place of production: local village and villagers' home

Production Type

The wattles is processed by the local villagers, and they themselves find the proper materials in the forest and they handled them artificially and naturally.

All the facades of the building (including its roof) are enclosed by 45 thousand densely arranged wooden sticks of different lengths. The sticks were chosen because they are the most abundant natural resource in the area, used by local residents as cooking fuel and heating.

Quality Control of the Production

The wattles are evaluated by the construction team principal and the site architect.



Worksite Construction

Design and work site organization

The direct site organization and work plan is made by the site architect Liu Yayun, and the first level control is made by the main architect Li Xiaodong.

The contractor Wang Hongli is in charge of the safety issue.

Construction methods

Work site technologies utilised: regular system:scaffold structure.

Work coordination: only one company involved---Wang Hongli Construction Team.

Working sequence:

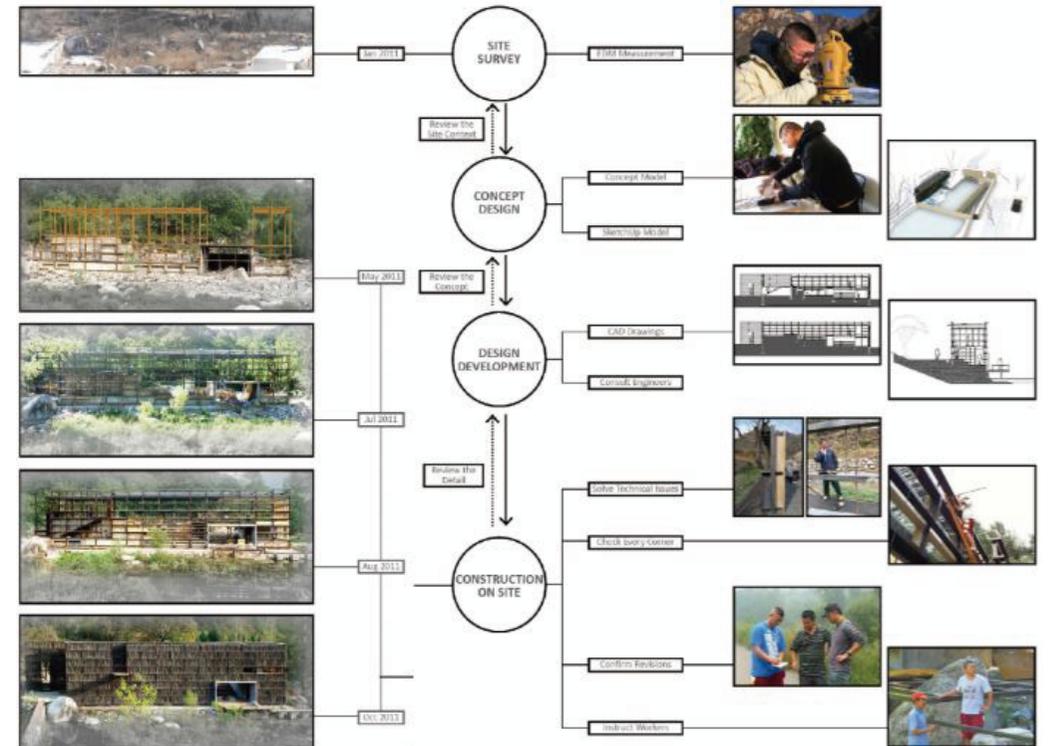
2011.5:finish the foundation and build the scaffold;

2011.7:build the main steel structure of the library;

2011.8:finish the double-glass façade and tear the scaffold structure down;

2011.10:install the wattles to the façade and finish the window and door, finish the indoor decoration.at the construction on site, they did the following works: solve technical issues;check every corner; confirm revisions; instruct workers.

image sources: 360 文库



Tests



Management tests

At the construction on site, they did the following works: solve technical issues; check every corner; confirm revisions; instruct workers.

The little public project is self-support and self-built, so there is no acceptance of work test and lack of standardization. When the project is finished, the main architect Li Xiaodong arrived to checked around the whole building, and took the pictures of it, and this is can be identified as the test. And they had an opening ceremony, inviting a lot of people including the town leaders, announced the Wattle School's opening.

Drawing tests

Usually in China, according to the Construction law, before the construction process is begin, the drawing should be delivered to the City Construction Insitution as soon as possible to apply for the permission to be practiced once the drawing is finished. And one of the original copy is asked to be kept in the government institution in case the project is going on well. This little project is too small and private, so the drawing needn't to be delivered to the institution, and with no foemal test it was just brought to the working site to be built.

image sources: 百度文库

Structures

During the construction process, because many related joint construction practices couldn't be implemented, the architect need to do the experiment, test, and see the real results on the site, and that caused a lot of additional work, waste of materials and rework. The lack of preparation and on-site test made the constructors very depressed, and at a time they fell to the slowdown state with negative emotions, that brought great trouble to the progress of the project.

Materials & Construction system

All the details are not decided when the site construction started. And the site architect had to make a real material model wall with scale 1:1 to check out, then he followed the foreman to Huairou County Market (almost all of the construction materials have to brought at Huairou County Market) bought square steel, wood and glass. And then the welder and carpentry immediately follow his sketch to make the wall. Then the site architect went back to university to show the photo to the main architect Li Xiaodong and discussed about the practical methods; after the master nodded to agree, the most critical structure of the whole house was determined.



Management Control

Work hierarchical organization

Li Xiaodong Atelier is a independent architectural office, and the main architecture is of the Level 1 Professional Architecture with several students from the university.

Project team here mainly has four people:

Li Xiaodong, the main architect in charge of design control;

Liu Yayun, the site architect, helps Li Xiaodong putting the design ideas into practice, on-site working, reports site progress and various problems to Li Xiaodong, and delivers the meaning of Li Xiaodong to the foreman and workers;

Huang Chengwen, in charge of capital control, the contract is signed by him with the foreman signed and controls all the details about the process.

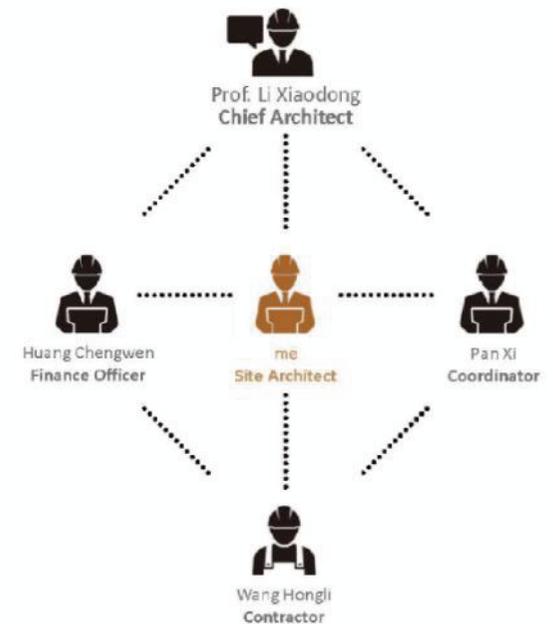
Pan Xi,deals with the all kinds of problems in all periods of the project, synthesizes all institution,communités efficiently with all actors involved,gives the proper solutions as soon as possible,making the project well run.And in the library project, the coordination donated extra 50000RMB herself to solve the financing insufficient problem.

Control and time conditions

Liu Yayun, the site architect, helps Li Xiaodong putting the design ideas into practice, on-site working, reports site progress and various problems to Li Xiaodong, and delivers the meaning of Li Xiaodong to the foreman and workers;

The site architect Liu Yayun negotiated with the building team and the finance officer and and the coordinator;if the problem can not be

solved,he delivered the problems to the main designer Li Xiaodong to decided.The main principal is Wang Hongli,he taked the responsibility to communicate with the builders and local community workers are volunteering or paid to construct.Site architect Liu Yayun with the Coordinator Pan Xi manage the work site and keep communité with the constructor.



Drawing Development

Drawing production

The drawing is provided by Li Xiaodong Atelier.

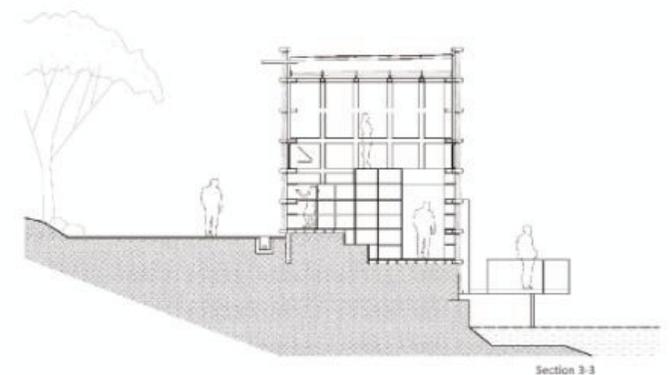
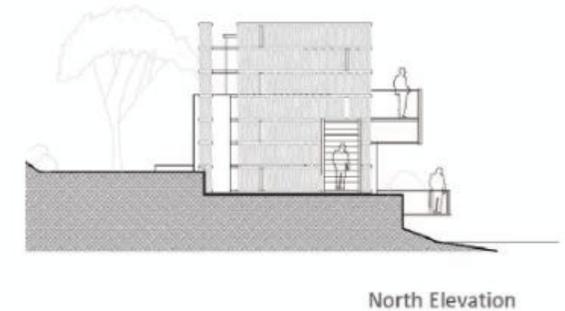
Before the construction started, they provided CAD drawings and Sketchup Models including site plan, plans, elevations, sections, detail structures.

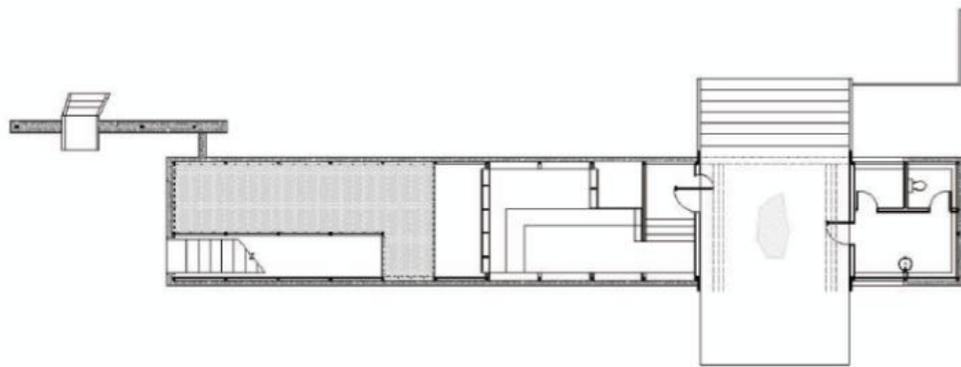
Production timing

4 months(2011.1-2011.5),at the beginning stage of the project, the atelier did the site survey and did the concept design, including concept model and sketchup model.then the design is completed with CAD drawings.

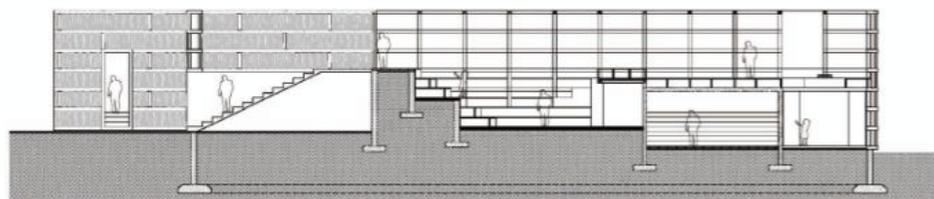
Drawing transmission

After that (2011.4) before the construction work started, they transferred the drawings to the engineers and consulted the engineers about the feasibility research of the project, reviewing the concept and the site context.





First Floor

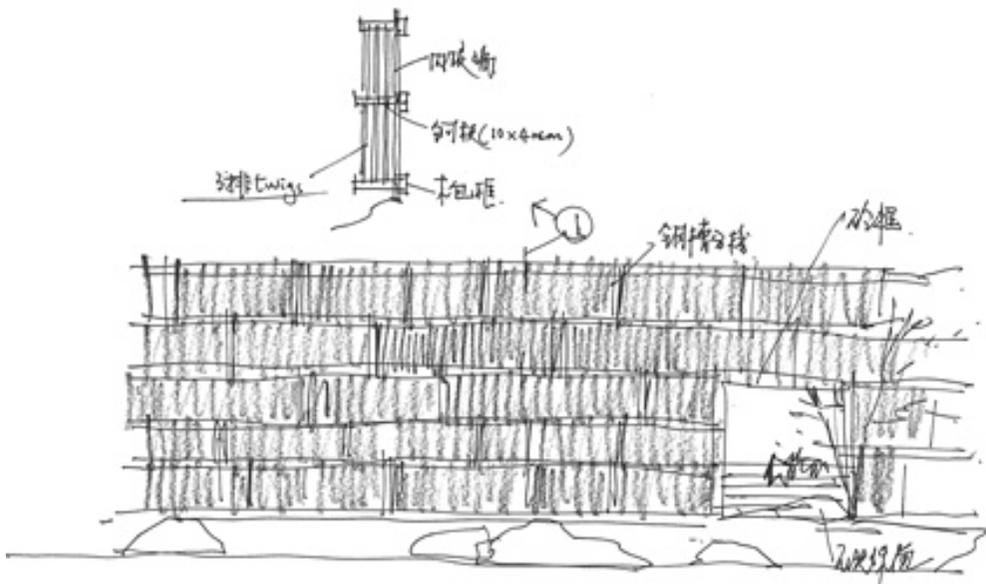
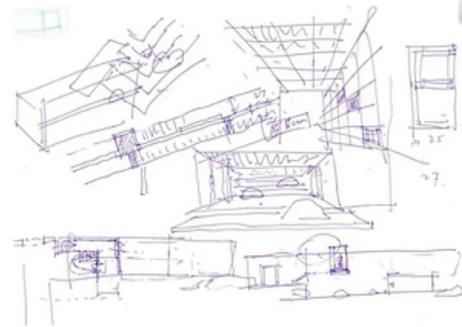
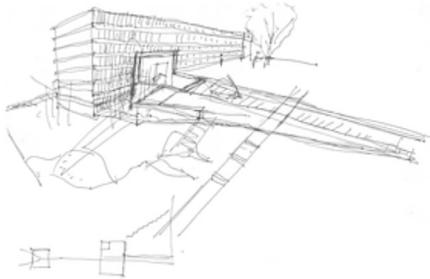


Section 6-6

Drawing management and organization

On March 2011, when the project started, the construction drawing is incomplete and the practice of the details are also not implemented. The details of the practice were discussed in the field with the construction team, and a lot of specific practices are written on the floor or wall by chalk on the site. Thus they determined the practice, with no formal drawings, all hand drawing, including a lot of sketches of firewood facade, glass enclosure, indoor wooden shelves of the wall structure, as well as the roof drainage strategies, etc. And that led to endless problems encountered in the construction subsequent, completely unable to construction according to the drawings. The site architect must be on-site and discussed the practice with the foreman, one by one and hand to hand to guide them cutting, processing and fixing.

Work Coordination



Pan Xi, the coordinator is a crucial role in the solution of various contradictions and communication between all sides. She lived in the village where the library located, and the intention to build a public library here is promoted by chance when the main architect was visiting her small courtyard. Construction team is also her private relationship with previous cooperation, and by her introduce they got the bid for construction. After the project started, Li Xiaodong focused on design regardless of money, while Huang Chengwen is only in charge of money with not enough understanding the progress of the site, and the site architect just deals with the site conditions. These three members have their own shortages, which caused a lot of resistance in the exchange ideas with the foreman, and every this time it counted on Pan Xi coming forward to negotiating about money things, the quality of the project, etc.

Control test & Certification agencies

This little project has no formal control test or certification agencies. Construction team foreman is Wang Hongli, from a civil construction team of Shandong, used to do interior decoration and film scenery. He repaired Pan Xi 's small courtyard, and continued this project. The foreman Wang Hongli is responsible for all the engineering organizations.

Contractual Relation

The design contract is signed by Li Xiaodong with the legal person of village committee of Beijing Huairou District in 2011. And it's an informal contract between the promoter and the client with private relationship.

The financing officer Huang Chengwen contacted the construction team and signed the contract. And for this case, there is no formal contractual relationship, and both sides only signed an informal handwritten contract. The two sides signed a brief document to reach a civil agreement and that caused a big problem in the construction period, the two sides had contradictories on the capital and material cost problems repeatedly, and even led to the extension of the project, but finally they counted on the coordinator's private relationship, though repeated consultations and coordination of private relations, these endless problems were hardly resolved.

The project location in the remote ravine and is also a small project for charity, which means the construction team may had no money to earn, even would lose money is things got worse, so construction team is willing to take over and the project delayed at the beginning. Eventually relying on the coordinator Pan Xi's private relationship, the whole project is contracted to Wang three brothers construction team at 900,000 RMB.

image sources: 百度文库

Maintenance & Use

Maintenance Plan

The villagers volunteer working in the library, they ensure library security and sort the books in turns and totally by volunteer. 2015 the library had a main maintenance of changing the façade wattles. It cost 200000RMB, and the main architect Li Xiaodong made a advertisement for a car company to get the donation.

And the library is running same of the actual maintenance

Building use

The building is designed for totally public use, open and free for people to read.

During the maintenance period, the changes in use of the scope that the little library is becoming a cultural landmark, and taking the lead of the village tourism business. The little library once finished is well welcomed by the villagers and the citizens who love the quiet



Innovation



environment and the reading-lifestyle, it becomes quite famous and people prefer to drive to this little village for holiday and read in the library in the daytime and also living in the farmhouse.

Problems

But there are still existing several problems during the maintenance process.

- Lack of supporting facilities: the little library is designed as a total natural and sustainable place, there is no water and electricity supply, so it is closed very early every day. And the site is hundreds of meters away from the nearest water and electricity branch, costing 3 million RMB to build. And no heating system makes the library unavailable in winter. Also no municipal sewer leads to no toilet in there which is very inconvenient.
- Lack of maintenance fund: the maintenance work is volunteered by the villagers and they use their spare time besides their daily farm work. They are lacking of funds to provide the library workers some financial support to run the library better.

image sources: 百度文库

In conclusion

The Little Wattle Library is total philanthropy with public concern and kindness, but in the organization and construction of the project, non-standard organization and operation, very limited time and money makes the construction process come across with a lot of problems, rework and disputes.

The public citizens love it, also criticized a lot about it. It is impossible to ask the architect to solve all the problems in such limited funds and limited time, "the architect is never the god." The real value of this little library is not the shape or facade, it is its self-support system: the donation money from the beginning, the local people self-build and the volunteer maintenance work, and now the public library is becoming the local mark to attract visitors which brings a chance to the local development. It has released a lot of social energy as such a small building, and has exceeded its social expectations.



Case study B2

ASILO GUASTALLA • GUASTALLA • ITALY

Self supporting kindergarten for public • Designed by
Mario Cucinella Architects • 2015

Characteristics



image sources: 百度文库

Context	Urban
Concept	MCA project is thought to stimulate the child's interaction with the surrounding space according to a vision of "teaching" in which nothing is left to chance, from the distribution of educational areas to the choice of materials of construction, up to the integration between indoor and outside space.
Orientation	South-East/North-West
Dimension	1400 sqm
Shape	rectangular plan with parallelepiped shaped volume
Floor Number	Only one floor with height of 4.8 m
Construction systems	The structure involves the use of natural or recycled materials with low environmental impact. In particular, the supporting structure is made up of wooden frame: a safe and ideal material to keep the thermal insulation of the building.
Visual&Thermal confort	Sensory high efficiency lighting system Using stack effect in heating/cooling floor where natural circulation can go through from bottom to top. Solar panels involved.
Sustainability	Architectural elements like the shape of the interior, their organization, the choice of materials, all the sensory perceptions related to the light, the colours, the sounds, the tactile suggestions - are designed taking into account of the pedagogical and educational related to the growth of the child.

Commissioning

Promoter	Government of Guastalla
Land owner	Government of Guastalla
Client	Government of Guastalla
Designer	Mario Cucinella Architects ¹
Type of bid	Public call for tender
Type of work	-Building and surrounding design inside the construction site -Functionality of interior spaces in relation to the functional program contained in the preliminary draft -Quality and appropriateness of the furnishings and interiors of the spaces that will form the nascent childcare facility -Quality of the relationship between solids and voids in the design of prospects, quality of the relationship between interior and exterior spaces in relation to the relevant areas and the main accesses -quality and adequacy of the works of environmental engineering in relation to the function and the user type
Expected cost	3,150,000 euro
Final building property	Public building for educational scope
Brief writers	Process responsible: Mario D'Araio Architect: Anna Maria Ricci



1. MCA - Mario Cucinella Architects)
Project managers: Mario Cucinella and Marco Dell'Agli
Design Team: Alberto Casarotto, Valentino Gareri, Ferruccio Palumbo, Irene Sapezza, Alberto Bruno
Models maker: Yuri Costantini
Landscaping consultancy: Marilena Baggio
Rendering: Cristian Chierici – CC79
Structures: Geoequipe Studio Tecnico Associato
Electrical and mechanical Design: Area Engineering srl
Acoustic: Enrico Manzi

Team component: Architects, engineers

image sources: <https://www.mcarchitects.it/project/nido-d-infanzia-la-balena>

Financing

Budget Management

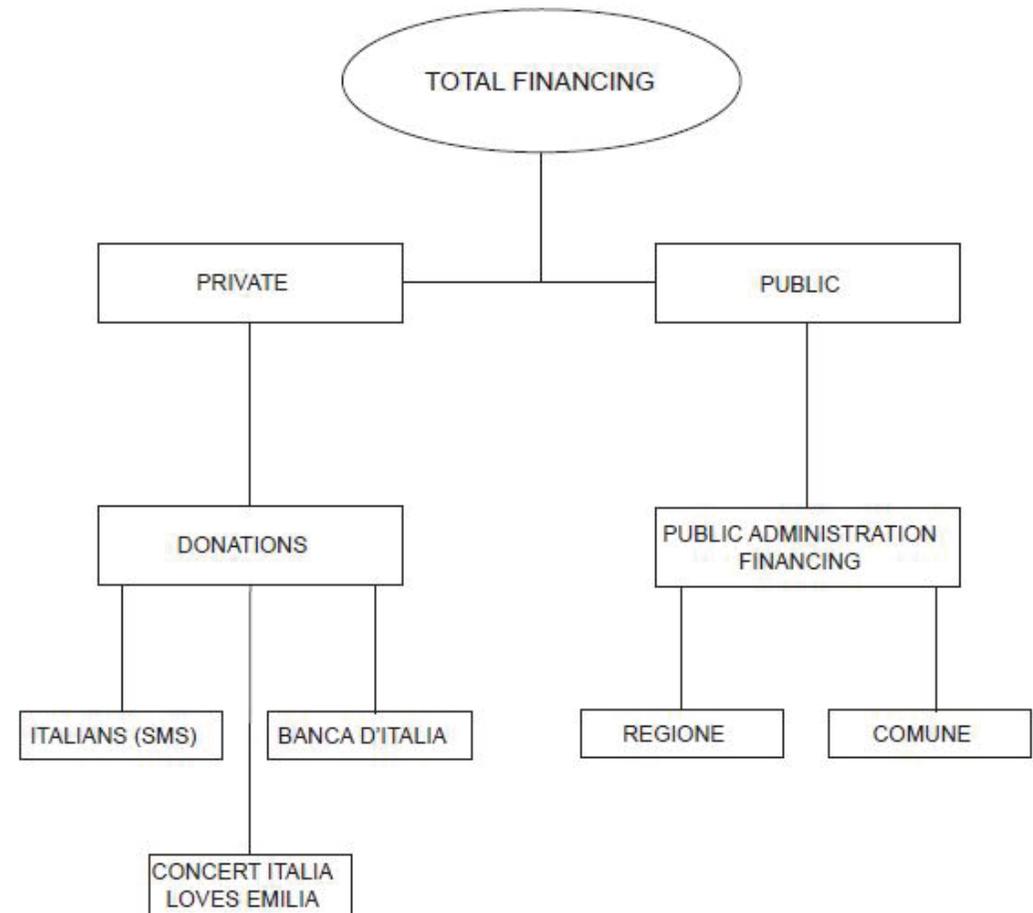
Comune di Guastalla was the budgeted manager during the project and currently is monitoring the budget through the financial balance

Financing Method

The financing method is defined by the Stability Pact to local authorities in which a spending cap imposed by the regulation. In the Stability Pact, the net debt of the Public Administration (P.A.) is the main parameter to be controlled.

Entity

Regione Emilia Romagna
Concert (Italia loves Emilia)
Comune di Guastalla
Italian people (SMS solidarity)



Program

Urban Setting
Building Scope

PGR
Kindergarten

Site Study

Site located in Via Rosario, in a low density area, characterized by lots of sport facilities, green open spaces and a primary school. That specific area present a no compact ground and an abundant vegetation with medium and tall plants. Moreover it's present a driveway on the public street and a connected parking.

Reason to choose this type

Replacement of two kindergartens previously destroyed by the earthquake (2012)

Architectural
Brief Requirement

- well organized external space with covered paved area and lawn areas, ensure safety
- activity area and play area for children
- meet energy efficiency code
- soundproof requirement

Correspondence
(requirements & result)

- convenient step flow with unique ground floor correspond presented such as
- function arrangement
- space and volumes
- volumes and voids. etc

Sustainable
Brief Requirement
Influences on the brief
requirments

Eco-compatibility of material and construction system

- Quality and adequacy of environmental engineering works



- Quality and adequacy of the green spaces of the buildings relevance
- Quality and appropriateness of materials
- Quality and appropriateness of the internal spaces finishes
- Quality and appropriateness of the furniture and interior spaces arrangements that will form the nascent childcare facility
- Energy class of the building
- Index of supply from renewable sources
- Reduction of daily drinking water requirement for indoor use

image sources: architetto,info

Component Production

Place of raw material

Spruce comes exclusively from alpine areas undergoing reforestation that are located within a radius of 150-200 km from the headquarters of Rubner Italy.

Waste use plan

The waste materials are disposed of in a landfill site following the provisions of construction management, at the contractor's expense that is offset the transportation and disposal costs with contractual payments scheduled for demolition.

Who produced the components: Rubner Holzbau SpA



image sources: <https://www.mcarchitects.it/project/nido-d-infanzia-la-balena>

Worksite Construction

Within 15 days after the delivery date report, it is necessary to provide a detailed implementation program of work in which are specified the technology used, business decisions and work organization.

In this program must be present estimates for each type of processing, the amount alleged, partial or progressive, the progress of work concerning the limits previously decided.

Site manager: Scisciani e Frascarelli Impresa Edile

Time plan

Prepared by the awarded undertaking. It must be updated monthly and delivered to the construction management along with the work progress report.

Safety plan

Drawn up by the contractor and delivered to the Client

Worksite control

The contractor and subcontractors shall appoint the technical site manager Safety control (Responsabile sicurezza)

Working Sequence

- 1.Site cleaning operations;
- 2.Foundation in reinforced concrete with igloo system;
- 3.Installation of the structural frame in fir glulam;
- 4.Self-supporting portal in Cirmolo wood with metal flashing protection;

5. Installation of the wooden facing panels;
6. Installation of the vertical closures, both opaque and transparent ones (double glazing);
7. Laying of paving system;
8. Internal glass division;
9. Cover panels.

Worksite technologies

The production quality have been guaranteed thanks to the CNC machines which, with the cutting and the planing of the different frames, allowed to obtain perfect wooden elements. This system also allowed to reduce to the minimum the work in situ.



image sources: <https://www.mcarchitects.it/project/nido-d-infanzia-la-balena>

Tests

Builder test

Within 30 days from completion of work the contractor has to provide the certification of the materials behaviour, issued by the Official Institutions

Management test

testing by CCIA, city of Guastalla

On site test

During the execution of the work the Contracting Authority can perform control operations or partial acceptance in order to check the total correspondence between the works and what is required in the design documents.

Management Control

On site management

It was built with some urgency, and it was so because it also stands as a symbol of the pride of the region of Emilia. It was a collective effort, including the city council, teachers, families, and not least of all, the children.

The monitoring and control

1. Feed measurement of project activities;
2. Comparison with the Project Management Plan forecasts that form the baseline for the project;
3. Development and control of corrective actions to remove problems and / or avoid the risks in order to restore the desired productivity of the project;
4. Surveillance towards the implicit adoption of scope changes (change request) is not agreed and approved.
5. The measurements presuppose the definition of a defined system of indicators at the beginning of the project (project metrics) of which they are almost always part of the costs and the amount of paid work (effort).

Drawing Development

Drawing production

The drawing is provided by eighteen tender participants, which separately the work in terms of their different skills such as architectural engineering and management etc.

Following the design principles they provide drawings for architectural design, security, drawings for supply and installation of furniture in municipality of Guastalla.

Production timing

45 days for overall project and time management for every definitive project stage

Drawing transmission

Hand carried or sealed transmitted from the tender participant to the Unione dei Comuni Bassa Reggiana (Protocol office)¹.

1. The “Unione dei Comuni Bassa Reggiana” is a consortium that represents the municipality of Guastalla

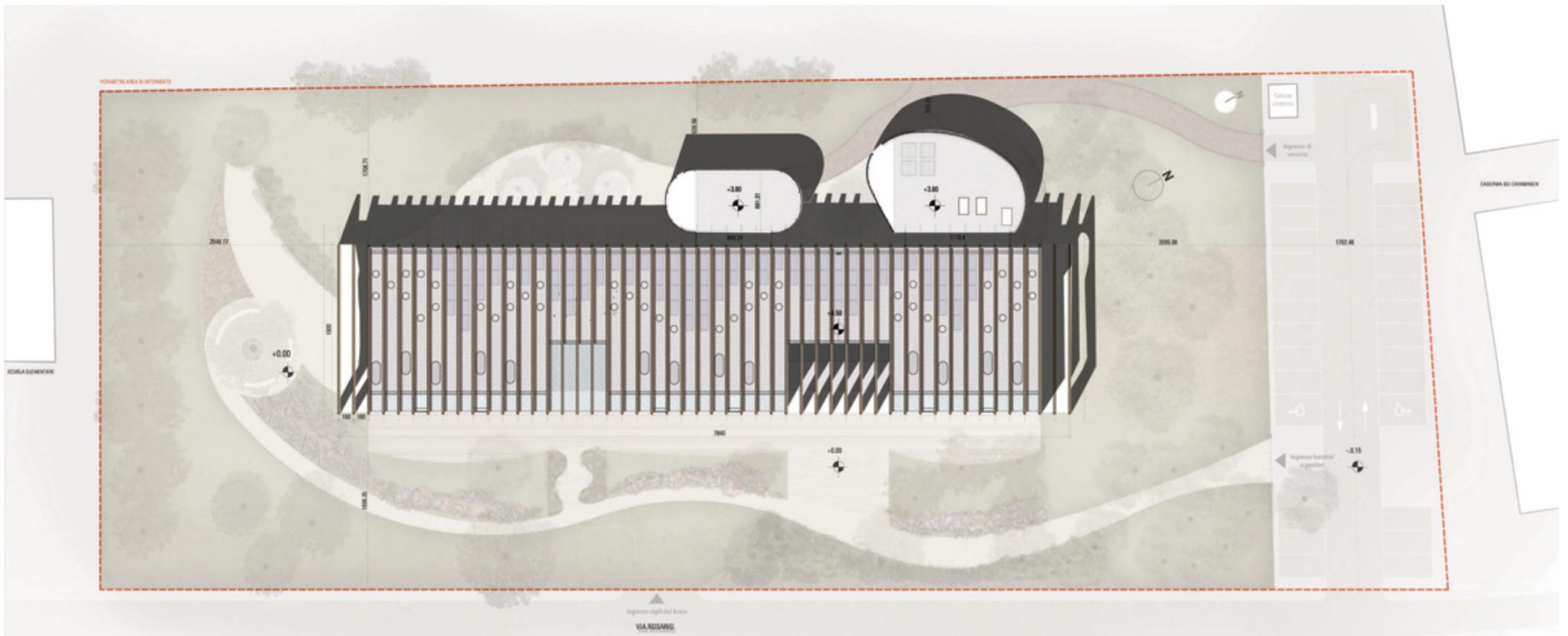


image sources: <https://www.arketipomagazine.it/nido-dinfanzia-a-guastalla-mario-cucinella-architects/>

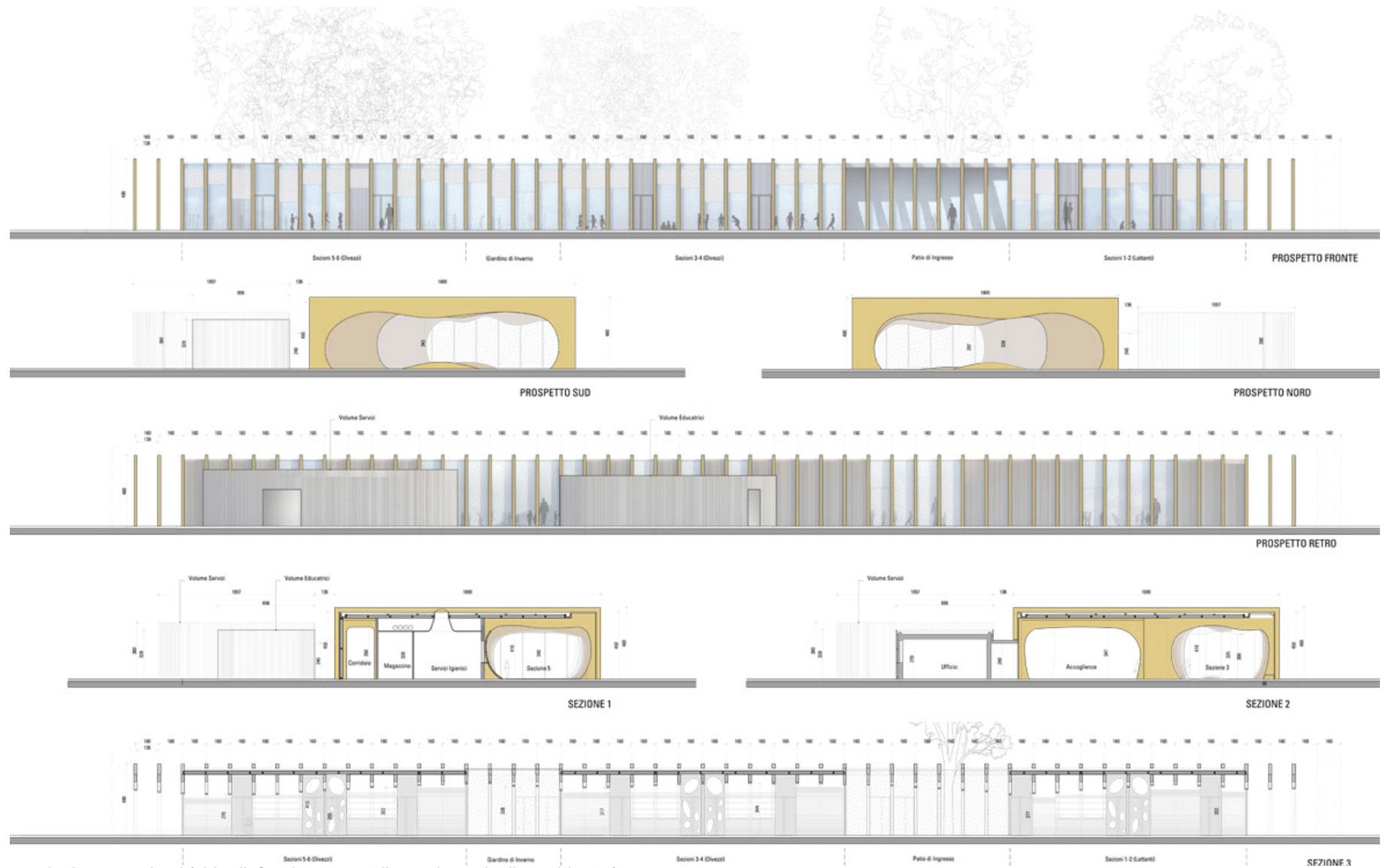


image sources: <https://www.arketipomagazine.it/nido-dinfanzia-a-guastalla-mario-cucinella-architects/>

Work Coordination

In team design

Project managers: Mario Cucinella and Marco Dell'Agli
Design Team: Alberto Casarotto, Valentino Gareri, Ferruccio Palumbo,
Irene Sapeza, Alberto Bruno
Models maker: Yuri Costantini
Landscaping consultancy: Marilena Baggio
Rendering: Cristian Chierici – CC79
Structures: Geoequipe Studio Tecnico Associato
Electrical and mechanical Design: Area Engineering srl
Acoustic: Enrico Manzi

Coordination works

1. Provide detailed information on the job play with the team of workers work and ensure that the job of Team is run according to directions given
2. Integrate the operators team different backgrounds, language, levels of autonomy

3. Detect the degree of compliance with the Safety standards at work,
4. Promote the recruitment of Safety behaviors and preventing, suppressing behaviors not complying
5. Verify that the processes are carried out correctly and consistently with available and input with instructions received

The technical coordination of the site is responsible for organizing and coordinate the activities of shipyard workers, planning daily activities and the material to be put in work, following the progress of work and checking the supply of the starting material from order to delivery on site. It operates both in the construction of buildings in the construction of engineering structures civil. It carries out the activities at construction companies of any size, mostly with employment contract.

It operates with a considerable degree of autonomy by relating with site manager, with the head of security and all the components of the working teams.

Contractual Relation

Contract type

The integrated contract with acquisition of the final draft during the bidding, has for object the commitment of the executive design (including the coordination of safety in the design phase) and the realization of a nursery school in the Comune di Guastalla to be achieved by timber construction systems.

Supervisor: Technical Office for public works (City of Gustalla)

Possible revision

The consideration for the works, as determined during the tender, remains fixed and invariable without that it can be relied on by the contracting parties any verification on the measurement or on the value attributed to the amount of such work. In consideration for the execution of the works (lump sum work) it means always included any necessary spending to give the work accomplished under the conditions laid down by the Special Tender Specifications and second types indicated and provided in the design documents.

Therefore, no compensation can be claimed for works, supplies and services that are not explicitly specified in the job description in the body, are detectable with elaborate graphics or vice versa. The same applies to works, supplies and services that are technically and inherently essential to the completeness and proper completion of the work contracted out according to the rules of art.

Contract termination

The termination of contract could occur in the event of the contractor's delay of the deadline for submission of the detailed design of the works of more than 45 (forty five) consecutive days, the Administration proceeds, after warning to fulfill, to the right of rescission, pursuant to art. 1454 of the Civil Code, unless the additional damages.

Contract cease

All resignations by the winning companies must be submitted to the administration by registered letter, the penalties are laid down in the tender documents.



image sources: <https://www.arketipomagazine.it/nido-dinfanzia-a-guastalla-mario-cucinella-architects/>

Maintenance & Use

Maintenance Plan

Organized by Unione dei Comuni Bassa Reggiana

The maintenance works expected for the building are those provided by Italian standard regulations for school buildings (UNI).

For specific maintenance works of the building it refers to the maintenance plan of the project. However, because of the innovation of the construction systems, materials and treatments on them, in particular regarding the wooden structure, it was possible to reduce the maintenance works.

Building use

The building is designed and had not been changed its function and scope.

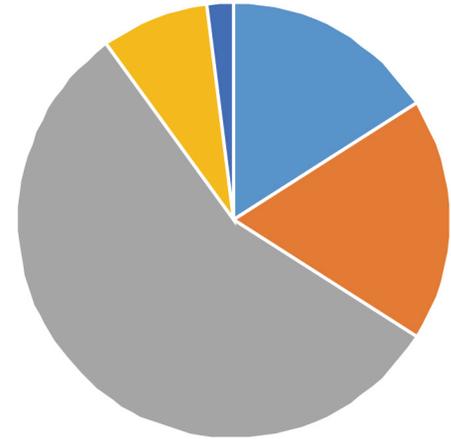
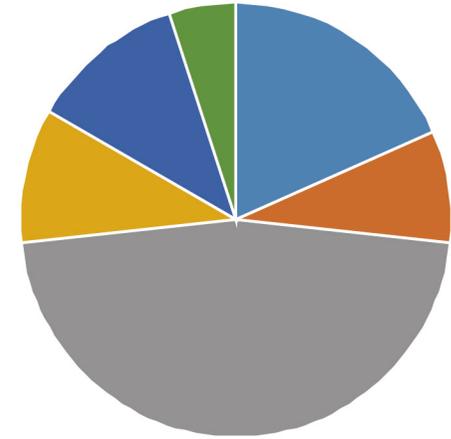
Results and Discussion

Comparison of decision makers and innovation results
considering the responsibilities of architect during overall process in
China and Italy

Ningbo Museum_A1
Auditorium Parco della Musica_A2
Wattle School_B1
Asilo Guastalla_B2

Decision maker and innovation results

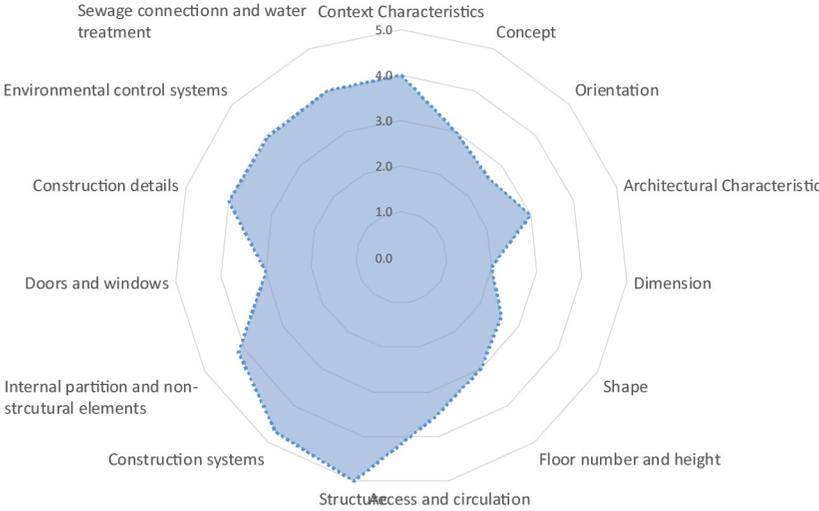
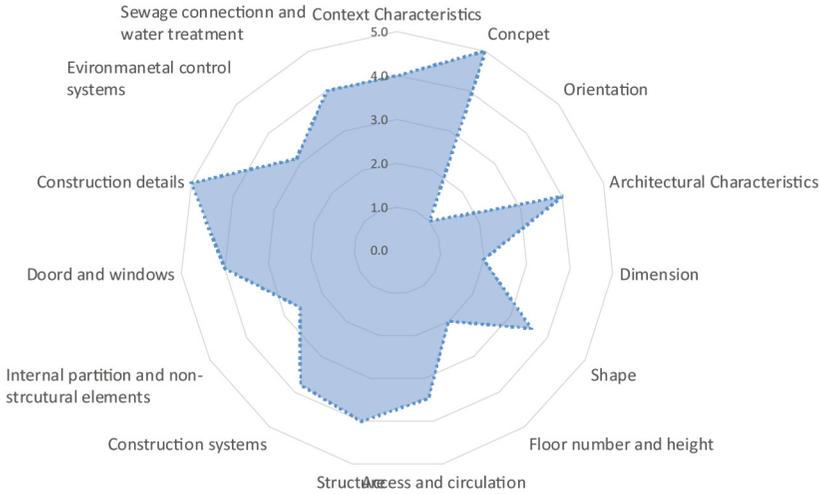
Case study A1-A2



- Institutions
- Client
- Designer
- Builder
- Industry
- Users
- Other

Decision makers during the "building" part.

- Issue taking into account:
- Context characteristics
 - Concept
 - Orientation
 - Architectural Characteristics
 - Dimension
 - Shape
 - Floor number and height
 - Access and circulation
 - Structure
 - Construction systems
 - Internal partition and non-structural elements
 - Doors and windows
 - Construction details
 - Environmental control systems

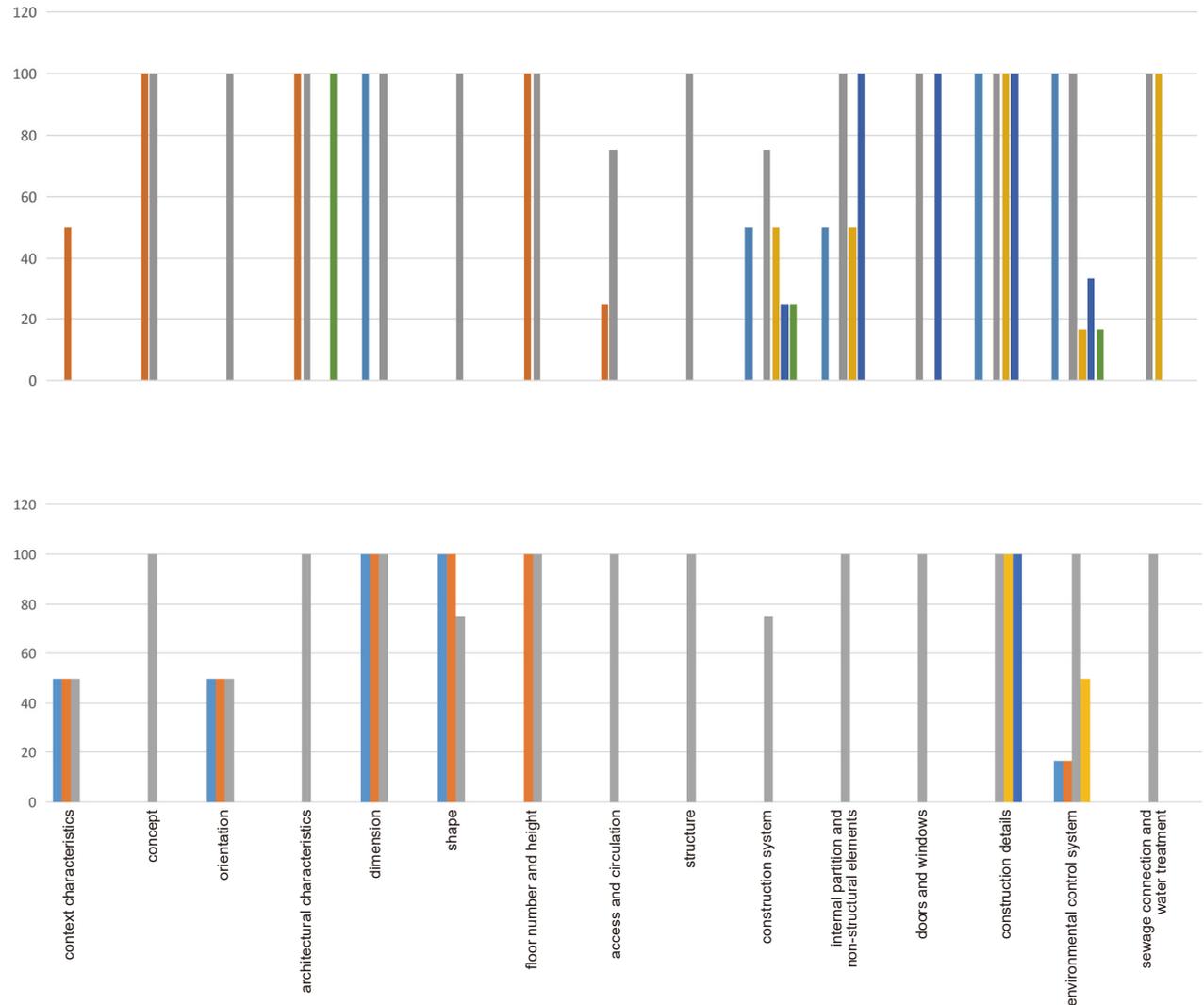


Decision maker and innovation results

Case study A1-A2

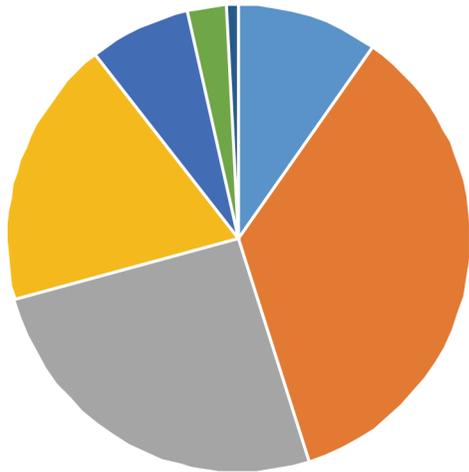
In terms of national capital projects, the decision makers of Ningbo Museum works more average, designer make less than half decisions overall. While for Rome Auditorium, designer, client together with institutions make almost all of the decisions, among which designer takes more than half percentage.

Because of different ways of building management, decision makers are more complicate in China than in Italy. The bar graph represents the decision maker during the whole "building" part. There are 8 aspects decided totally by designer in case study A2 project while in A1 there are only 3 which are building orientation, building shape and structure. Within the context of Chinese building environment, government, institutions and industries get more involved which result in high differential of innovation degree. Some impacts have to be designed within the limitation of strict rules, to make the project more sustainable, other impacts need to be more innovative. Thus, improve professional ability of the institutions or governments who make the rules is one of the practical point to have better building activity environment.



Decision maker and innovation results

Case study A1



- Institutions
- Client
- Designer
- Builder
- Industry
- Users
- Other

Decision makers during the "process" part.

- Issue taking into account:
- Commissioning
 - Financing
 - Program (brief)
 - Component Production
 - Worksite/Construction/Assembly
 - Tests
 - Project Management/Control
 - Work coordination
 - Contractual relations
 - Maintenance/Building Use

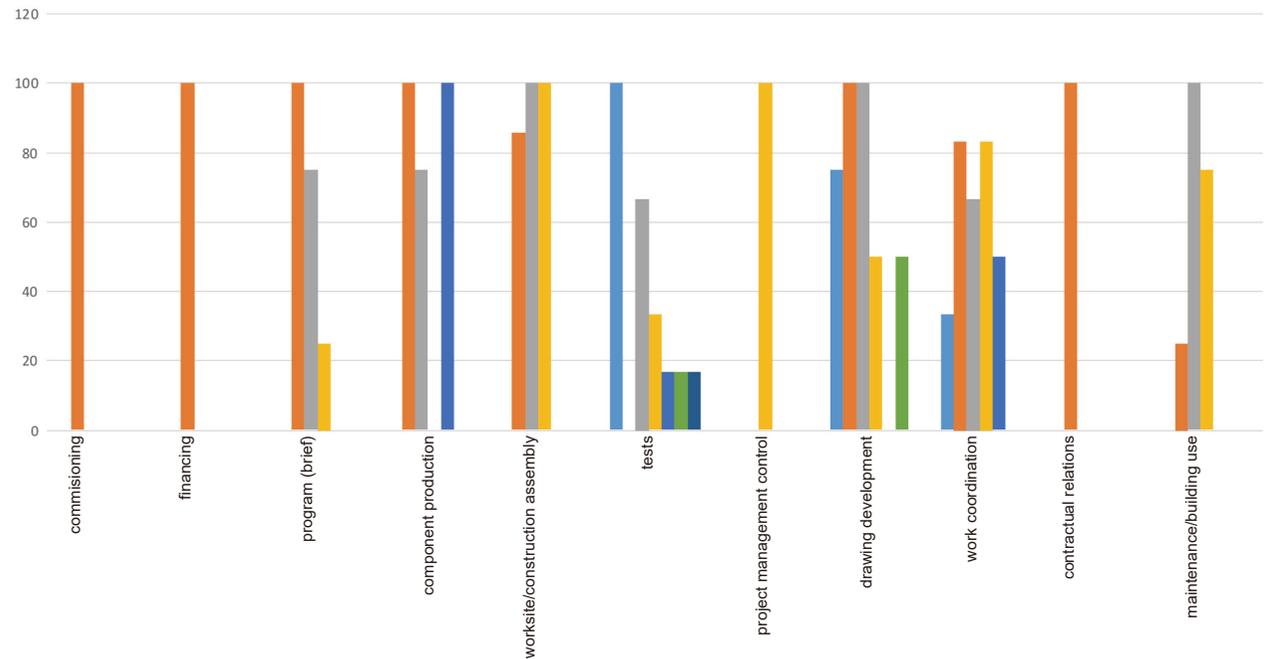
Because of lacking of information about "process" of Rome Auditorium. There is only analysis of Ningbo Museum in term of "process" part.



Decision maker and innovation results

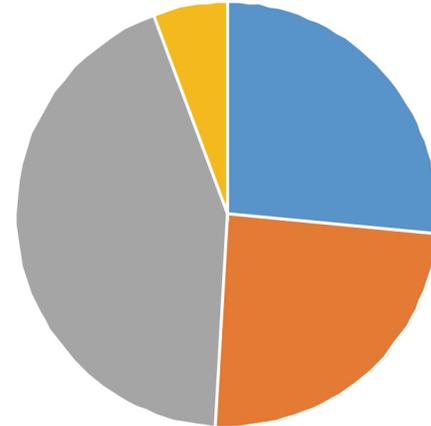
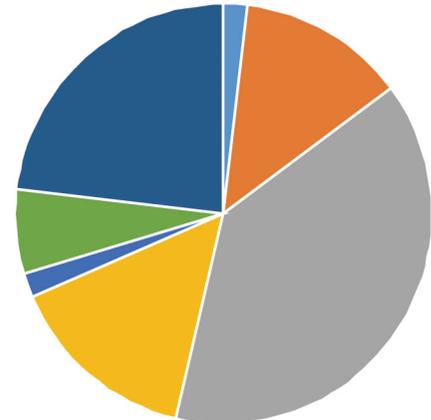
Case study A1

In "process" part of analysis of Ningbo Museum, in term of decision maker, client and designer together playing important roles and have more or less the same importance. Builder involved in building elements control, users and institution involved only in few specific aspects, industry have the least influence on architecture characteristics.



Decision maker and innovation results

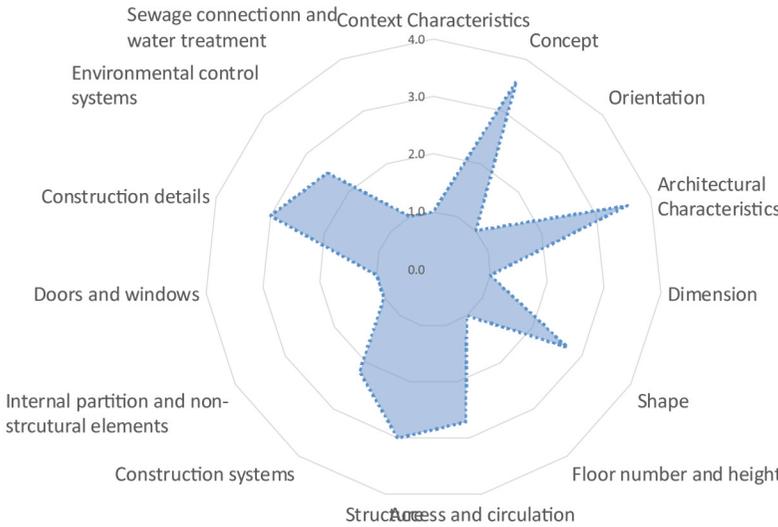
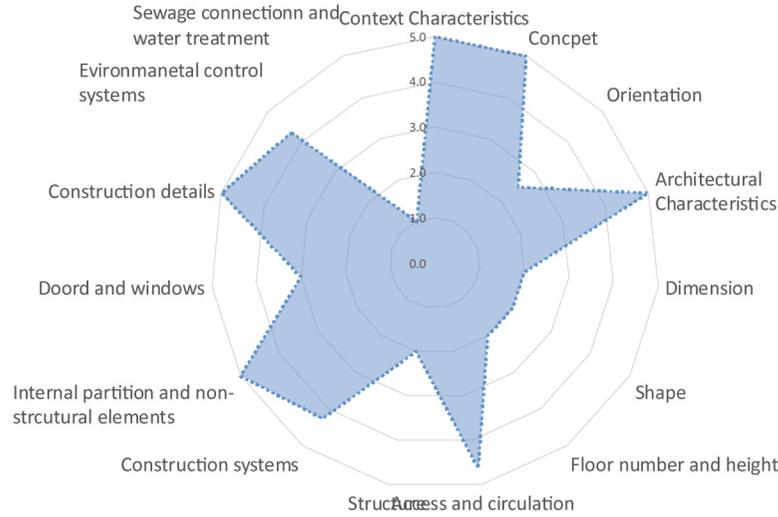
Case study B1-B2



- Institutions
- Client
- Designer
- Builder
- Industry
- Users
- Other

Decision makers during the "building" part.

- Issue taking into account:
- Context characteristics
 - Concept
 - Orientation
 - Architectural Characteristics
 - Dimension
 - Shape
 - Floor number and height
 - Access and circulation
 - Structure
 - Construction systems
 - Internal partition and non-structural elements
 - Doors and windows
 - Construction details
 - Environmental control systems



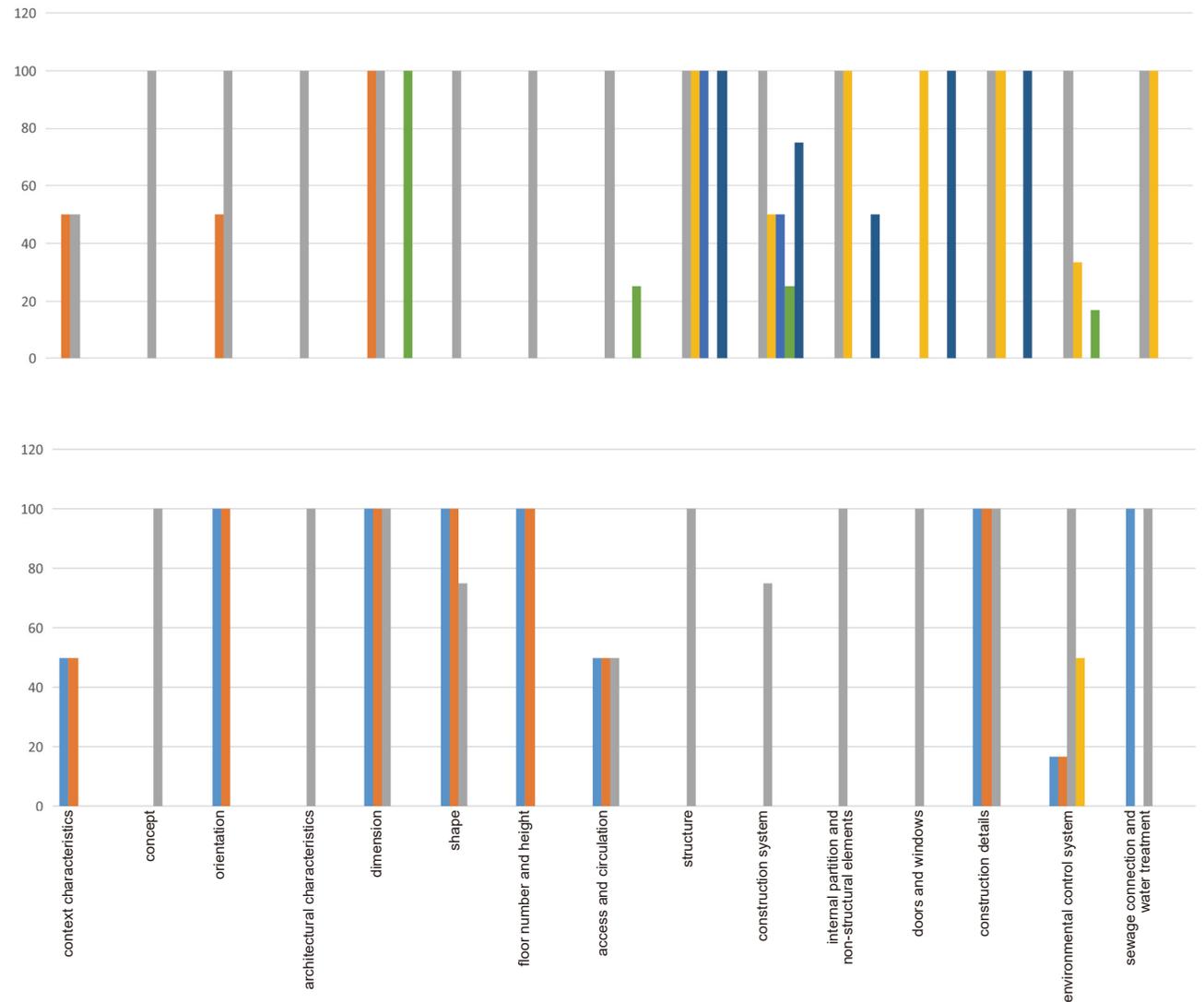
Decision maker and innovation results

Case study B1-B2

In terms of self-support building projects, decision maker become more simple than national big projects. Especially in Asilo project, there are only four group taking part in the decision making. Architects of two project plays a more equivalent role, while in Wattle School because of the special material the designer choose, builders and other group involved more in decision making.

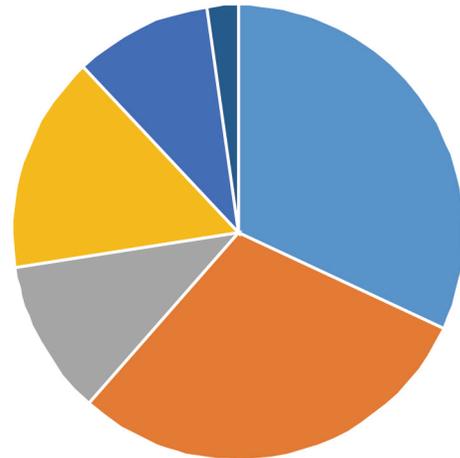
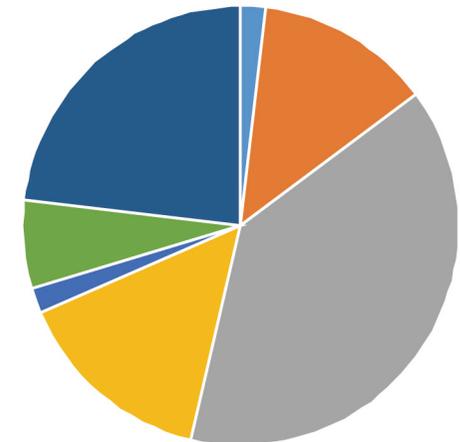
Architects or professions are more free during the designing process. For example, in Wattle School project, designer plays an important role through the whole process. Comparing to the Italian Asilo project, less institution and client involved in the building design, more builder and indstry effect on construction part.

In such kind of projects, innovation graphs are similar comparing two projects. One of the reason can be less support for innovation research. For Chinese architects, although they get more control ability in self-support projects, the number of architect who has this opportunity to run a building project is quite small. More encouragemental policy from government is still highly needed.



Decision maker and innovation results

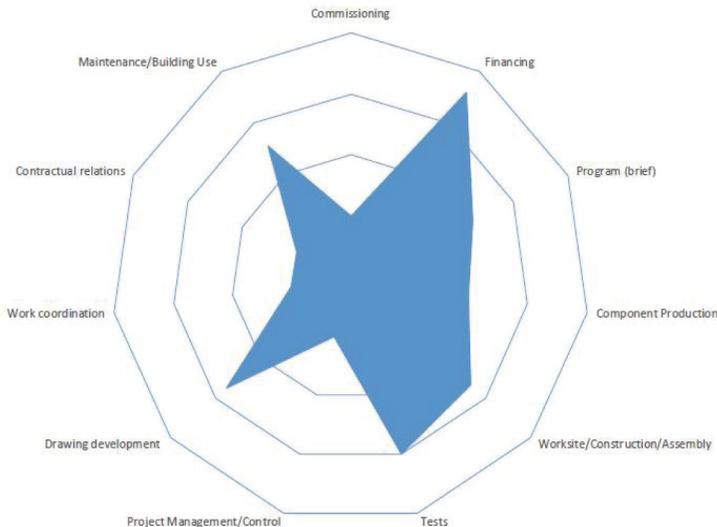
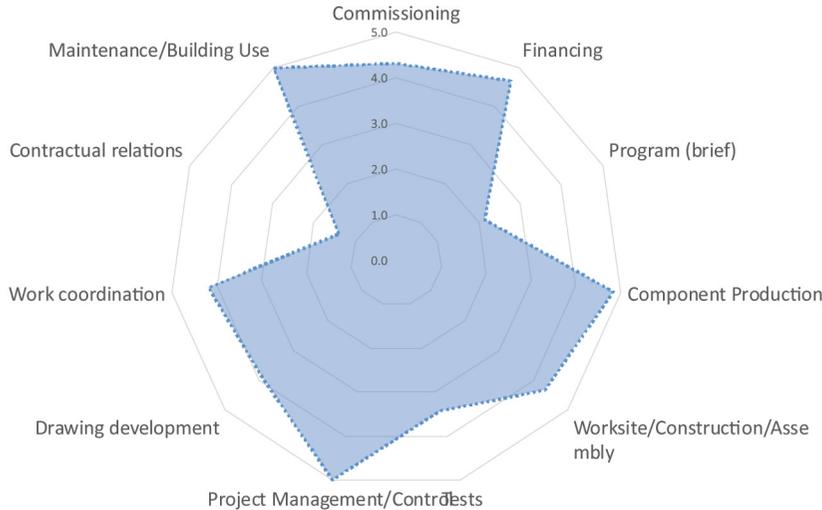
Case study B1-B2



- Institutions
- Client
- Designer
- Builder
- Industry
- Users
- Other

Decision makers during the "process" part.

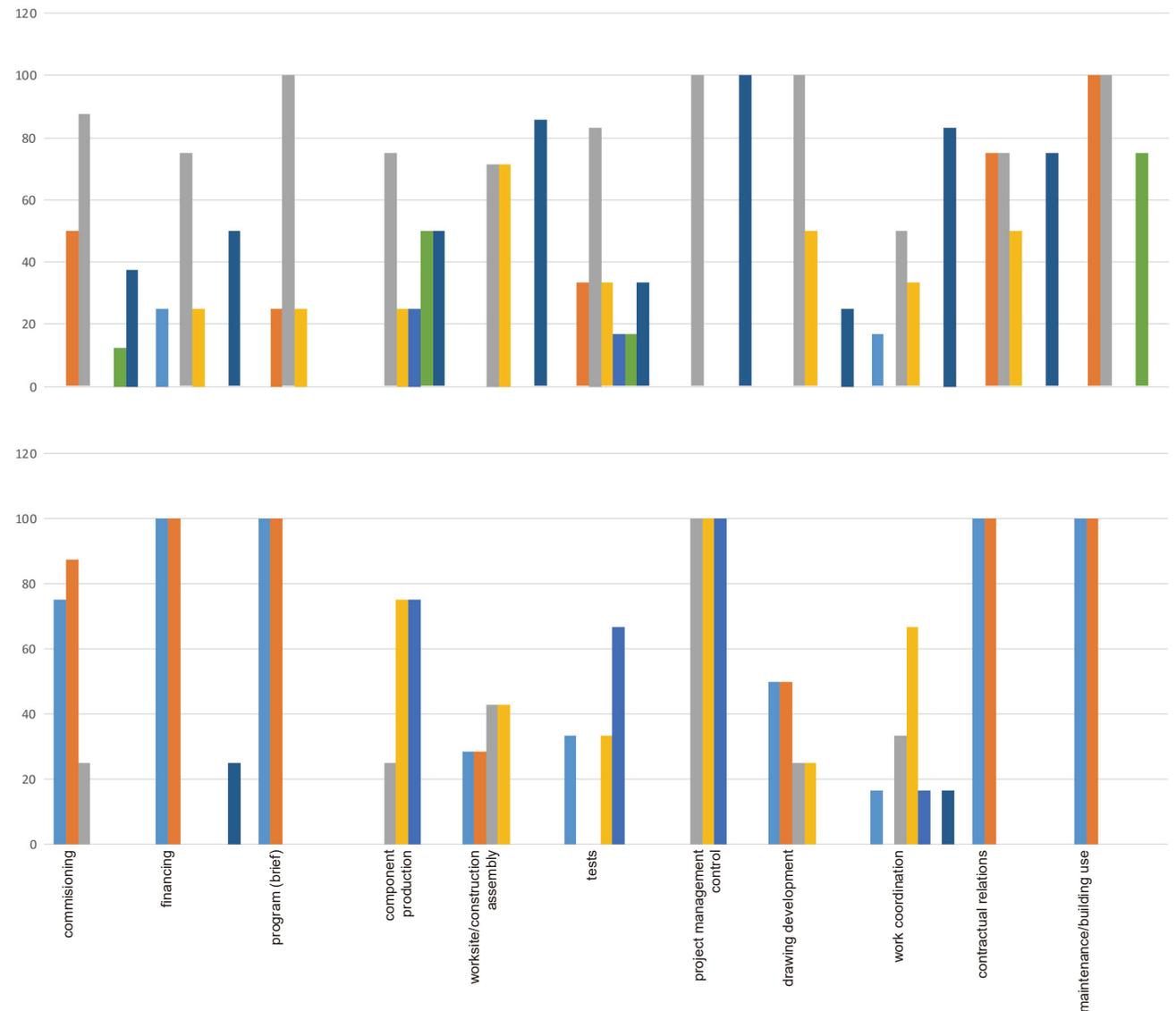
- Issue taking into account:
- Commissioning
 - Financing
 - Program (brief)
 - Component Production
 - Worksite/Construction/Assembly
 - Tests
 - Project Management/Control
 - Work coordination
 - Contractual relations
 - Maintenance/Building Use



Decision maker and innovation results

Case study B1-B2

Comparing the different decision makers during the "process" of self supported projects, architect of China gets a first time higher control ability than Italian project. Architect in B1 project involved almost all parts of process from commissioning, financing, program to contractual relations even maintenance and building use after construction phase. Decision maker of Wattle School during "process" is much complicated than Asilo project, which can be explained that more other group of people taking part into the decision making. For example financing of Wattle School, because of the special type of collecting money, some institution such as donation institute involved in financing control to ensure the specific use of fund. It is a common issue that self-supported projects is more "free" than national promoted projects in terms of management. Thus it is more easy to have innovation and on the other hand it also need to be more supervised.



Conclusion

What can be improved during building process under current situation of China?

What can architects do in order to better adapt and foster building sustainability under the new building activity situation ?

To summarize the discussion of the case study comparison, there are two main aspects to optimize the building process environment in China to better achieve the goal of sustainability.

(1) Reform management model

The management model is mainly composed of three management elements, which are the management concept, management technology and management system. Reforming the management model of construction enterprises is to reform these three management elements of construction enterprises.

With the reform of management concepts, China has established a socialist market economic system. The business management and management concepts under the market system are different from the traditional systems in the past. In the past, the enterprise was to complete the planning tasks assigned by the superiors, pursue the output value, and be characterized by administrative order management. Now it is the concept of profit, the management of the enterprise. In pursuit of profitability, it is characterized by scientific decision-making management and the pursuit of innovation and development. The business concept is crucial to the survival and development of an enterprise. Only when the business concept is transformed and the requirements of the new economic form are met can the enterprise continue to grow and develop. The reform of the management system, the establishment of a flexible productivity, rigid industrial structure and close to the market and other characteristics and scientific and rational organizational system, so that China's construction industry's productivity organization is in line with its own rules of activity. Specifically, it includes: the separation of the construction management and operation functions of the general contractor, and the flexibility of the employment system; the head office

can operate across regions and can directly sign contract with the owner. The specialized labor service company under the head office cannot flow, and can only subcontract the construction work tasks from the general contractor; the organization of the head office should meet the requirements of the market, and the rights should be appropriately decentralized to the project department to establish a flexible organization that combines centralization and decentralization.

Management technology reforms, using advanced, scientific and quantitative management techniques. For example, the use of network planning technology to prepare the construction project schedule, to facilitate project management, to ensure the progress of the construction period; the use of data statistics technology to the project's capital utilization, the maximum degree of benefit is divided to save control costs; establish performance evaluation indicators The system to know whether the project has achieved the expected goals, how to gain, how to have gaps, sum up the rules, accumulate experience, determine the rewards, and draw lessons for future work.

(2) Improve the quality of personnel

Although China's construction industry is still a labor-intensive enterprise today, the improvement of personnel quality is a crucial task. The personnel of the construction enterprise management department must be professionalized as the standard, and must have the professional knowledge and network technology application ability, and must be professionally trained before they can be employed. The management personnel should have the ability to carry out the progress and quality control of the contracted projects according to the overall objectives of the project, so as to ensure the duration and quality of the project.

Based on the current low level of skill of first-line operators, construction

companies can set up a special personnel quality training department to conduct skills and safety work training for front-line operations, and implement effective performance management strategies in grassroots management to work. Efficiency and quality are rewarded and punished as standards, prompting grassroots operators to consciously improve their business quality

The construction market in Western countries is basically saturated, and in addition to the renovation of old buildings, there is a relatively lack of architectural design projects. In addition, along the opening-up of Chinese society, more and more building project designed by foreign architects arise. For a foreigner, adapting to the working environment in China is challenging. There is a interview of Nicola who designed the Museum of Ancient Chinese Oracles of Anyang.

"The difference between countries is very big. First of all, due to the speed of the project process, your deadline is very short. It is always very difficult to deal with this problem. The relationship difference between architects and customers is also very big. Usually, in Europe, architects and clients communicate and communicate, and clients give architects plenty of room to make decisions for the project. However, in China, in most cases, customers always want to control the overall situation, so this kind of strong interpersonal Relationships are difficult to deal with. This situation is also very challenging. Interestingly, there are different situations. When customers have enough budget, they will let you do the project well and invest heavily in the project. The situation is not sustainable."

Foreign architects' involvement in the building activity would be a

situation more and more normal in the future of China, which will be both opportunity and challenge for Chinese architectural field. While increasing working competition among Chinese architects, it stimulates a more rapid and innovative development of local architecture development.

The addition of fresh blood has brought more advanced technologies and innovative ideas to China. To achieve the goal of sustainability, choosing optimal building material as saving resources is necessary, but rather, how to manage the building process is also a crucial problem to foster sustainability. The exploration is continue, architects are always on the way.

References

D. A. Turin (2003) *Building as a process*,
Building Research & Information, 31:2, P 180-187, DOI: 10.1080/09613210302002

Marianna Nigra & Branka Dimitrijevic (2018)
Is radical innovation in architecture crucial to sustainability? Lessons from three Scottish contemporary buildings,
Architectural Engineering and Design Management, DOI:10.1080/17452007.2018.1465392

Henderson, Rebecca M.; Clark, Kim B. (1990)
Architectural Innovaton: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms,
Administrative Science Quarterly; P 9

Case study References A1 Ningbo Museum

Hu Jun, (2014) Co-creation - Sidelights of the Construction of ningbo Museum.

强凌波 . (2014). 关于王澍建筑作品的艺匠·意境研究 . (Doctoral dissertation, 西安建筑科技大学). P 58-64

钱诗磊 . (2013). 王澍建筑的语言艺术研究 . (Doctoral dissertation, 扬州大学).. P13-14

俞禹滨 . (2012). 竹、木、砖、瓦：当代建筑中乡土材料的运用 —— 以王澍作品为例 . (Doctoral dissertation, 南昌大学).

Zhu Xuechen, Zhang Ting (2008). *Architecture Creation Based on Function and Space Experience - Design Course of Ningbo Museum*.

宁波历史博物馆 —— 王澍建筑

(<http://leonfoto.blog.163.com/album/?1312272932380#m=1&aid=227115446&p=4>)

四月里 . 王澍建筑与宁沪杭现代建筑之旅 (佳能 G1 X)

(<http://www.youkewangluo.cn/article/mb2387983564>)

Material Masters: The Traditional Tiles of Wang Shu & Lu Wenyu

(<http://www.archdaily.com/638948/material-masters-amateur-architecture-studio-s-work-with-tile>)

Contemporary Architecture in China, Part 2: What Works

(http://www.architectmagazine.com/technology/contemporary-architecture-in-china-part-2-what-works_o)

Detail inspiration

(<http://www.detail-online.com/inspiration/historical-museum-in-ningbo-103492.html>)

Museum Ningbo Wikipedia

(<https://zh.wikipedia.org/wiki/%E5%AE%81%E6%B3%A2%E5%8D%9A%E7%89%A9%E9%A6%86>)

Current Work: Wang Shu, Amateur Architecture Studio

(<https://www.youtube.com/watch?v=-BR1sSRv9Vw>)

Ningbo Museum / Best in Heritage

(<https://www.youtube.com/watch?v=OZHglB5jc28>)

Amateur Architecture Studio

(<http://www.chinese-architects.com/zh/amateur>)

Ningbo Museum
(<http://www.nbmuseum.cn/>)

A2 Auditorium Parco della Musica

Renzo Piano Workshop (2004), *Auditorium Parco della musica*, a cura di Maria Alessandra Segantini ARCHIDIAP, Auditorium Parco della Musica

Renzo Piano Building Workshop
(<http://www.archidiap.com/opera/auditorium-parco-della-musica/>)

Musica per Roma Fondazione
(https://www.auditorium.com/la_storia.html)

Renzo Piano Building Workshop
(<http://www.rpbw.com/>)

B1 Wattle School

Lixiaodong Atelier
(<http://www.lixiaodong.net/indax.html>)

360 文库 201409 期篱苑书屋李晓东工作室
(http://www.360doc.com/content/14/1013/16/15828005_416584964.shtml)

篱苑书屋 (LiYuan Library) 解析篇 - 李晓东 (Li Xiaodong Atelier) - 建筑设计案例分析 - 树状模式

(<http://www.treemode.com/case/selected/189.html>)

李晓东 . 篱苑书屋 , 北京 , 中国 [J]. 世界建筑 , 2011(11):108-113.

李晓东 . 乡野清境 北京篱苑书屋 [J]. 室内设计与装修 , 2012(7):104-108.

杨晓 . 以自然的名义 —— 篱苑书屋 [J]. 节能与环保 , 2012(10):64-65.

凯特 • 古德温 , 路培 . 李晓东工作室 [J]. 世界建筑 , 2014(9):30-32.

佚名 . 篱苑书屋 : 京城最美图书馆 [J]. 城市住宅 , 2012(7):19-19.

B2 Asilo Guastalla

Bassa Reggiana Attachments, "Project Report"

Asilo structure (<http://www.architetto.info/news/progettazione/asilo-nido-di-mario-cucinella-a-guastalla-le-strutture/>)

Zup Design (<http://www.zup.it/works/asilo-guastalla>)

Kindergarten in Guastalla / Mario Cucinella Architects

(<https://www.archdaily.com/775276/nido-dinfanzia-a-guastalla-mario-cucinella-architects>)

Video: ASILO GUASTALLA RUBNER HOLZBAU

(<https://www.youtube.com/watch?v=q7mlQTR17pw>)



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WEI JIALIN

wjl303727956@gmail.com

+39 39218047121