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The sustainability of preservation. Integration of survey and documentation processes with technologies for the conservation of 20th century architectures in Brazil and India

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Candidate

Luca, ROSSATO

(UniFe Matr. N. 039235)

Supervisor DA / POLIS

Prof. Marcello, BALZANI

Supervisor DA / POLIS

Prof. Artan, FUGA

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The sustainability of preservation.

Integration of survey and documentation processes with technologies for the conservation of 20th century architectures in Brazil and India.

PhD Candidate Luca Rossato

Department of Architecture, University of Ferrara

The research has been developed under the supervision of prof. Marcello Balzani (DA Supervisor)
International Referees for the research path evaluation selected by the Academic Board have been Prof. Wilson Flório (Mackenzie University, São Paulo, Brazil) and Prof. Kulbushan Jain (CEPT University, Ahmedabad, India).

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rslicu@unife.it

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Io sottoscritto Dott. (Cognome e Nome)
Rossato Luca

Nato a:
Ferrara

Provincia:
Ferrara

Il giorno:
17/04/1979

Avendo frequentato il Dottorato di Ricerca in:
International Doctorate in Architecture and Urban Planning (IDAUP)

Ciclo di Dottorato
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Balzani Marcello

Settore Scientifico Disciplinare (S.S.D.)
ICAR/17

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Abstract

This research has begun from the concept that sustainability and heritage conservation cannot be considered anymore two separate issues: preserving our cultural heritage and meeting the needs of present generations without limiting those of future generations actually define social behaviours culturally and technologically similar in terms of models and principles.

For doing this the dissertation explores the current state of art of 20th century buildings both in Brazil and India and possible future challenges related to the preservation of design process and buildings by the use of contemporary methodologies and technologies.

The part of the research carried out on the implications of 20th century migration in relation to the spreading out of new architectural styles in India and Brazil, provided a useful framework for understanding and examining the cross-cultural adaptation and hybridization of modernist principles that took place in both the countries and their societies.

A short overview of modern architecture in Brazil and India was then provided with the main aim of offering to the reader basic notions about the two scenarios.

The main core of the research path can be basically split in two part: on one hand the evaluation of available tools, protocols and procedures, which make possible the use of equipment for modern heritage preservation and, on the other hand, the identification of more than 250 buildings both Brazilians and Indians of the modernist period, on the which to applied three different filters of selection.

Within this framework the research has identified 80 buildings for application of data sheet and representation techniques, 25 buildings for application of BIM approach and 3 for 3D laser scanner survey application.

At the end of the research study the results and future developments have been many and heterogeneous. First of all, maybe the most important, a methodology for the enhancement and preservation of the 20th century architectures in Brazil India has been set up and more than 250 buildings were catalogued and thanks to 3D integrated surveys and related output drawings the overall knowledge on some of them was greatly improved. For what concerns the impact of the research in both the countries, several awareness programmes (seminars and conferences) on stakeholders have been spreading out new technologies in heritage preservation field. Last but not least some indications (outputs of the cross checking process) for the preservation of modern buildings by integrated methodology and continuous maintenance have been conceived.

The challenge to preserve these architectures, symbol of human intelligence and technological progress, for the future generations is just at its beginning ...

Dissertation index

0	Summary of dissertation	
1	The research path	FIRST PART
1.0	Chapter abstract.....	11
1.1	State of the art.....	12
1.2	Individuation of research field.....	13
1.3	Objectives.....	16
1.4	Research methodology.....	17
1.5	Technology impact on heritage preservation and enhancement.....	18
1.6	Stakeholders (Municipalities, International Foundations, etc.....)	25
1.7	Innovative aspects of this research study.....	26
1.8	Expected results.....	26
2	Brazil and India, a sociocultural approach	SECOND PART
2.0	Chapter abstract.....	29
2.1	20th century architects migration flows.....	30
2.1.1	Transculturation phenomenon.....	32
2.2	Brazil and India: a common path.....	34
2.2.1	The fight for international visibility and for appropriate architecture.....	38
2.3	Issues related to innovative materials of modern architecture.....	39
3	Modern architecture in Brazil	
3.0	Chapter abstract.....	43
3.1	The pre-modern period.....	44
3.2	The Search for Modernity in Brazil.....	44
3.3	Modernism in architecture.....	46
3.4	The Schools and its masters.....	47
3.5	Main modern architectures in Brazil.....	51

4 Modern architecture in India

4.0	Chapter abstract.....	63
4.1	The pre-modern period.....	64
4.2	Early modern architecture in India.....	65
4.3	First generation of modern Architects.....	66
4.4	Second generation of modern architects.....	68
4.5	Main modern architectures in India.....	69

5 Evaluation of the topics to be applied

THIRD PART

5.0	Chapter abstract.....	75
5.1	Technologies for cultural heritage preservation and enhancement.....	76
5.2	Creating accessible databases and digital archives.....	78
5.3	BIM model as possible preservation tool.....	79
5.4	Spreading out non-invasive and low cost predicting technologies.....	80

6 Analyses and validation of operative tools

6.0	Chapter abstract.....	83
6.1	Application of integrated methodology for representation and survey.....	84
6.1.1	3D Advanced survey.....	84
6.1.2	3D modelling and prototyping.....	86
6.1.3	Surface diagnostic analyses.....	86
6.1.4	3D database.....	87
6.2	Technical information about equipment and tools of analysis.....	88
6.2.1	Software applied to this research.....	88
6.2.2	Equipment employed in this research.....	89

7 Identification of case studies in Brazil and India

FOURTH PART

7.0	Chapter abstract.....	95
7.1	Case studies: preliminary information.....	96
7.2	Filter 1: description and representation. Selection of 80 modern buildings.....	97
7.3	Filter 2: 3D analyses and representation. Selection of 25 buildings.....	121
7.4	Filter 3: 3D survey application. Selection of 3 buildings.....	141

8	Results	FIFTH PART
8.0	Chapter abstract.....	151
8.1	Application of topics on case studies: problems and new inputs.....	152
8.2	2D and 3D database on modern buildings.....	153
8.2.1	2D and BIM database.....	154
8.2.2	3D integrated surveys database.....	159
8.3	International Laboratory net for the conservation of Modern Architecture.....	180
8.4	Awareness programme towards the preservation of modern buildings.....	187
9	Conclusions and further opportunities	
9.0	Chapter abstract.....	191
9.1	Impact of the research.....	190
9.2	Adaptability of the research to other contexts.....	190
9.3	Future developments.....	191
9.3.1	Gautam Sarabhai.....	192
9.3.2	The B.M. Institute for mental health, by Gautam Sarabhai, Ahmedabad, India.....	193
9.3.3	The project: toward an advanced management plan.....	198
	Libraries and research centres consulted.....	206
	Image credits.....	210
	References.....	214
	Acknowledgements.....	224

0 Summary of dissertation

This research began from the concept that sustainability and heritage conservation cannot be considered anymore two separate issues. The future has to deal with the available resources, a careful energy balance and the human environmental impact but it should also interact with preservation of heritage (both tangible and intangible) that is the base of the continuity of a critical development for humankind (the theoretical principles of the reversible restoration are just one of possible examples). Preserving our cultural heritage and meeting the needs of present generations without limiting those of future generations actually define social behaviours culturally and technologically similar in terms of models and principles. Due to its mainly bad state of conservation an overlapping area between sustainability and heritage conservation can be the twentieth century architecture. Currently these architectures are all over the world in danger and under attack: these buildings (in many cases designed by international renowned professionals) are facing a silent destruction process. This is in part due to the vision that modern architecture is not seen as an art to be restored and included in the cultural heritage scenario.

Despite the extensive adoption of modernist architecture in developing countries, standard history books focus on its development in Europe and USA. With the exception of the work of a very small number of acclaimed architects, little attention was devoted to modern architecture in developing countries which was considered merely lesser forms of European and north American modernism. The global research on modern architecture started few decades ago but it has already involved many historians, academics, curators, writers, archivist and journalist: people who were willing to improve their knowledge on this topic in order to better understand a miscellaneous phenomenon. In this wide research field the global exchange of architectural ideas and forms over the century is an important characteristic to be highlighted which came from the geographical movements and migrations of architects and engineers.

This research explores the current state of art of 20th century buildings both in Brazil and India and possible future challenges related to the preservation of design process and buildings by the use of contemporary methodologies and technologies (see the research path described in the FIRST PART, chapter 1). In my opinion the innovative aspects of this research has been the application of an integrated technological methodology probably never applied before for the enhancement and preservation of modern buildings in Brazil and India. Furthermore, very few authors (at least after a deep literacy review) have been correlating the modern architecture of the two countries analysing the similarities and the common path toward an own version of modernism strongly connected with local peculiarities. Nowadays many programs are trying to address the challenge of preservation of modern architectures: among these, the Getty Conservation Institute (Getty Foundation, Los Angeles) developed *Keeping It Modern*, a grant initiative that continues the deep commitment to the conservation of historic buildings. This research is also strongly related to the Getty's initiative taking advantage of grants awarded to, FAU

USP (São Paulo, Brazil) and Nirmala Bakubhai Foundation (Ahmedabad, India)¹. Thanks to international cooperation it has been possible to take advantage of the technological innovation in the field of cultural heritage preservation: technology is currently an important tool to support the commitments of conservators and researchers. These technologies need to be hybridized with the knowledge of architects and conservators and only a gentle process of adapting methods and experimental protocols may allow, in fact, the use of innovative techniques in this field. Sometimes these technologies are economically uncompetitive if transposed to cultural heritage preservation processes without the right methodology and proper use; thus this research is proposing an integrated methodology able to adapt itself to local context being, at the same time, flexible and inexpensive. The integration of survey and representation techniques applied on the modernist architecture can be very effective and could really improve the knowledge towards peculiar aspects of the architectural object. The interaction of different technologies allowed also to exploit the advantages of each, and even diminish the effect of the specific weaknesses.

The SECOND PART (chapters 2, 3 and 4) of the dissertation explores first of all the implications of 20th century migration in relation to the spreading out of new architectural styles in India and Brazil, providing a useful framework for understanding and examining the cross-cultural adaptation and hybridization of modernism principles that took place in both the countries and their societies. After that, a short overview of modern architecture in Brazil and India is provided with the main aim of offering to the reader basic notions about the two scenarios. Later, following the principle of integration (including multidisciplinary integration) of processes and tools for representation and preservation of modernist architectures, the research has started to select and analyse specific topics to be applied to the case studies (identified in the large and heterogeneous set of architectures built in Brazil and India during the period between the end of 20s to early 70s.).

The research path was then split in two: on one hand the evaluation of available tools, protocols and procedures, which make possible the use of equipment for modern heritage preservation (see the THIRD PART, chapters 5 and 6), and, on the other hand, the identification of more than 250 buildings both Brazilians and Indians of the modernist period, on which to apply three different filters of selection. Within this framework the research has identified 80 buildings for application of data sheet and representation techniques, 25 buildings for application of BIM approach and 3 for 3D laser scanner survey application (see the FOURTH PART, chapter 7).

The application of identified topics on selected buildings it has not been always easy. Sometimes only few sources have been available and this is one of the reasons why it has been decided to limit the first analyses at 80 buildings. On these the survey of the original project has been carried out through interpretative sketches and the very useful exercise of redrawing in order to understand not only the morphology but also the compositional process that led to their creation in a period so multifaceted for the

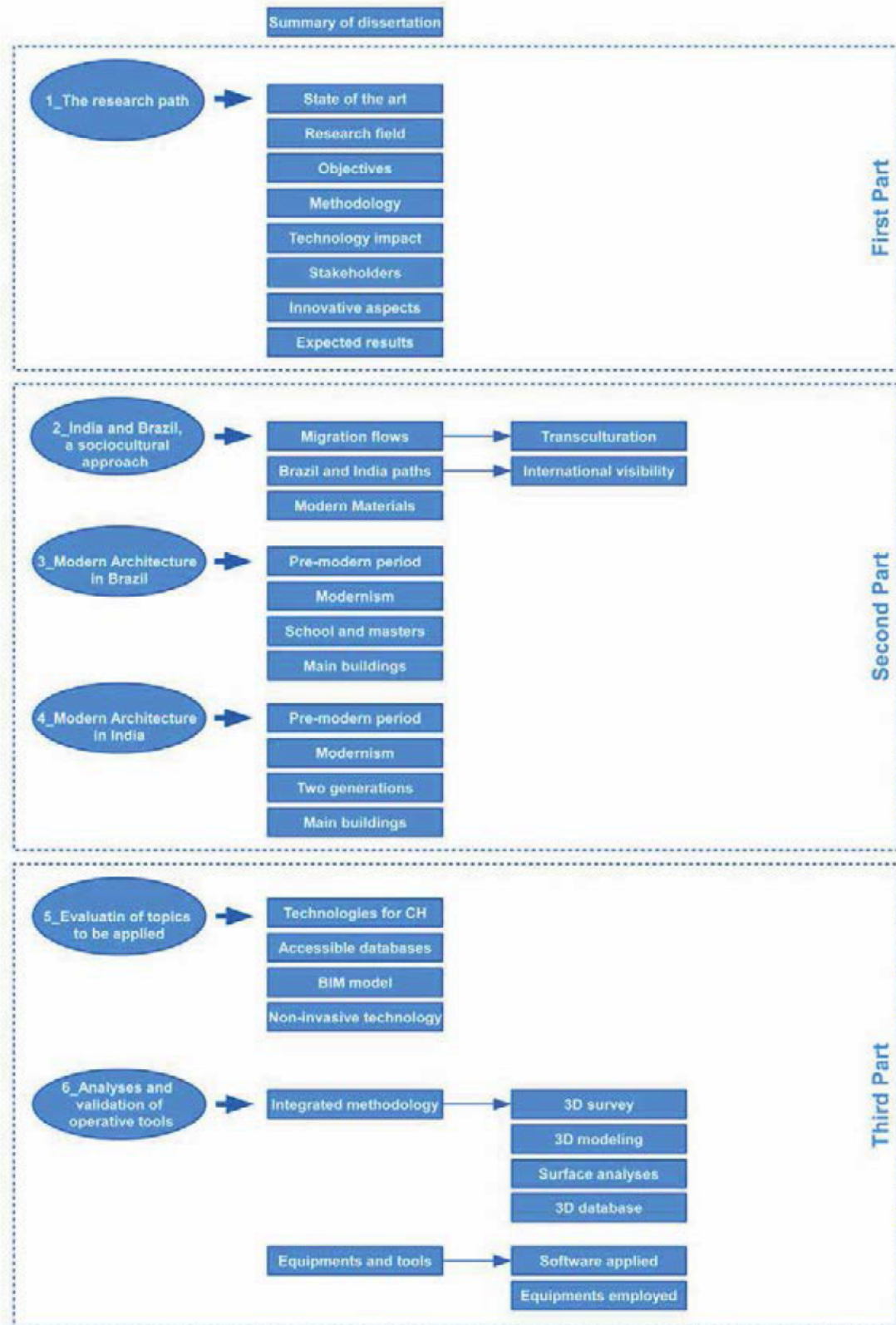
¹For more info, see: http://www.getty.edu/foundation/initiatives/current/keeping_it_modern/

history of the two countries and, perhaps because of this, so stimulating. The further selection of 25 buildings for BIM procedures application was applied only among the residential buildings of the database: this is because this typology allows a better application of 3D modelling topics and also because it is an important part of the history of modern architecture in Brazil and India. Finally, 3 buildings were used as case studies for a integrated three-dimensional surveys carried out in cooperation with local institutions and sponsored partially by equipment manufacturers. Only these 3 buildings were selected due to the high cost of a three-dimensional survey and the low available funds: on them, beside the obtained 3D database, the research has been able to also offer capacity-building programmes and technology transfer seminars working in collaboration with local partner institutions.

At the end of the research study the results and future developments have been many and heterogeneous and they are described in the FIFTH PART (chapter 8 and 9). First of all, maybe the most important, a methodology for the enhancement and preservation of the 20th century architectures in Brazil India has been set up and more than 250 buildings were catalogued and thanks to 3D integrated surveys and related output drawings the overall knowledge on some of them was greatly improved. For what concerns the impact of the research in both the countries, several awareness programmes (seminars and conferences) on stakeholders have been improving the spreading out of new technologies in heritage field. In some case as for the University of Sao Paulo this has led to the creation of a laboratory net between Italy and Brazil able to autonomously develop local methodologies for the modern buildings preservation. Last but not least some indications for the preservation of modern buildings by integrated methodology and continuous maintenance have been conceived with local partners in order to reduce the need of important restoration works.

At the end of this dissertation it's possible to find information concerning the libraries and research centres consulted. Being part of an international al PhD programme, the research has been carried out taking advantage of several abroad periods, from 2013 to 2016. During this time I had the chance to spend abroad 8 months in order to collect information, consult references, meet experts and advisors in different countries; of course basically in Brazil and India, but also in research centres and Universities in USA, France and Albania. Furthermore some of the research steps were presented in international symposium (such as EUROMED 2016 in Cyprus, and in "Le vie dei Mercanti" in Capri, Naples, in 2015).

Few line about the references, as they are mainly split up in two section: in one hand a strong bibliographic base made up of volumes about the modernism in Europe, Brazil and India seen also from a sociological and cultural point of view. On the other hand many publications related to the use of technologies in cultural heritage with a special focus on technologies for preservation management and enhancement.



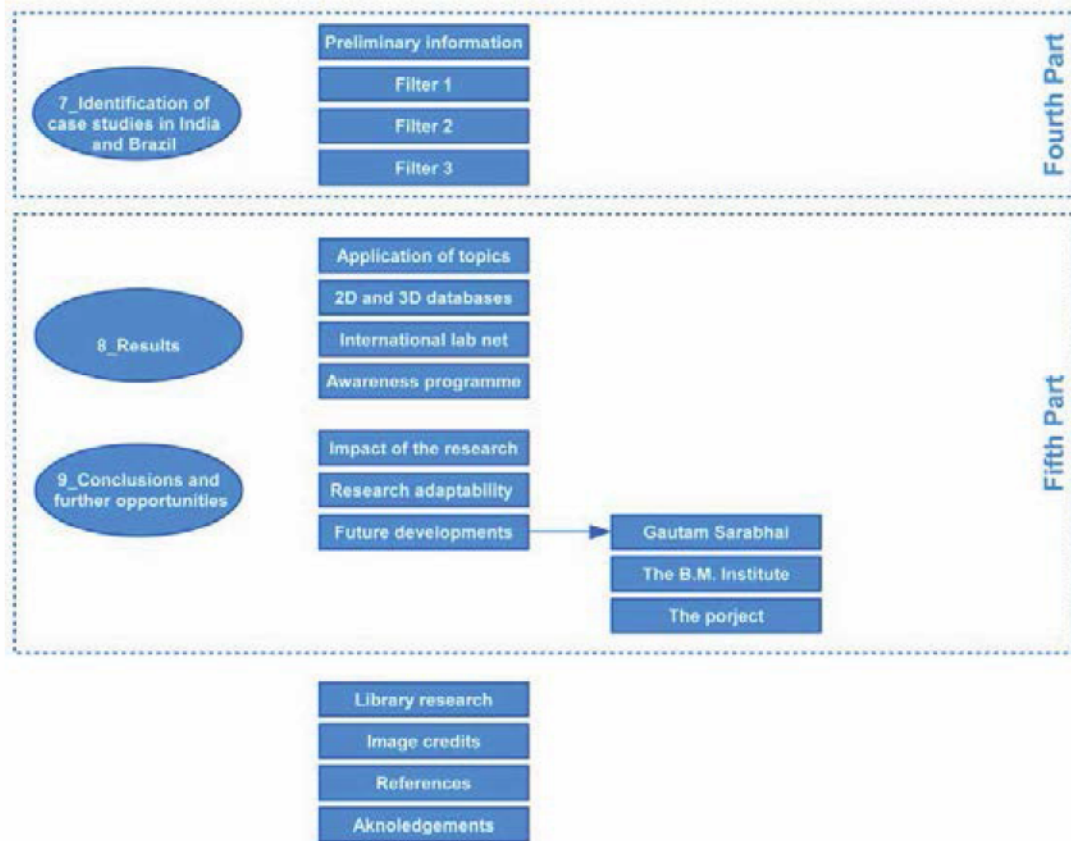


Figure 0: dissertation parts, chapters and main topics.

FIRST PART

CHAPTER 1

The research path

“Every discourse, even a poetic or oracular sentence,
carries with it a system of rules for producing analogous things
and thus an outline of methodology”.

Jacques Derrida

1.0 Chapter abstract

The first part of this research, based on the strong relation between the new modernism principle influence in Brazil and India and the anthropological effect on local societies and styles could help to better understand this tangible (and also intangible) heritage toward its preservation and enhancement. Beside this a careful study of modernism phenomenon has been carried out through literacy review and archive research which has identified hundreds of buildings built into the mainstream of ideas and concepts of the period. The preservation and valorisation are at the present actively linked: researchers are nowadays able to laser scanning a building, produce increasingly sophisticated computer models to aid their research in cultural heritage, and quick disseminate it across the world. Technologies are very often also young people attractor, which is crucial point in country such as the so called global south countries (former developing countries), where students are not always keen to study conservation disciplines at university. This research shows as data capture, virtual modelling for management study or for public display, non-invasive technologies and other techniques can assist researchers and professionals in heritage preservation field. The dissertation, soon after the research process, identifies the main topics of the research project that were lately evaluated and studied in order to create the bases for a structured research path. In parallel the case study assessment led to the identification several suitable buildings (both in Brazil and India). The chosen topics were then applied to the most suitable case studies in order to reach a methodological proposal.

1.1 State of the art

Modern architecture is one of the defining artistic forms of the 20th century. The outstanding achievements of modern movement all over the world have come to demonstrate the wide 20th century ideals of progress, technology, and openness.

Currently Modern architectures are all over the world in danger and under attack: these buildings (in many cases designed by both local and international renowned professionals) are facing a silent destruction. Daily they are slowly modified in terms of materials, volumes, colours or even demolished. These architectures are still used for public purposes or as residential buildings but they are usually in bad conditions and their state of materials conservation is quite poor. This is in part due to the vision that modern architecture did not qualify as art to be restored and included in the historically significant city. Furthermore modern buildings are at least as sensitive to apparently minor changes as those of earlier historic periods.

To preserve this massive built heritage it is essential to understand their history and fundamental design principles. If we really want to cure the buildings diseases, like doctors do, we should know the anamnesis of our patients, their background and causes of illness. The design of windows, for example, often is the most interesting part of their architectural characterization.

Modern buildings are, for their concepts, shapes, materials, perfect case studies to explore the integration of sustainable architecture and heritage conservation concepts. “The explosion of building technology starting in the late nineteenth century led to innovative building forms and construction materials that now pose new conservation challenges. This theme explored the approaches needed to advance the field in relation to environmental, technical, and physical conservation” (NORMANDIN, MACDONALD, 2013, pp. 3,4).

During the last decades local, national, and international organizations have been created in order to conserve modern heritage: among these Docomomo International, the Modern Heritage Committee of the Association for Preservation Technology (APT), the ICOMOS International Scientific Committee on Twentieth-Century Heritage, modern Asian Architecture Network.

This wide range of institutions / organizations demonstrates an interest toward the recent built architecture of 20th century. In this framework the work developed by Docomomo International since its establishment in 1988, has been hugely influential in creating a network of academics and professionals willing to preserve the Modern Cultural Heritage¹. The institution is still enhancing the practice of modern architecture preservation and simultaneously aims to conserve the legacy of modern architects by gathering architects, experts and critics related to the subject.

In the 1990s professional organizations such as APT and government heritage agencies in Europe and North America started to organize conferences and workshops and issue publications on technical issues

¹Source: *The History of Docomomo*, in DOCOMOMO JOURNAL, vol. 27 (June 2002), p. 10. - ISSN 1380-3204

and all these materials were the basis for a continuous development of an international practice supported also by ICOMOS International Scientific Committee on Twentieth-Century Heritage². Since 2000s, many other organizations have also been working in a variety of ways to improve the quality of knowledge in this area of conservation.

But, even if many efforts have led to a better preservation of some 20-century buildings, according to Susan Macdonald (currently head of Field Projects at the Getty Conservation Institute in Los Angeles, U.S.) “Considering twenty-five years of practice and all that has been achieved, it would be easy to surmise that modern heritage is well loved, cared for, and conserved. However, many important twentieth-century places remain unprotected. There is still little research addressing common technical problems impeding the repair of these buildings. With the termination of the Conservation of Modern Architecture course—a partnership of various Finnish institutions and ICCROM—there is no dedicated training on the subject at an international level, and there are only isolated opportunities at national levels (MACDONALD, 2013)”.

1.2 Individuation of research’ field

The individuation of Brazil and India as main research fields could be explain as a choice related to the search for excellence in extra European modern architecture.

As recently stated by the Italian sociologist Domenico De Masi, Brazil and India are currently the last two countries bringing a sort of humanism within their deep cultures. On the one hand Brazil is the land of the corporal humanism due to its image of “country of happiness”, where things are very often related to the human body, on the other hand India is the country of spiritual humanism, a place where souls and thoughts merge and spread out a sense of deep personal involvement in every visitor³.

Also the built architectures of this countries have always reflected this views, especially the ones from the twentieth century buildings designed by the great masters of modernist architecture in a period of incredible flow of ideas and concepts. For instance, in Brazil, modernism was a movement that involved artistic and cultural areas. The main modernist ideals arrived in Brazil from the first decade of the twentieth century, introduced by manifestos such as the Modern Art Week held in 1922 in São Paulo.

Modernism was a reflection of the cultural effervescence of the time: during the period the country went through industrialization and during a period of great patriotism, which led to the search for art - including the exploration of a national architecture, without being bound by European standards. The movement generated a new aesthetic phase that ended up integrating tendencies that were already appearing in a kind of hybridization of European architectural principle.

² See: ICOMOS International Scientific Committee on Twentieth-Century Heritage, *Madrid Document: Approaches for the Conservation of Twentieth-Century Architectural Heritage*, 2011. <http://icomos-isc20c.org/id13.html>.

³ See: D. De Masi, *Mappamundi*, Italy, Rizzoli, 2014

In Europe, due to problems generated by the social and economic changes during the Industrial Revolution, architectural modernism had found solutions inspired by such changes. In Brazil it has arisen without the need to solve social problems, since the modernist works appeared when the process of industrialization was still beginning.

In Brazil the field of architecture was influenced by foreign architects, adherents of the movement. Russian Gregori Warchavchik designed the "Modernist House" (1929-1930), a work that was marked as the first house in Modern style in São Paulo, however the style became known and accepted in Brazilian through projects by Oscar Niemeyer and Lúcio Costa.

When the modern movement spread in Brazil, recently graduated architects began to study works of foreign architects like the Germans Mies Van der Rohe and Walter Gropius, F. L. Wright⁴ but it was Franco-Swiss architect Le Corbusier who most had influence in the formation of Modernist thought in the Brazilian architects. His innovative ideas had a vast influence on the movement in Brazil, being a source of inspiration for the pioneers of Brazilian modern architecture.



Figure 1.1: Hybridization of European and US Modern Architecture in Brazil and India.

⁴For what concerns the US influence on Brazilian Modern Architecture see: D. FABBRI FORESTI, *Aspectos da arquitetura orgânica de Frank Lloyd Wright na arquitetura paulista: a obra de José Leite de Carvalho e Silva*. Dissertação de Mestrado - Universidade de São Paulo (USP). Escola de Engenharia de São Carlos São Carlos, 2008.

In India the modernism thoughts clearly emerged for the first time in 1922. One year before, in 1921, the Indian Poet Rabindranath Tagore had been visiting Weimar and the Bauhaus and was so impressed by the work of Walter Gropius at the school that decide to try to bring back to India a kind of atmosphere he felt there. For this reason a selection of Bauhaus works was shipped to Calcutta to be exhibited, in December 1922 at the fourteenth annual exhibition of the Society of Oriental Art⁵. The selections was made up of works by Wassily Kandinsky, Paul Klee, Johannes Itten, Georg Muche, Lyonel Feininger, Gerhardt Marcks, Lothar Schreyer, and Margit Tery; Furthermore many works by Indian cubist artists were exhibited at the same time.



Peter
Behrens
(1868–1940)



Adolf
Loos
(1870–1933)



Henry Hobson
Richardson
(1838–1886)



Louis
Henry Sullivan
(1856–1924)



Charles-Edouard
Jeanneret
(1887–1965)



Walter
Gropius
(1883–1969)



Ludwig
Mies van der Rohe
(1886–1969)



Frank
Lloyd Wright
(1867–1959)

Figure 1.2: Masters of XIX and 20th century modern architecture: European and North American schools.

By that year “Rabindranath himself appears to have moved away from the Orientalism of the Bengal School, and to be seeking a new direction for his art school at Shantiniketan. Even before the December exhibition, the sociologist Benoy Sarkar, exposed to modern start in Berlin and Paris, had initiated a

⁵ See: R. Bittner, K. Rhomberg. *The Bauhaus in Calcutta. An Encounter of the Cosmopolitan Avant-Garde*, Hatje Cantz Verlag, 2013

heated dispute in the Orientalist journal *Rupam* by urging India's artists to adopt the international avant-garde's 'aesthetics of autonomy' in accordance with their quest for political autonomy.

In fact much of the cultural debate is carried out in journals such as *Rupam*, *Modern Review*, *Prabasi*, and *Bharati Sarkar* and Kramrisc wrote approvingly of Gaganendranath's Cubist fantasies, and Kramrisc's careful critical evaluation of Sunayani's work is still relevant. If we admit the happy coincidence of 'the modernist moment' with the year 1922 in India as in Europe, it must be noted that it is not the influence of the Bauhaus, but the experiments of Gaganendranath and Sunayani, that initiate a modernist idiom" (BROOKER, GASIOREK, LONGWORTH, THACKER, 2010 p. 944) .

In architecture, beside the influence from western well known professionals the Indian building style was also stimulated by south American architects such as Oscar Niemeyer and Lucio Costa.

A double hybridization (from Europe-US and from South America) of modern principles put new fuel on the architecture debate in the country.

1.3 Objectives

This research could actually help towards the creation of a more aware study on modern architecture in Brazil and India, learning from an anthropological approach and applying the outputs toward the creation of a strong base also for conservation management plans able to guide long-term maintenance and preservation policies on specific buildings. A future publication of the study on the similarities (and diversities) between the socio-cultural relations in India and Brazil and the development of local modernism (and later of a more appropriate architecture) would be an innovative contribution in the field. The research main aim is to identify a suitable survey process in order to both develop restoration and conservation practices on twentieth century buildings.

By the selection of case studies (analysed within the research parameters) it would be possible to apply on them the research topics taking in account opportunities and local contexts, peculiarities and needs of building construction market. A limitation of this research may be the application of selected topics over different case studies.

We have to consider that a wide extension of limits will go further the possibilities (time and effort) of a PhD research and for this reason only one topic will be applied on the identified case studies.

Currently it is not possible to choose which topic will be the most suitable for the main aim of this project and only during the research process this will be clear.

In this wide framework some questions for research have been identified as follows:

- Can we state that the preservation of tangible and intangible heritage is a sustainable design operation?
- Could the research field may be the twentieth century architecture heritage?
- Do sustainability and conservation of modern heritage play a major role of mutual dependency?
- Which research topics could be applied to twentieth century architecture?

- Which could be the most suitable case studies?
- Is it possible to apply a methodology also to more recently built buildings?
- Is it possible priority list of buildings intervention?

1.4 Research Methodology

The research explores by deep study the history of modern architecture in Brazil and India and 3D and 2D technologies for the heritage conservation, highlighting the current state of art, opportunities, processes and possible future challenges.

The research themes are:

- Twentieth century architecture framework in India and Brazil
- Documentation processes and technologies

The Research process is based on the evaluation of:

- Architects migration flows and related transculturation phenomenon
- Materials of modern architectures in Brazil and India
- Digital archives and database use for heritage enhancement
- 3D modelling for documentation
- Non-invasive technologies

In selection process the main topics of the research project were evaluated and studied in order to create the bases for a structured research path. In parallel the case study assessment identified suitable buildings as possible case studies.

The main selection process steps were:

- Selection of case studies (250 buildings analysed)
- Selection of the most suitable topics to be applied on case studies

In application process the chosen topic were then applied to the most suitable case studies in order to reach a design proposals guidelines based on local context and environmental issues. The research main topics have been the following:

Data sheet and representation techniques (applied on 80 buildings out of 250)

- BIM approach (applied on 25 buildings out of 250)
- 3D laser scanner survey (applied on 3 buildings out of 250)

The cutting-edge building materials and structural systems that define the modern movement were often untested and have not always performed well over time. Heritage professionals do not always have enough scientific data on the nature and behaviour of these materials and systems to develop the necessary protocols for conservation treatment. This research could actually help towards the creation of local conservation management plans that could guide long-term maintenance and conservation policies and the testing and analysis of modern materials.

1.5 Technology impact on heritage preservation and enhancement

Even if the importance of protecting significant historic buildings from decay and destruction seems to be nowadays undeniable in some cases there is a different approach towards many important post-war buildings. These deserve to receive wider formal recognition but in many cases continue to be mistreated or even demolished⁶.

This study will examine through three case studies the philosophical and practical issues surrounding the conservation of Brazilian and Indian modern buildings and also the problems faced by building practitioners in dealing with buildings constructed in a wider range of styles and materials than at any other time. Climate change in particular has forced change in the way in which we think about buildings, with the pressures to address issues of energy efficiency becoming more urgent and likely to have consequences that may alter the perceived architectural and historic interest of modern and traditional buildings alike.

Actually, very often, Modern Movement Architecture is envisioned as a concept that deals with forms, spaces, techniques and social responsibility. Modern Movement is often mistakenly related to a style, perceived in a skin-deep point of view and superficially adopted as simple form, as a modern shape, when in fact Modern Movement has always shown great concern with such issues, seeking for efficiency and economy, i.e., an accurate use of materials, a design approach that incorporates intelligent saving resources in order to create a better world.

This concept is nowadays synthesized in the so called Sustainability, whose misuse might have lead sometimes to a trivialization of the word. That's why the identified theme to focus on is Modern Movement as the absolute primacy of the process over the style, looking for quality of life. The devices created to be efficient according to place and climate, the reflection made on building physics, the relation between heritage, energy and economy, are themes to be discussed both as Modern Movement concepts, on a documentation level, and as Modern Movement intervention nowadays, on a conservation level.

If time has slowly switched off the power of the transformer dreams of modernist architects, their buildings are a legacy of extraordinary value that should be protected and enhanced as it is a collection of

⁶ See: Kindred, B., Macdonald, S., Normandin, K., (2007). *Conservation of Modern Architecture*, London: Routledge.

real lessons of architecture. For this reason, the in-charge teachers of the course of Techniques of Architectural Representation a discipline of the second year of Architecture Curriculum at the Department of Architecture of the University of Ferrara, decided to analyse by different groups of students the heritage built in the vast and heterogeneous Indian and Brazilian contexts. For the third consecutive year through the works of the greatest architects of the period it is possible to browse an important slice of history of architecture, passing by the national identity search for specific local features, an architecture that is eclectic, hybridized, which addresses the theme of living, of dwelling, with a completely new and varied language of a different symbolism from that of the past, redesigned with poetry and sharpness.

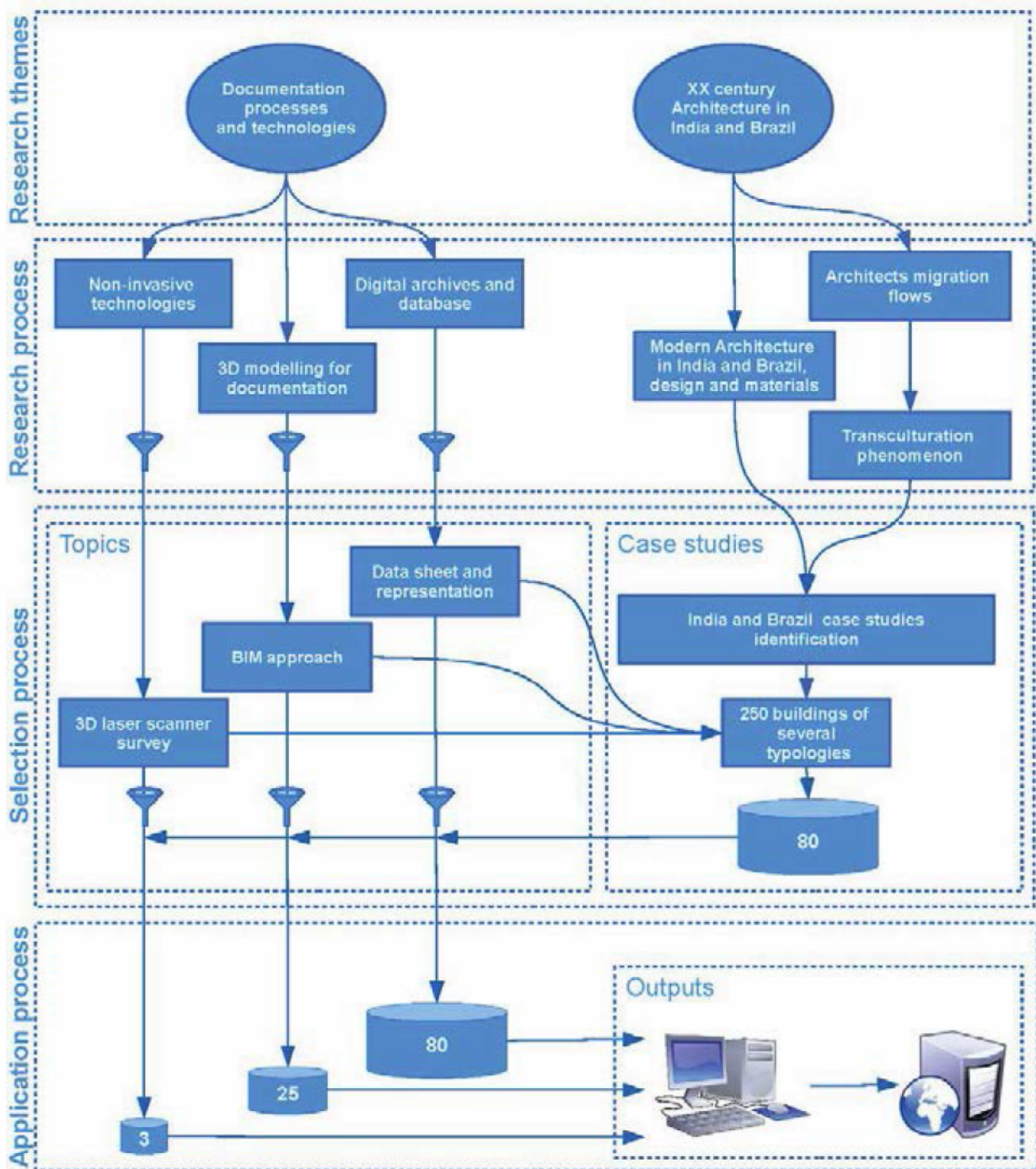


Figure 1.3: Main steps of research methodology.

The use of drawings in order to carry out analytical reviews of the archival heritage of 20th century architectures in India and Brazil can reveal design experiences that reflect the different territorial contexts from which they emerged and the cultural forces behind them. The so called “survey of the project” was

the adopted methodology: by analysing and redrawing the original documents using innovative graphic layouts the research can highlight the potentials of these built heritage.

The aspects taken into account in this phase describe the complexity of the study and the need of well-structured data. The process led to a very good understanding of the designer's work by the interpretation of original drawings, scheme and pictures, that reveal the design process behind the construction. The deep knowledge of the buildings, carefully selected and analysed with a precise methodology and representation techniques, had as outputs an exceptional variety of ideas for further research and reinterpretations.

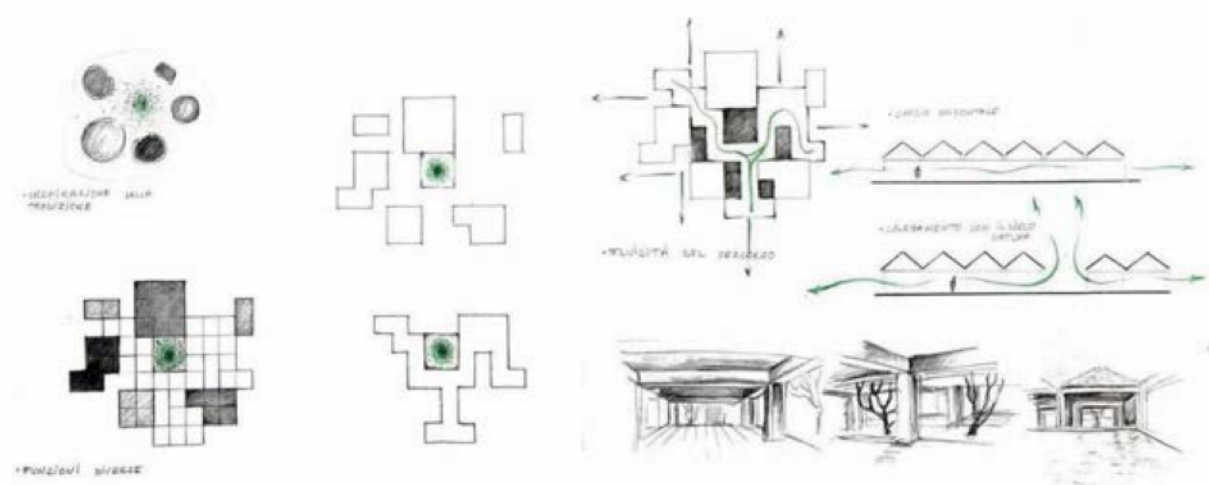


Figure 1.4: Redrawing and understanding modern architecture: Gandhi Ashram in Ahmedabad by Charles Correa.

For example the study of demolished modern buildings or the reconfiguration of different design hypothesis for the most important buildings of this period. The elaboration of digital models by Ferrara University Architecture Department staffs has gone through a careful planning and guided process in the field of BIM (Building Information Modelling), a virtual three-dimensional space in which each component can be called full-scale, integrating all information related to the geometry with details concerning the materials employed, the phases of realization, costs, technical characteristics, and by linking the building with environmental factors. In this framework, the Development of geometrical single-disciplinary Building Information Model (BIM) of the Ramkrishna House in Ahmedabad gave to research team basic shared knowledge of the data harvested from the documentation analysis and it will help to manage all information about the building.

The house, designed by Charles Correa, presents parallel walls which form the backbone of its plan, a structure divided into 4 main zones: living areas, guest rooms with private garden, service area and bedrooms on the upper floors.

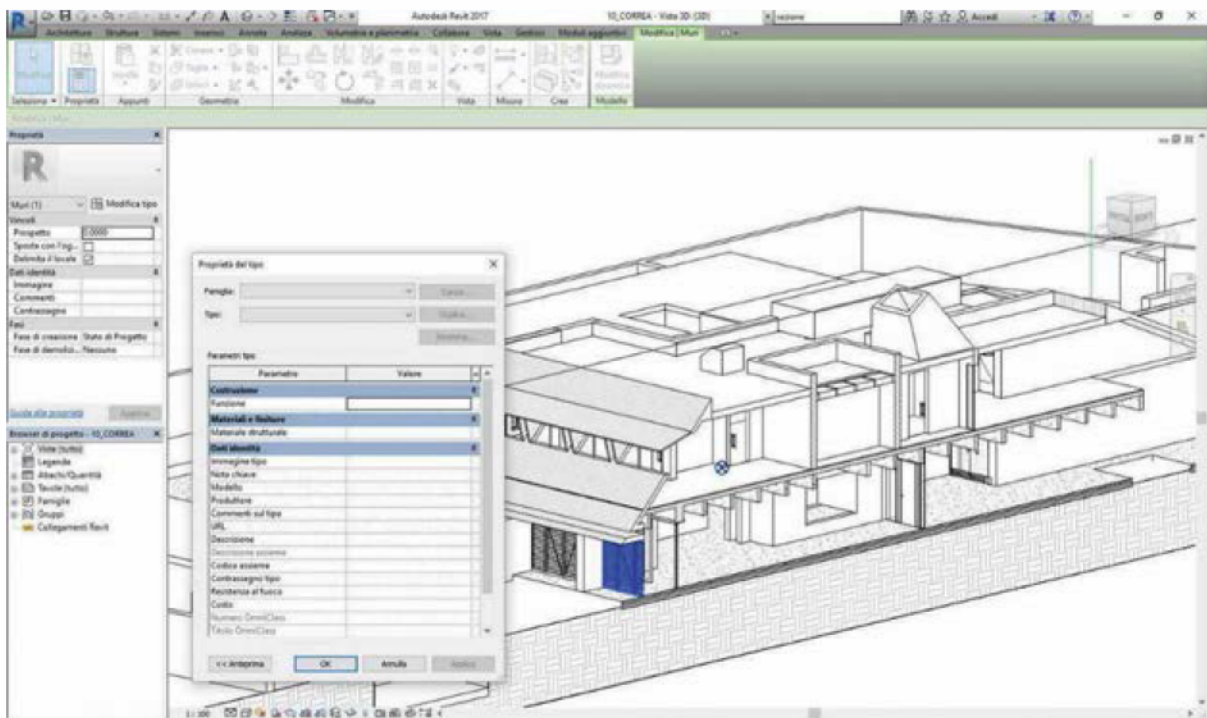


Figure 1.5: Ramkrishna House by Chalres Correa, Revit 2017®.

Built between the 1960 and 1962 the house explores the ideas related to dwelling issues in India in strong relation with climate challenges. The BIM model of this architecture has been created taking advantage of the documentation research on Charles Correa drawings⁷. The picture of the original construction were thus utilized in order to study the materials framework. Beside being a strong base for spatial research and study by this model was also possible to create a virtual reality (VR) model. Software as V-Ray use a proprietary stereoscopic rendering camera to generate a 3D environment with existing Revit cameras, lighting and materials. With this environment it was so possible to generate photo-realistic images of the Correa project to give to the public a sense of what the house look like by creating a VR “map” of a building inside and out.

The key passages of the BIM creation were focused on: acquisition of building data, integration of other sources of information able to describe the built heritage, definition of reference geometries for architectural components, development/detailing of the building as 3D digital reconstruction, and implementation of instruments for the exploitation of the model between valorisation and management.

The advantages associated to the approach proposed concern the flexibility of the instruments adopted, the quality of the results obtained in terms of precision and level of detail, and the possibility of

⁷ See: Frampton, K., 1997. *Charles Correa*, London: Thames & Hudson and Murray, I., 2013. *Charles Correa: India's Greatest Architect*, London: RIBA Publishing.

communication between the product developed and other solutions oriented on the exploitation of the building through the model.



Figure 1.6: Ramkrishna House in Ahmedabad, by Charles Correa: original pictures (left side) and photo-realistic views (right side).

The final output of this 3 years BIM research highlighted a strong synergy between building management and valorisation approaches through the workflow. Future perspectives of this scenario are related to the diffusion of accurate methods for the acquisition of building data and the development of 3D models. Building Information Modelling methodology is increasingly penetrating into building design. Currently laser scanning appears to be the ideal solution for data acquisition on existing buildings. It allows the quick and precise high definition capture of 3D data.

The challenge here is to create a parametric 3D BIM model from the precise depiction of the real world, in the form of a point cloud. For instance point snapping allows the precise remodelling of the point cloud regions with 3D BIM elements⁸. The great opportunity to document and survey one of the most significant architectures by modernism masters, should be developed in cooperation with local foundations and public bodies. The past experiences have shown how the 3D survey integrated methodology is able to reveal new aspects of buildings and to analyse spaces and surfaces by means of innovative methods that have allowed to track research paths completely unexplored and unpublished.

⁸ See: Tommasi, C., Achille, C., Fassi, F. (2016). From point cloud to bim: a modelling challenge in the cultural heritage field, *Proceedings of The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, Volume XLI-B5, 2016, XXIII ISPRS Congress, 12–19 July 2016, Prague: ISPRS

The three-dimensional survey has always been proved to be essential to represent areas that would be otherwise impossible to analyse, for example elevations surrounded by trees, and to find plan matches essential to understand the architectural “philosophy” on which the designers has based the realization of a project. In the representative phase there is a motivational value, which makes the survey-representation a real project itself, with significant critical implications aimed at the determination not only of geometric precision but, especially in architecture, of visualization and conceptual representation of reality. The limitations of the data and representation models pose the borders of each possible ambition. The 3D survey will be a strong base for future conservation projects and it will preserve the memory of these extraordinary buildings. Furthermore, the 3D laser scanner survey is consistent with the digitalization process that is being carried out by many Foundation Archives, one of the priority in order to create drawings archive for researchers and academics willing to explore the modernism research field.



Figure 1.7: Olivo Gomes House by Brazilian architect Rino Levi: 3D survey pilot project and first elaboration of external stairs from point cloud images.

The spreading out of such techniques may bring a wide and common evolution, influencing preservation and enhancement policies of cultural heritage currently adopted in India and Brazil with the optimization of management strategies and improvement of knowledge on modern heritage.

The approach aiming at the integration of traditional management tools and digital tools for enhancement take into deep consideration also the intangible aspects of heritage: traditions, cultural behaviours, and local believes are issues very often related to built cultural heritage, particularly in global south countries. As stated by Yehuda Kalay, Thomas Kvan, Janice Affleck in *New Heritage: New Media and Cultural*

Heritage “the complement of traditional methods to cultural heritage management has been augmented with the introduction of digital or new media. [...] Digital media can be utilized for much more than re-creation or re-presentation of physical entities. It has the capacity to become a tool to capture both the tangible and intangible essence of cultural heritage and the society that created or used the sites”. (KALAY, KVAN, AFFLECK, 2008, p. XV)⁹. Global south countries are often rich in cultural heritage resources and till now this led to the creation of the most attractive tourist destination in the world. Despite challenges and opportunities, the tourism pressure needs to be managed and very well calibrate to preserve the right balance between conservation and enhancement. Is it possible to enhance and at the same time to preserve the cultural heritage in these countries? As identified by J.T. Dallen (Dallen, 2009)¹⁰ one of the most frequent threat to cultural heritage sites (in global south countries) inscribed into the UNESCO World Heritage List is the lack of management and tourism planning. And this framework participatory processes and audits with involvement of Indian students and researchers can improve the knowledge of problems related to tourism pressure or lack of planning in high density residential areas such as Jodhpur old city.

Another issue relates to high number of restoration projects carried out by foreign professionals in these countries.

There is a strong need of multinational projects able to improve the capacity of local professionals in heritage preservation and management field. Learning-by-doing programmes able to take advantage of cooperation between world western and eastern institutions play a key role in heritage preservation in former developing countries¹¹.

1.6 Stakeholders

Modern architecture is one of the defining artistic forms of the 20th century. The crowning achievements of modern architecture, from Walter Gropius's Bauhaus buildings to Ludwig Mies van der Rohe's Seagram Building and Lucio Costa and Oscar Niemeyer's Brasilia have come to symbolize the broader 20th century ideals of progress, technology, and openness.

Heritage professionals do not always have enough scientific data on the nature and behavior of these materials and systems to develop the necessary protocols for conservation treatment. To address these challenges, the Getty Foundation in Los Angeles, USA, developed *Keeping It Modern*, a grant initiative

⁹ KALAY Y., KVAN T., AFFLECK J. (2008). *New Heritage: New Media and Cultural Heritage*, Routledge, New York.

¹⁰ DALLEN J.T. (2009). *Cultural Heritage and Tourism in the Developing World: A Regional Perspective*, Routledge, New York.

¹¹ See: KAPPAGODA A. (2002). *Conserving World Cultural Heritage Sites in Developing Countries: Sri Lanka, a Case Stud.* Kensington: University of New South Wales pres

that continues our deep commitment to the conservation of historic buildings. *Keeping It Modern* will support grant projects of outstanding architectural significance that promise to advance conservation practices. This research could actually help towards the creation of conservation management plans that guide long-term maintenance and conservation policies and the testing and material analysis.

1.7 Innovative aspects of this research study

This research has been conceived from the desire to fill the gap in the preservation and enhancement of modernist architectures of the twentieth century in Brazil and India. First of all, we have to say that in Brazil and India PhD theses related to the enhancement and record of modernist heritage have been growing by a considerable number in recent years. This is because the preservation of the modern is becoming (especially in South America where there seems to be greater awareness of the problem) a particularly contemporary topic and a real conservative emergency. So the real innovation of this research doesn't fit in this aspect but maybe in the fact that for the first time it has been proposed a relevant methodology as a basis not only for the preservation and enhancement of the buildings but also of the project and the ideas of the pioneers of modernism in the two Countries that in some cases could get lost in forgotten archives. It should also be stressed that only a very few authors (and in small compared tunes within their volumes) have attempted a comparison between the modern architecture of these two countries by searching and identifying a possible common path¹².

This research has aimed to define the two phenomena, looking for the socio-political aspects and common cultural roots toward what we define as a real hybridization of modernist concepts that came with so much strength from the European continent during the first years of twentieth century.

1.8 Expected results

The results of this research path have been:

- Database of more than 250 Modern Architecture buildings in India and Brazil;
- BIM models of 25 Modernism buildings in India and Brazil;
- 3D integrated surveys and related output drawings (3 pilot projects) on important modern buildings in Brazil and India;
- Awareness programmes (seminars and conferences) on stakeholders in order to improve the spreading out of new technologies in heritage field;
- Creation of a Laboratory net between Italy, Brazil and India, able to develop local methodologies for the modern buildings preservation and capacity building programmes.

¹² Among these the interesting work carried out by Lang, J.T., Desai, M. & Desai, M., 1997. *Architecture and independence: the search for identity: India 1880 to 1980*, Oxford: Oxford University Press.

SECOND PART

Chapter 2

Brazil and India, a sociocultural approach

“The Brazilian architecture is very different from that of Le Corbusier, it is an architecture that combines nature and the local climate. If the Brazilian architecture was influenced by Le Corbusier, we can also say that, in the last works, the master has suddenly abandoned the right angle following an architecture that came from Brazil with a lot of talent”.

Amédée Ozoeфанant

2.0 Chapter abstract

During this beginning of 21st century Europe is experiencing one of the most significant influxes of migrants and refugees in its history: hundreds of thousands of people have fled the Middle East and Africa, risking their lives along the way. Anthropologists are trying to identify the most relevant effects of this migration flow in our lives and traditions without clear results. Also the 20th century has seen a strong similar phenomenon: European people left their countries before, during and after the two World Wars looking for better opportunities in “new” worlds. Among them there were young architects and engineers willing to become successful professionals in more hospitable and inspiring places. This first part of the dissertation explores the implications of 20th century migration in relation to the spreading out of new architectural styles in India and Brazil, providing a useful framework for understanding and examining the cross-cultural adaptation and hybridization of modernism principles that took place in both the countries and their societies. Through the theories of Fernando Ortiz and Marina Waismann it might be possible to better understand the hybridization of modern concept with local culture in a sort of cultural adaptation which is at the base of the growth of modernism in Brazil and India and led these two countries to a common path in developing their own modernist principles.

2.1 20th century architects migration flows

The Twentieth Century saw advances in construction technology, from the first use of air conditioning in large buildings around 1900 to experimentation with very thin reinforced concrete shell from 1910. New building types were made necessary and available by advances in medicine, transport communication and industry. Radical changes in political systems and social structures and a corresponding growth in urbanization also determined the main preoccupation concerning architects from urban planning to social housing. In many regions vernacular buildings were modified by technological developments and in some cases by what was seen as a new international and global style. Trade flows and the colonies system made architecture a global enterprise where the most renown architects used to design buildings also for foreign clients in distant locations. As economic and political connections between countries have changed throughout the twentieth century so the patter of global architecture has changed.

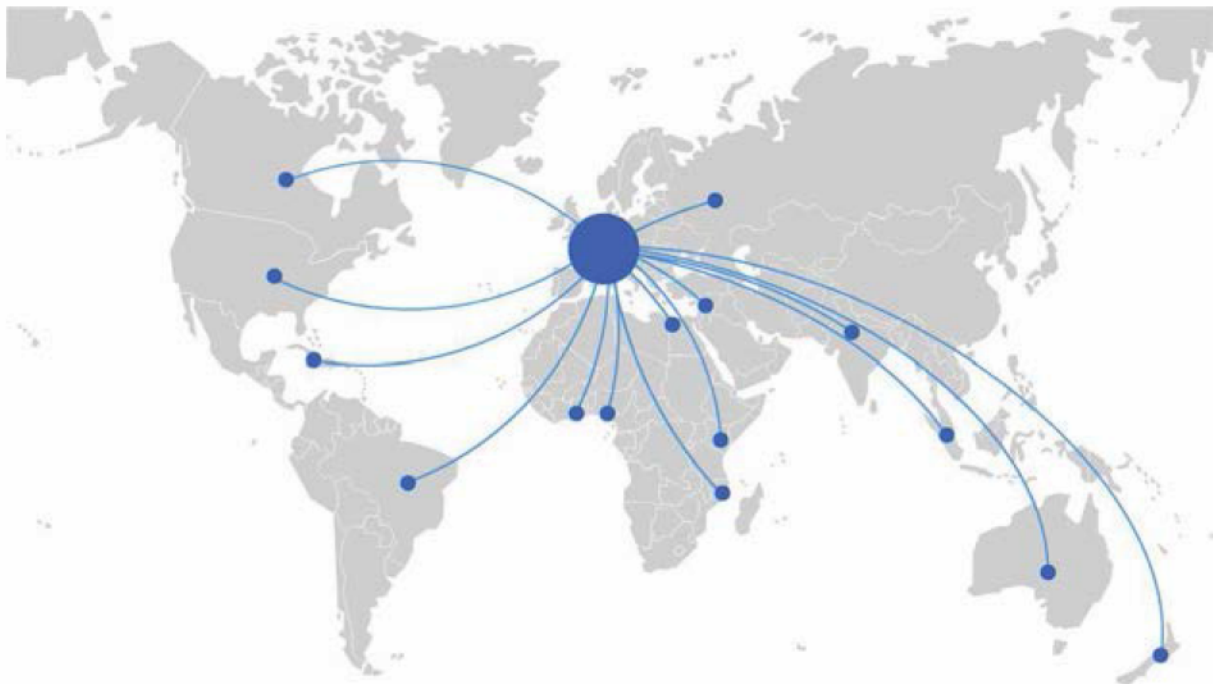


Figure 2.1: Migrating architects from Europe between 1900 and 1970 (source: Thomas H., *20th-century world architecture*, USA, Phaidon, 2012).

At the end on the XIX-Century a wave of economic globalization associated with colonial relations strengthen the link between European imperial centers and distant colonies across the globe. Most former European colonies in South America were independent countries but the whole Africa and part of Asia remained under the control of European imperial rule. The European construction methods and patterns

were replicated in a diversity of cultural, geographical and climatic contexts. Pattern of formal transfer were not always straightforward, with inventive combination of European and local influences¹.

In this change the movements and migration of architects to new homelands and workplace had an important role and a strong influences on local architecture cultures and form of architecture practice all over the world. The growing awareness of 20th century heritage has led to an appreciation of the production and consumption of modern architecture by the European émigré community. Preceding the two large post-wars migration flows the impact of European people on the cultural life of many countries was considerable. Amongst these emigres were architects who had studied modern architecture at University level in Europe, often with leading figures in the movement as their teachers, many abandoning promising careers and thriving practices due to the European socio-politic situation.

Marcel Breuer Ungary -> USA (1937)	Richard Neutra Austria -> USA (1933)
Antoni Bonet Spain -> Argentina (1938)	Eero Saarinen Finland -> USA (1923)
Max Cetto Germany -> USA (1938)	Clorindo Testa Italy -> Argentina (1923)
Walter Gropius Germany -> USA (1937)	Gregory Warchavchik Italy -> Brazil (1923)
Victor Gruen Germany -> USA (1938)	Laurie Baker UK -> India (1945)
Louis Kahn Estonia -> USA (1906)	Lina Bò Bardi Italy -> Brazil (1947)
Frederick Kiesler Austria -> USA (1926)	Fabrizio Carola Italy -> Mali (1970)
Leopold Krakuer Austria -> Palestine (1925)	Henry Klumb Germany -> Puerto Rico (1945)
Ernst May Germany -> Kenya 1933	Enrico Taglietti Italy -> Australia (1956)
Eric Mendelson Germany -> Palestine (1935)	Arturo Mezzedimi Italy -> Eritrea (1940)
Ludwig Mies van der Rohe Germany -> USA (1938)	Harry Seidler Austria -> Australia (1948)

Chart 2.1: Architects leaving Europe between 1906-1970 (source: Thomas H., *20th-century world architecture*, USA, Phaidon, 2012).

¹ See: Duanfang L., *Third world modernism: architecture, development and identity*, USA, Routledge, 2011

For what concerns this research the Ukrainian Gregory Warchavchik moved from Italy to Brazil in 1923 whilst the Italian Lina Bo Bardi migrated from Milan to Sao Paulo along with her husband Pietro Maria Bardi in 1947.

2.1.1 Transculturation phenomenon

Transformation / adaptation process on modernism buildings in Brazil and India could be defined as a kind of architectural transculturation phenomenon. The term transculturation has been coined by Cuban anthropologist Fernando Ortiz in 1947² to describe the transition process of merging and converging cultures. But transculturation encompasses more than transition from one culture to another; it does not consist merely of acquiring another culture (acculturation) or of losing or uprooting a previous culture (deculturation). Rather, it merges these concepts and additionally carries the idea of the consequent creation of new cultural phenomena (neoculturation). In this wide scenario the nationalist movements and newly independent colonies coincides with the modernist architectural thinking and the promotion of an international style. This, especially after the First World War was an approach that slowly and self-consciously signaled progress and deliberately broke links with the past. As the European colonies disbanded and new national identities were forged hybrid architectural approaches drew from multiple global influences emerged. Architects responded to the increasing challenges in different ways, some employed technological innovations, others got inspired from vernacular solutions to design regional interpretations of modern architecture principles.



Figure 2.2: From left to right, Brazil: indigenous vernacular architecture, XVIII century western inputs and modernism influence

² See: Ortiz, F., 2002. *Contrapunteo cubano del tabaco y el azúcar Letras His.*, Spain, Catedra.

The climate adaptation of construction technology was clear in many urban project in equatorial climates such as India and Brazil. *O interior da história* (The interior of history)³ was the second monographic books published by Marina Waisman. The Argentinian architect and critic faces in this publication complex and dangerous theme. The strategy to address them is fragmentary and progressive. It is in the second part of the book that Waisman discuss the problem of uncritical adoption of a historical periodization invented to characterize the European styles as processes with a beginning, a development and a decline phase. Latin Americans, have traditionally worked periodization of continent architecture history in connection with European settings. It seems that there was always a necessary dependence of these definitions of periods and durations.



Figure 2.3: From left to right, India: vernacular architecture, XIX century western inputs and modernism influence.

But Marina Waisman warns that the ideas and forms of architecture have not come to Brazil (and in India as well) as finished products, but in a process of transculturation ideas. European concepts were interpreted freely according to local circumstances. And the political, economic and other extra-architectural factors determined often the continuities and discontinuities.

According to Waisman it is undeniable that there was spread of ideas from Europe to America. But this was not a gradual transmission but sometimes both quick and slow, for sure uneven.

Writing about the cultural heritage of south America she stressed as “the symbiosis of such dissimilar elements, colonial and native, resulted, during three centuries under European domination, in an original architecture that, starting from European modes, adapted these to local conditions, techniques, material

³ See: Waisman, M., 2013. *O interior da história*, Brazil, Perspectiva.

site, scale, and so forth and, in certain periods like the eighteenth century, transformed their primary spatial meaning by way of the fantastic treatment of interior surfaces” (WAISMAN, 2000, p. 57). Hence, many of the categories drawn up in Europe eventually collide in the American or Asiatic environment.

Through the theories of Fernando Ortiz and Marina Waisman it might be possible to better understand the hybridization of modern concept with local culture: a cultural adaptation which is at the base of the growth of modernism in Brazil and India.

2.2 Brazil and India: a common path

A question could find an answer thanks to this research: have India and Brazil had similar paths?

In the early Twentieth century modernism was constructed in the context of the European Enlightenment specifically as a universal and transnational, style. It made its claims not as historically or locally defined architecture but rather as an ahistorical and foundational reading of the purpose of architecture. Due to this approach modernism’s ahistorical style made it ideal for adoption as expressive Architecture and aesthetic problems faded into the background.

1922 was for both the countries a crucial year. In Brazil it was held “The Modern Art Week” (or *Semana de Arte Moderna*, in Portuguese), an arts festival in São Paulo, which is commonly known as the beginning of Brazilian Modernism. Several Brazilian artists (that were developing modernist work before the week) defined the movement and introduced it to Brazilian.

It was organized by painter Emiliano Di Cavalcanti and poet Mário de Andrade.

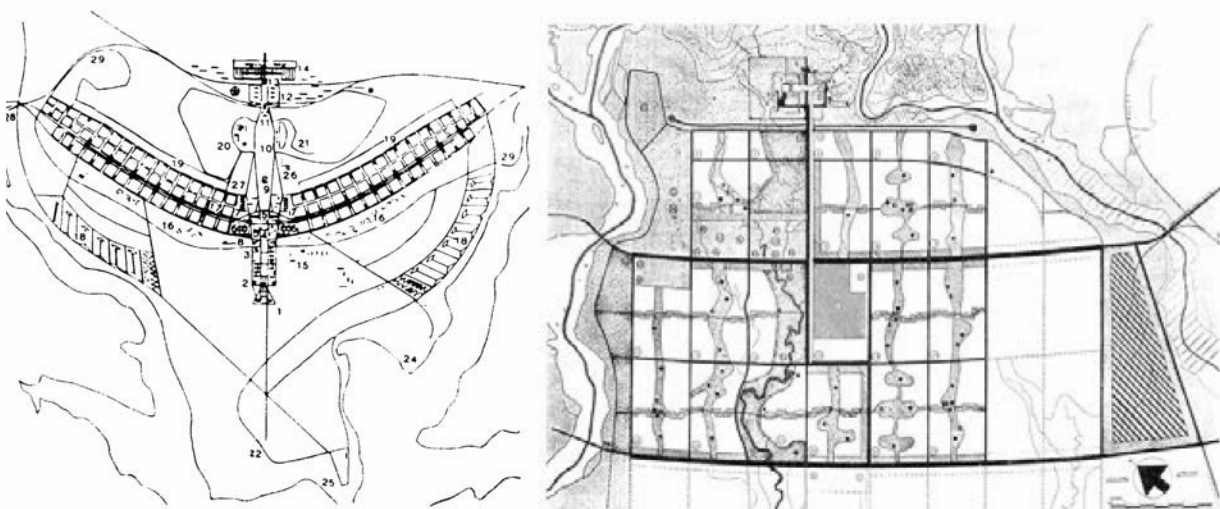


Figure 2.4: From left to right, Brasilia and Chandigarh masterplan (both designed during the 50s).

In the same year, in 1922, in India, Gaganendranath Tagore organized the fourteenth annual Indian Society of Oriental Art exhibition, which opened in Kolkata, India, in December 1922. The exhibition included diverse artworks from over sixty Indian artists, as well as work by all, but one, of the artists from the Bauhaus, in Germany, and was meant to highlight the common ground shared by these two groups of artists, but also promote European modernism in India.

In architectural field, classics of modernism (Le Corbusier, Niemeyer, Costa) made his visions of urban design in India and Brazil. The two largest projects - Chandigarh (Mayer/Le Corbusier), and especially Brazil (Costa/Niemeyer) implement urban concept formulated in the Charter of Athens (1934), breaking the traditional layout of the city in the functionally distinct neighbourhoods, connected by a network of highways. Magnificent architectural designs (done by the brilliant architects) were artificial flowers decorating the structure of the promenades and axes.

Modernism principles were used in both the countries as an emancipation tool: in the first half of the twentieth century, India and Brazil aimed to couple political independence with their cultural emancipation, and demanded the invention of an authentic architectural tradition to serve as the basis of an autonomous modern local art. The quest for modernity was parallel to an intensified quest for identity, emphasizing all things that differentiate Indian and Brazilian culture from the European one.

Beside this tentative of emancipation we have to highlight that the influence of local context and cultures (also due to the vastness of the territory) on new architectural principles was high and in many cases a result of authors' search for indigenous traditions.

For instance, from 1958 to 1965 in his career in India, Pierre Jeanneret related closely to the native population of Punjab, trying to grasp their culture of dwelling and subsequently at his home studio in Chandigarh he designed a number of furnishing, ascetic in spirit but modern in look⁴. During his staying in India Jeanneret was also so deeply involved into the local context that began increasingly to design low-cost housing for low income groups. Strongly influenced by Le Corbusier and Bauhaus ideals, modern architecture achieved a broader and deeper dissemination also in Brazil. The outstanding "anti-rationalist pioneers" of the 1940s and 1950s, combined the modernist avant-garde with traditional and local forms to achieve widespread public acceptance. And while the first generation of modernists in Brazil were educated in Europe (Rino Levi, Gregory Warchavchick), it was those educated at the *Escola Nacional de Belas Artes* (ENBA) and galvanized around Lucio Costa who took this "tropical offspring" to a whole new level of identity and appropriation. The design ideas of Oscar Niemeyer, Carlos Leão, Affonso Reidy, and Burle Marx were disseminated throughout the country, with evidence of this

⁴ See: Prakash V., *Chandigarh's Le Corbusier: the struggle for modernity in postcolonial India*, USA, University of Washington Press, 2002

dispersion obvious in the innumerable elements of modern architecture adopted in houses in many Brazilian cities during the 1950s and 1960s⁵.

One more analogy between the two countries development of modernism was the key role played by political leaders. For instance Juscelino Kubitschek after becoming Brazil president in 1956, began an intense period of industrialization and modernization, which saw the building of Brasilia, under the motto of “50 years in five”. Kubitschek's determination to build what he called “the most beautiful capital in the world”, led him back to Oscar Niemeyer who shared his beliefs. The aim was to build a capital that would symbolize the future and open up the centre of the country. The finished products would contribute to a new sense of collective identity and hope for the Brazilian people.

On the indian side, in the same years, prime minister Jawaharlal Nehru, had the idea of creating Chandigarh, a new city post-Independence, free from the shackles of history, unbound and a symbol of modernity belonged entirely to Jawaharlal Nehru. In 1949 on Nehru's invitation, Le Corbusier began his Chandigarh experiment, which became an extraordinary laboratory of architecture and town planning⁶.

As stressed by J.T. Lang in *A concise history of Modern architecture in India* (India, Orient Blackswan, 2002) “the Nehru era was one of unbridled optimism. His death in 1964 coincided with beginning of a more pragmatic political period. Modernist architectural ideologies, especially those of the rationalist stream, began to be challenged as their imitations became clear in the pragmatic world of professional practice” (LANG, 2002, p. 91). Beside political and social environment similarities it is also possible to unveil some influences between Brazilian and Indian architects during the modernism period.



Figure 2.5: From left to right, Oscar Niemeyer with Juscelino Kubitschek and Le Corbusier with Jawaharlal Nehru.

⁵ See: Cavalcanti, L., *When Brazil Was Modern: A Guide to Architecture, 1928-1960*, USA, Princeton , Architectural Press, 2003

⁶ Bahga, S., *Le Corbusier and Pierre Jeanneret: footprints on the sands of Indian architecture*, India, Galgotia Pub. Co., 2000

“The indirect impact of Le Corbusier’s work via the work of other architects can also be seen in India. Indian architects of the era were inspired by the extensive Le Corbusier-inspired modernism work built in Brazil while Europe was at war. There are specific buildings by Brazilian architects like Oscar Niemeyer that have counterparts in India. Among the best known of such buildings is the Apsara Cinema (1968) in Mumbai designed by Yahya Merchant which has direct formal antecedents in Niemeyer’s work, probably his chapel of São Francisco in Pampulha. It is however the idea of Brazil and its architectural achievements that was probably more of an inspiration” (LANG, 2002, p. 68). Another example of this could be for instance the work of Icaro de Castro Mello (1913-1986), a Brazilian architect who developed several projects requested by municipalities and clubs with a strong presence in several Brazilian cities, can be seen as a reference for Indian architect L. Chitale. A Mello’s project, the swimming pool in Agua Branca was probably one of the the references for the Auditorium at Sri Venkateswara University that L. Chitale designed at the end of the 60s. The two buildings look quite similar in shape and materials and it seems clear a sort of influence coming from Brazil into the Auditorium project.

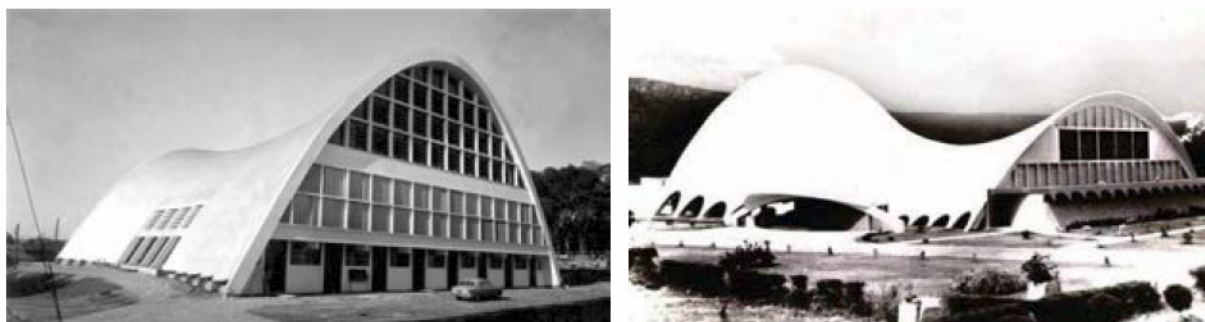


Figure 2.6: From left to right, swimming pool by Ícaro de Castro Mello (1950, Agua Branca, SP, Brazil) and Auditorium at Sri Venkateswara University by L. Chitale (1970, Tirupati, India).

As stated by Peter Scriver and Amit Srivastava “Indeed it was the pedigree of Oscar Niemeyer in the original UN building design rather than that of Le Corbusier, that appears to have been most inspirational in the evolving work of Chitale firm in this period. The debt, directly or indirectly, to the flamboyant Brazilian master of tropical modern expressionism seems clear in the voluptuous thin shell concrete vaulted auditorium designed by S.L. Chitale and his associates in the early 1970s for the Sri Venkateswara University in Tirupati, Andhra Pradesh [...]. The Bombay architects Durga Bajpai and Pilo Mody’s design of 1958 for the Oberoi International hotel, drew far more subtle but elegant references from the same precedent and Niemeyer’s tropical functionalism in general. In the same period work had also begun on the master planning and design of the new campus of the Indian Institute of Technology at Bombay (first phase completed circa 1962).



Figure 2.7: From left: Oberoi Intercontinental Hotel, New Delhi, Durga Bajpai and Pilo Mody architects (1958) and São Francisco church in Pampulha by Oscar Niemeyer (1943).

Sited in a paradisiacal jungle reserve bounding Powai Lake north of the city, the salubrious weave of concrete, stone and planting that comprised their campus architecture was less derivative in terms of obvious formal quotations, but comparable in approach and character to the syncretism of modernist building elements and tropical landscape that Niemeyer and the equally legendary South American landscape architect Roberto Burle Marx had so seductively and influentially demonstrated in their residential and institutional works of 1940s and '50s." (SCRIVER AND SRIVASTAVA, 2015, pp. 202-203).

2.2.1 The fight for international visibility and for appropriate architecture

Modern architecture has also been seen as a way to demonstrate the capacity and sometimes the economic power of developing countries. In India, after the independence from the British, the main priority was the transformation of the group of states into a strong nation. In 1947 India had a population of 350 million and was the second largest country in the world after China.

The nation slowly entered into the modern era thanks to the prime minister Jawaharlal Nehru, who created a centralized state and invested in technology, giving priority to scientific knowledge over traditional learning centers. Thus Modern architecture rapidly after the Second World War started to spread out its principles while the "modern" vocabulary seemed to offer big chances of prosperity and international visibility. In this process some of the most active Indian architects at that time had to fight against a movement willing to reintroduce a more traditional Indian style in new construction.

The prime minister Nehru at the end of the fifties present his strong opposition to such movements, giving his support to modern architects in India⁷.

⁷ See: Belluardo J., Kazi Khaleed A., *An architecture of Independence*, USA, The Architectural League of New York, 1998

After all we have to say that the Nehru's technology based policies weren't able to eradicate traditional culture as happened for instance in modern China: crafts continued, even if a very clear difference between past and present, and the rural atmosphere of the country remained so untouched that many architects tried to use traditional materials and technologies in new construction toward a more appropriate Indian architecture.

At the same time the Kubitschek's Brazil was guided into the modernization era also thank to the partnership between the president and the architects Oscar Niemeyer and Lucio Costa. The decision to build a new capital with outstanding architectures at the end of the fifties was motived by the need to consolidate the support of a marginal electorate as well as the need to project brazil into the technological age (SENNOT, 2004, p. 78).

Once again modern architecture became a way towards modernization, a path that probably led the country to one of the most important worldwide built heritage. Before the crisis of the 1960s and the isolation of the 1970s, Brazilian architecture was celebrated internationally as a step ahead of the functionalist and rationalist theories, Brazilian Modernism acquired at home the status of a paradigm. (SEGAWA, 1998, p.57). If India was able to preserve indigenous features in contemporary architecture some Brazilians architects tried to deal with regional architectures and modern principles. Probably the most important sign Of this remains the Park Hotel in Nova Friburgo, were Lucio Costa in 1942 translate the modernism style using wood, stone and traditional techniques.

2.3 Issues related to innovative materials of modern architecture

The new building technologies in the late nineteenth century led to innovative construction materials that are now facing strong conservation challenges. This issue requires new approaches related to environmental, technical, and physical conservation. There is a strong need of techniques and treatments that provided balanced and measured interventions in order to addressing these challenges.

Many professionals and public /private institutions are currently carrying out works in conservation of modern building technologies and materials, but many improvements can still be made to advance practices. Crucial point is conservation of modern architectures is the examination of the life span and conservation of modern building materials and the challenges inherent in sustaining the service life of modern buildings. Current research studies demonstrated how full examination and a deep understanding of the building itself can result in a successful outcome. "In general, there is a lack of knowledge and skills for conserving modern building systems and materials, and a lack of engagement with the repair industry as well. As an example, the working group discussed heritage sites like the Unité d'habitation by Le Corbusier in Marseille, France, where one of the structure's character-defining features is the fair faced (exposed) concrete surfaces. In this example, material authenticity is crucial to conservation. If major surface repairs were made and were a coating applied to the building, this would alter its appearance and negatively affect its authenticity. Participants agreed that because we do not currently

have an appropriate treatment for the fair faced concrete of this building (and of similar modern concrete buildings), we do not have the technical means to conserve it that is, to protect it and retain its significance” (NORMANDIN, MACDONALD, 2013, pp. 7-8).

Nowadays it is essential to raise awareness about modern architectures materials and be conscious and sensitive when working with them. In the future it could be essential to work with the construction industry to research and develop repair methodologies for 20th century materials in order to develop technical guidance, educational programmes, protocols and buildings conservation standards and guidelines.

SECOND PART

Chapter 3

Modern architecture in Brazil

"I deliberately disregarded the right angle and rationalist architecture designed with ruler and square to boldly enter the world of curves and straight lines offered by reinforced concrete. [...]
This deliberate protest arose from the environment in which I lived, with its white beaches, its huge mountains, its old baroque churches, and the beautiful suntanned women."

Oscar Niemeyer

3.0 Chapter abstract

Initiated in Europe, modernism was a movement that involved artistic and cultural areas. The main modernist ideals arrived in Brazil during the first decade of the twentieth century, introduced by events such as the Modern Art Week held in 1922 in São Paulo.

Modernism was a reflection of the cultural effervescence of the time: during that period the country went through industrialization and, at the same time great patriotism, which led to the search for art (including the national architecture) without being bound by European standards. The Modern movement was not limited only to architecture and modern art, since it involved aspects related to social, technological, economic and artistic areas. The beginning of the thirties still marks the conflict between the neo-colonial, dominant style in the Brazilian architecture of the time and Modernism, which was beginning to gain space. After the disclosure of the Modern Movement a subdivision into various stylistic trends began to rise. For instance in Rio de Janeiro, the European Modernist principles were merged with the local heritage and landscape resulting in an architecture of free forms, into the which was clear the originality of Oscar Niemeyer. In São Paulo, the Escola Paulista, was originally the architecture produced by a group that developed an architecture marked by the emphasis on constructive technique, by the adoption of the apparent reinforced concrete and appreciation of the structure.

3.1 Pre-modern period

Much of the historiography on Brazilian architecture of the nineteenth century shows the dominant tendency to work out rigid divisions between styles, emphasizing the opposition between baroque / rococo and neoclassicism at the beginning of the century, and then neoclassicism and eclecticism in the late nineteenth / early twentieth century.

This posture stems from another generalized notion in the literature on Brazilian art: the idea that there is a correspondence between artistic languages and historical periods; so the Baroque would predominate in the Colony, neoclassicism in the Empire and Eclecticism in the First Republic.

It is possible to observe in 19th century architectural practice a set of much more complex, in which several elements are interwoven: the persistence of colonial forms and techniques; the necessity of new programs and functions; the incorporation of imported materials; the diversification of agents.

Therefore, instead of a single dominant feature, coexist techniques, programmes and styles of the past and of the present, evidencing the permanence of the colonial tradition mixed with the desire for modernization and the need of an image of new nation¹.

From 1816 to 1889 (its constitution as a republic) Brazil has seen many European presence beside the Portuguese. For instance significant French artist and architects were brought there by Emperor Joao VI, thus began a period of strong French influence (see the building of *Escola de Belas Artes* in Rio de Janeiro). Since then the neoclassicism was the model for public buildings in the middle of the nineteenth century.

After the country independence, in 1889, the biggest urban areas faced dramatic changes due to commercial and development pressure. In this period architectural eclecticism and big scale planning completely changed the urban scenario of many cities.

Specially in Rio de Janeiro, the Portuguese heritage was slowly replaced by a French influenced architectural taste characterized by boulevard, public spaces and highly ornate façades (with many materials imported directly from Europe).

English influence was stronger in São Paulo, where it was built the *Luz* station by Charles Driver (1900), and several English half-timbered style villas along the Avenida Paulista.

The first decades of the twentieth century are in some ways characterized by internationalization of Brazil and this increased its architectural eclecticism: some urban districts faced in this period the presence of Gothic Revival, Swiss Cottage Style, and Art Nouveau.

¹ See GOMES PEREIRA, SONIA; 2005. "A historiografia da arquitetura brasileira no século XIX e os conceitos de estilo e tipologia". *Estudos Ibero-Americanos*, Vol. XXXI, pp. 143-154.

3.2 The Search for Modernity in Brazil

Brazilian modernism was a broad cultural movement that had a strong repercussion on the Brazilian art scene and society in the first half of the 20th century, especially in the field of literature and the visual arts.

The movement in Brazil was triggered by the assimilation of cultural and artistic trends launched by the European vanguards in the period before the First World War, such as Cubism and Futurism. The new modern languages posed by the European artistic and literary movements were gradually assimilated by the Brazilian artistic context, but focusing as elements of the Brazilian culture. According to Lúcio Costa, Brazilian Modernism is justified as style which affirms the identity of Brazilian culture and represents the "spirit of the time". It is considered the Week of Modern Art, held in São Paulo in 1922, as the starting point for modernism in Brazil².

It was one of the main events in art history in Brazil, able to reaffirm the search for a truly Brazilian art and marking the emergence of Brazilian Modernism.

From the beginning of the twentieth century, although several artists spent seasons in Paris, they still did not bring the information of the vanguard movements that fizzled in Europe to Brazil.

The first Expressionist exhibitions in Brazil of the work by Lasar Segall in 1913 and, a year later, the one concerning the Anita Malfatti production, did not attract attention; It is only in 1917, with the second exhibition of Malfatti, or even more with the criticism that it received from Monteiro Lobato, that there was a polarization of renewing ideas.

In the Week of Modern Art, painters, sculptor, architects and intellectuals have been taking part. During three days, between February 13 and 17, 1922, the Municipal Theater of São Paulo was attended by literary and musical sessions in the auditorium, besides the exhibition of plastic arts in the lobby, with works by Anita Malfatti, Di Cavalcanti, Victor Brecheret, Ferrignac, John Graz, Martins Ribeiro, Paim Vieira, Vicente do Rego Monteiro, Yan de Almeida Prado and Zina Aíta (painting and drawing), Hildegardo Leão Velloso and Wilhem Haarberg (sculpture). The exhibitions had a strong impact and were very badly received by the audience formed by the São Paulo elite, which in fact would contribute to open the debate and the diffusion of new ideas at the national level.

Didactically, Modernism is divided into three phases: the first phase, more radical and strongly opposed to everything that was earlier, full of irreverence and scandal; a second one more soft, that formed great novelists and poets; And a third, also called Postmodernism by various authors, which was in some way opposed to the first. Despite this sparkling scenario, in the early 1930s there was still a conflict between neo-colonial and modern architecture.

One of the predominant factors for the diffusion of the modernist style in Brazil was the support of the *Estado Novo*, which saw in this style a symbol of modernity and progress.

² See: Camargos, M. (2002). *Semana de 22 - Entre Vaia e Aplausos*, São Paulo: Boitempo Editorial

3.3 Modernism in architecture

When the modern movement spread in Brazil, recently graduated architects began to study works of foreign architects like the Germans Mies Van der Rohe and Walter Gropius, but it was Le Corbusier who most had influence in the formation of the Modernist thought in the Brazilian architects. His innovative ideas had a vast influence on the Brazilian movement, being an inspiring source for Lúcio Costa, Niemeyer and other pioneers of Brazilian modern architecture.

Russian Gregori Warchavchik designed the "Casa Modernista" (Modernist House, 1929-1930), a work that was marked as the first house in Modern style built in São Paulo even if it was built using traditional materials, bricks and wood, in contrast with modern material (reinforced concrete and steel).

The first modernist projects were marked by rationalism and functionalism, as well as features such as geometric shapes, lack of ornamentation - the work itself is considered an ornament in the landscape; Separation of structure and fence, use of *pilotis* in order to liberate the space under the building, continuous glass cloths in the facades instead of traditional windows; Integration of the architecture with the landscaping, and with the other plastic arts through the use of decorated tile panels, murals and sculptures.



Figure 3.1: From left, *Escola de Belas Artes* in Rio de Janeiro and *Casa Modernista* by Gregori Warchavchik as they were in 1930.

Due to the problems generated by the social and economic changes during the Industrial Revolution, architectural modernism was born in Europe to find solutions generated by such changes. In Brazil it has arisen without the need to solve social problems, since the modernist works appear when the process of industrialization was still beginning. Brazil has several times received Le Corbusier: to guide the team of architects who in 1936 designed the building of the new headquarters of the Ministry of Education in Rio de Janeiro (Gustavo Capanema Building) and to held conferences to spread out modernism ideals.



Figure 3.2: the Ministry of Education in Rio de Janeiro (Gustavo Capanema Building) during the '40s.

Designed in 1936 during the period of the government of Getúlio Vargas by the team of architects: Oscar Niemeyer, Affonso Eduardo Reidy, Carlos Leão, Jorge Moreira and Ernani Vasconcelos, led by Lúcio Costa, the Ministry of Education and Health of Rio de Janeiro was the first modern architecture bringing a national repercussion³.

Led by Le Corbusier the building of the ministry was conceived according to the modernist foundations, representing the break with the architectural forms ornamented with historicist and symbolic motifs that were used at the time. The building façades were designed using architectural elements such as brises soleils and glass. The floor plan follows the modernist parameters such as free floor without fixed walls. Some surfaces received tiles and murals from the painter Candido Portinari, gardens planning by Roberto BurleMarx and sculptures by Lipchitz, Bruno Giorgi and Celso Antonio.

3.4 The Schools and its masters

After the disclosure of the Modern Movement there was a subdivision into various stylistic trends. During the development of this dissertation main attention was paid to the two most important in terms of production and masters. In one hand, the “Escola Carioca” (1935-1965) in Rio de Janeiro merged the European Modernist principles with the native heritage that resulted in an architecture of more free forms, within which is evident the originality of Oscar Niemeyer⁴.

Niemeyer abandons the exaggerated functionalism of the modern ideals and uses in its works freer curves, that look for the beauty, not a final result based solely on its function.

³ Source Segre, R., 2013. *Ministério da Educação e Saúde*, São Paulo: Romano Guerra Editora.

⁴ See also: Serapiano, F. (2016). *Escola carioca: arquitetura moderna no rio de janeiro*, in *Monolito* vol 31. Rio de Janeiro: Editora Monolito

These characteristics are evidenced in the Conjunto da Pampulha (1942-1943), in Minas Gerais, in the famous buildings of Brasília, in Ibirapuera Park (SP, 1951-1955) and the Ouro Preto Grande Hotel (MG, 1940 by Lucio Costa).

The architecture of the "Carioca school" was internationally renowned in the immediate post-war period, thanks to the excellent quality of its works.

In the early 1950s, some of its architects began to propose works that highlighted new directions, and that could be considered as a moment of transformation: for instance the Affonso Eduardo Reidy (1909-1964) use of large structures in apparent concrete (see the Brazil-Paraguay School in Asunción, Paraguay, 1952), a work of brutalist language employing external transverse porches in apparent concrete which reaches his top level in Rio de Janeiro Modern Art Museum.



Figure 3.3: Museum of Modern Art, Rio de Janeiro, by Affonso Eduardo Reidy, 1948 (construction site picture).

On the other hand, the so called “Escola Paulista” architecture is one of the most striking trends in the modern Brazilian and international architectural panorama from the post-World War II period until at least the late 1970s.

The works identified with it are characterized mainly by the use of reinforced concrete made apparent, emphasizing the design printed by natural wood forms, a technique that was used more frequently in civil architecture at that time, both as a technological resource and in search of greater plastic expressiveness.

The so called “brutalist” trend began in the early 1950s in São Paulo, gaining some prominence in the work of a new generation of talented architects that emerged in that decade. The beginning of the brutalist tendency in Brazil is concomitant, not later, with the competition and construction of Brasília, although it gains more notoriety and consolidates in the 1960s when it passes national repercussions. Neither at that

moment nor afterwards the brutalist architecture of São Paulo became hegemonic, either in São Paulo or in Brazil, having always lived simultaneously with other tendencies and proposals, based on other orientations. It is not easy to define brutalism in an accurate manner. Used as much as snubbed by the architectural literature of the second of the twentieth century, it is far from setting up a unanimous concept, the different meanings that are attributed to it overlapping in an unclear way, appearing to be one when there are many, and to unravel them it takes some detective patience⁵.



Figure 3.4: *Rodoviária de Jaú* by J. B. Vilanova Artigas (1973).

In Brazil, in addition to the case of São Paulo, parallel experiences can be recognized in other regions, and there is not necessarily a relation of influence with the architecture of São Paulo, but rather with creative dialogue. In the 1980s, with changes, some technological changes in the construction sector coincided with the gradual exhaustion of the conceptual guidelines of brutalism, which were intensified by the confrontation opened by the debates on modernity that took place at that moment.

At the end of the 20th century, Brutalist Paulista architecture was once again re-valued for its avant-garde artistic quality and value, and its place in modern Brazilian and international architecture has been

⁵ See: Zein, R. V. (2005). *A Arquitetura da Escola Paulista Brutalista 1938-1973*. PhD dissertation, PROPARG-UFRRGS.

reconsidered. Several of his works can already be considered as an important part of the modern heritage, and in this condition, has been deserving several studies and research by several scholars.

Beside the brutalist architecture of São Paulo can now be better understood from its own architectural values (which guarantee its status as an important aspect of modern Brazilian architecture) it is still difficult to provide a clear definition of it. Some researcher such as Reyner Banham have been trying to define the movement and its international roots⁶. Banham argues that brutalism manifests itself in works located in various parts of the world, with no apparent affinity between them, except for sharing the teachings in Le Corbusier's work. The moment, when brutalism appears in the architectural field, seems to be that of the mid-1950s; A notable increase emerged after 1960 when there was partial recognition of the tendency by part of some authors and of the majority of the critics. The movement experienced a great expansion in the decades of 1960/70, when it obtained a certain status of "modern vernacular" (BANHAM 1966).

In terms of state of conservation the Paulista and the Carioca school provide different preservation issues: as stated by Richard J. Williams, "what can be said about it with certainly, however, is that it supplies a critique of the developmentalist aesthetic of the Carioca School. Paulista buildings age. Artiga's works look good regardless of their condition, because they seem to have been built as ruins in the first place. That of Reidy, by contrast, or Niemeyer needs constant attention to maintain an illusion of newness. The appalling physical state of Reidy's Pedregulho by contrast seems only to indicate its failure" (WILLIAMS, 2009, p. 146). In the early 1950s the architects João Batista Vilanova Artigas (1915-1984) and Carlos Cascaldi started to carry out works employing apparent concrete, such as the Estádio do Morumbi (1952), São Paulo or the Olga Baeta (1956), residence. Like Artigas, other then-active architects adopted the brutalist language in their works, beginning in the late 1950s: Lina Bo Bardi at MASP - Museum of Art of São Paulo (1958/1961); Fabio Penteadó at Club Harmonia Headquarters (1964); Carlos Barjas Millan at the Roberto Millan house (1960). Beside Artigas there were other architects very active at the same time such as Oswaldo Bratke, or still others like Rino Levi, or still some off the Rio-São Paulo axis, as Carlos Fayet in Rio Grande do Sul state.

A new generation of young architects trained at that moment began their career contributing to the consolidation of the São Paulo variant of the brutalist tendency: Paulo Mendes da Rocha, Joaquim Guedes, Pedro Paulo de Mello Saraiva, Paulo Bastos, Ruy Othake, João Walter Toscano among many others.

⁶ See: Banham, R., 1966. *The new brutalism: ethic or aesthetic?* London: Architectural Press.

3.5 Main modern architectures in Brazil

Code	Building name	City	Designer/s	Year
BR001	Casa Modernista Rua Itápolis	São Paulo	Gregori Warchavchik	1927
BR002	Casa Modernista Rua Santa Cruz	São Paulo	Gregori Warchavchik	1927
BR003	Sede da Fazenda Capuava	Valinhos	Flávio de Carvalho	1929
BR004	Casa Modernista Rua Bahia	São Paulo	Gregori Warchavchik	1930
BR005	Edifício Columbus	São Paulo	Rino Levi	1930
BR006	Apartamentos proletarios	Rio de Janeiro	Lucio Costa, Gregori Warchavchik	1931
BR007	Casa Nordchild	Rio de Janeiro	Gregori Warchavchik	1931
BR008	Conjunto de casas	São Paulo	Flávio de Carvalho	1933
BR009	Edifício Higienópolis	São Paulo	Rino Levi	1935
BR010	Edifício Guarani	São Paulo	Rino Levi	1936
BR011	Edifício ABI	Rio de Janeiro	Marcelo, Milton and Maurício Roberto	1936
BR012	Castelo d'Água	Olinda	Luís Carlos Nunes	1937
BR013	Aeroporto Santos Dumont	Rio de Janeiro	Marcelo, Milton and Maurício Roberto	1937
BR014	Estação de Hidroaviões	Rio de Janeiro	Attilio Corrêa Lima	1937
BR015	Ministério da Educação e Saúde	Rio de Janeiro	Lucio Costa, Oscar Niemeyer, Affonso Reidy, Jorge Moreira, Carlos Leão, Emani Vasconcelos, Le Corbusier (consultant)	1937
BR016	Obra do Berço	Rio de Janeiro	Oscar Niemeyer	1937

BR017	Edifício residencial na barão de Limeira	São Paulo	Gregori Warchavchik	1939
BR018	Casa Pedro Paulo Paes de Carvalho	Araruama	Lúcio Costa	1940
BR019	Grande Hotel de Ouro Preto	Ouro Preto	Oscar Niemeyer	1940
BR020	Casa Saavedra	Petrópolis	Lúcio Costa	1940
BR021	Casa do arquiteto	Rio de Janeiro	Álvaro Vital Brazil	1940
BR022	Park Hotel	Nova Friburgo	Lucio Costa	1940
BR023	Instituto de Resseguros do Brasil	Rio de Janeiro	Marcelo, Milton and Maurício Roberto	1941
BR024	Casa João Arnstein	São Paulo	Bernard Rudofsky	1941
BR025	Casa do administrador	Petropolis	Sérgio W. Bernardes	1942
BR026	Casa Hungria Machado	Rio de Janeiro	Lucio Costa	1942
BR027	Casa de Baile da Lagoa da Pampulha	Belo Horizonte	Oscar Niemeyer	1942
BR028	Cassino da Lagoa da Pampulha	Belo Horizonte	Oscar Niemeyer	1942
BR029	Iate Clube da Lagoa da Pampulha	Belo Horizonte	Oscar Niemeyer	1942
BR030	Residência Herbert Johnson	Fortaleza	Oscar Niemeyer	1942
BR031	Casa De Celso da Rocha Miranda	Petropolis	Alcides da Rocha	1942
BR032	Casa do arquiteto na Lagoa	Rio de Janeiro	Oscar Niemeyer	1942
BR033	Casa de Juscelino Kubitschek em Pampulha	Belo Horizonte	Oscar Niemeyer	1943
BR034	Igreja de São Francisco	Belo Horizonte	Oscar Niemeyer	1943
BR035	Colônia de Férias do Instituto de Resseguros do Brasil	Rio de Janeiro	Marcelo, Milton and Mauricio Roberto	1943
BR036	Casa de Francisco Inácio Peixoto	Cataguases	Oscar Niemeyer	1943

BR037	Casa Rivadávia de Mendonça	São Paulo, Brazil	João Vilanova Artigas	1944
BR037	Restaurante na Lagoa	Rio de Janeiro	Oscar Niemeyer	1944
BR039	Edifício Prudência	São Paulo	Rino Levi	1944
BR040	Residência Benedito Levi	São Paulo	João Vilanova Artigas	1944
BR041	Edifício residencial Luís Felipe	Rio de Janeiro	Hélio Uchoa	1945
BR042	Escola para meninos	Cataguases	Oscar Niemeyer	1946
BR043	Residência Tullio Ascarelli	São Paulo	Daniele Calabi	1946
BR044	Edifício Louveira	São Paulo	João Vilanova Artigas	1946
BR045	Conjunto residencial Pedregulho	Rio de Janeiro	Affonso Eduardo Reidy	1946
BR046	Edifício sede do Banco Boavista	Rio de Janeiro	Oscar Niemeyer	1946
BR047	Edifício Caramuru	Salvador	Paulo Antunes Ribeiro	1946
BR048	Hotel Amazonas	Manaus	Paulo Antunes Ribeiro	1947
BR049	Edifício-Sede da IAB	São Paulo	Rino Levi, Abelardo de Souza, Galiano Ciampaglia, Miguel Forte, Hélio Duarte, Jacob Rucht, Roberto Cerqueira César, and Zenon Lotufo	1947
BR050	Conjunto residencial de Paquetá	Rio de Janeiro	Francisco Bolonha	1947
BR051	Edifício Residencial Júlio Barros Barreto	Rio de Janeiro	Marcelo, Milton and Maurício Roberto	1947
BR052	Hotel Jaraguá	São Paulo	Franz Heep	1947
BR053	Oficinas de capela	Petropolis	Alcides da Rocha	1948
BR054	Residência Vilanova Artigas	São Paulo	João Vilanova Artigas	1948
BR055	Piscina coberta	São Paulo	Ícaro de Castro Mello	1948

BR056	Edifícios Nova Cintra, Bristol e Caledônia	Rio de Janeiro	Lucio Costa	1948
BR057	Restaurante do Instituto Oswaldo Cruz	Manguinhos	Jorge Ferreira	1948
BR058	Residência Bo Bardi (Casa de Vidro)	São Paulo	Lina Bo Bardi	1949
BR059	Casa de George Hime	Nogueira	Henrique Mindlin	1949
BR060	Casa Niclewicz	Curitiba	João Vilanova Artigas	1949
BR061	Casa Bettiga	Curitiba	João Vilanova Artigas	1949
BR062	Casa do arquiteto em Mendes	Mendes	Oscar Niemeyer	1949
BR063	Casa do arquiteto	Nova Friburgo	Carlos Ferreira	1949
BR064	Edifício Seguradoras	Rio de Janeiro	Marcelo, Milton and Maurício Roberto	1949
BR065	Casa de Hildebrando Accioly	Petropolis	Francisco Bolonha	1949
BR066	Casa de Heitor Almeida	Santos	Carlos Cascardi and João Vilanova Artigas	1949
BR067	Residência Michel Abu Jamra	São Paulo	Oswaldo Correa Gonçalves	1950
BR068	Residência Enzo Segri	São Paulo	Miguel Forte and Galiano Ciampaglia	1950
BR069	Edifícios Residenciais do parque Guinle	Rio de Janeiro	Marcelo, Milton and Maurício Roberto	1950
BR070	Fábrica Duchon	São Paulo	Oscar Niemeyer	1950
BR071	Residência Jacarepaguá	Rio de Janeiro	Afonso Eduardo Reidy	1950
BR072	Casa de criança	Londrina	João Vilanova Artigas	1950
BR073	Rodoviária de Londrina	Londrina	João Vilanova Artigas	1950
BR074	Casa de Walter Moreira Salles	Rio de Janeiro	Olavo Redig de Campos	1951
BR075	Edifício do Banco da Lavoura	Belo Horizonte	Álvaro Vital Brazil	1951
BR076	Colégio Júlia Kubitschek	Diamantina	Oscar Niemeyer	1951

BR077	Hotel em Diamantina	Diamantina	Oscar Niemeyer	1951
BR078	Edifícios do parque Iberapuera	São Paulo	Oscar Niemeyer	1951
BR079	Edifício COPAN	São Paulo	Oscar Niemeyer	1951
BR080	Residência Olivo Gomes	São José dos Campos	Rino Levi	1951
BR081	Casa Sérgio Corrêa da Costa	Rio de Janeiro	Jorge Machado Moreira	1951
BR082	Residencia Antonio Ceppas	Rio de Janeiro	Jorge Machado Moreira	1951
BR083	Casa Lota de Macedo Soares	Petrópolis	Sérgio W. Bernardes	1951
BR084	Residência Milton Guper	São Paulo	Rino Levi	1951
BR085	Residência e estúdio no Morumbi	São Paulo	Oswado Arthur Bratke	1951
BR086	Hotel da Bahia	Salvador	Paulo Antunes Ribeiro	1951
BR087	Casa de Jadir de Souza	Rio de Janeiro	Sérgio W. Bernardes	1951
BR088	Hospital maternidade	Cataguases	Francisco Bolonha	1951
BR089	Residência Cândido Norberto	Porto Alegre	Luiz Fernando Corona, Carlos Fayet	1952
BR090	Hospital Sul-América	Rio de Janeiro	Oscar Niemeyer	1952
BR091	Casa Oscar Americano	São Paulo	Oswado Arthur Bratke	1952
BR092	Casa Brandi	Petrópolis	Sérgio W. Bernardes	1952
BR093	Residência Leonel Miranda	Rio de Janeiro	Oscar Niemeyer	1952
BR094	Casa José e Irene Félix Louza	Goiana	David Libeskind	1952
BR095	Residência Luis Forte	São Paulo	Miguel Forte and Galiano Ciampaglia	1952
BR096	Residência Paulo Hess	São Paulo	L. Roberto C. Franco, Rino Levi and R. C. César	1952
BR097	Conjunto residencial Marques de São Vicente	Rio de Janeiro	Affonso Eduardo Reidy	1952

BR098	Colégio Estadual da Penha	São Paulo	Eduardo Corona	1952
BR099	Casa na Avenida Morumbi	São Paulo	Oswaldo Arthur Bratke	1953
BR100	Museu de arte moderna de Rio de Janeiro	Rio de Janeiro	Affonso Eduardo Reidy	1953
BR101	Casa da Canoas	Rio de Janeiro	Oscar Niemeyer	1953
BR102	Edifício Lausanne	São Paulo	Franz Heep	1953
BR103	Edifício do Instituto de Antibióticos	Recife	Mario Russo	1953
BR104	Casa de João de Carvalho	Petropolis	José Bina Fonyat filho	1954
BR105	Casa Cavanelas	Rio De Janeiro	Oscar Niemeyer	1954
BR106	Conjunto Nacional	São Paulo, Brazil	David Libeskind	1954
BR107	Faculdade de Arquitetura e Reitoria da UFRJ	Rio de Janeiro	Jorge Machado Morreira	1955
BR108	Edifício Concordia	São Paulo	Rino Levi	1955
BR109	Casa de Homero Souza e Silva	Rio de Janeiro	Carlos Leão	1956
BR110	Residência Couto e Silva	Rio de Janeiro	Affonso Eduardo Reidy	1956
BR111	Residência Spartaco Vial	São Paulo	David Libeskind	1956
BR112	Casa na rua Suécia	São Paulo	Oswaldo Arthur Bratke	1956
BR113	Residência para engenheiros das Usnas Elclor	Rio Grande da Serra	Rino Levi	1956
BR114	Palácio da Alvorada	Brasilia	Oscar Niemeyer	1956
BR115	Superquadras	Brasilia	Oscar Niemeyer	1956
BR116	Edifício Renata Sampaio	São Paulo	Oswaldo Arthur Bratke	1956
BR117	Edifício Itália	São Paulo	Franz Heep	1956
BR118	MASP Museu de Arte de São Paulo	São Paulo	Lina Bo Bardi	1957

BR119	Residência Olga Baeta	São Paulo	Carlos Cascaldi and João Vilanova Artigas	1957
BR120	Residência Maurício da Rocha	São Paulo	David Libeskind	1957
BR121	Casa José Anthero Guedes	São Paulo	Joaquim Guedes	1957
BR122	Residência Antonio Maurício da Rocha	São Paulo	David Libeskind	1957
BR123	Residência Georges Khalil	São Paulo	Victor Reif	1958
BR124	Casa Jardim do Cristal	São Paulo	Lina Bo Bardi	1958
BR125	Catedral de Brasília	Brasília	Oscar Niemeyer	1958
BR126	Residência Castor Delgado Perez	São Paulo	Luís Roberto Carvalho Franco, Rino Levi and Roberto Cerqueira César	1958
BR127	Residência Alvino Slaviero	São Paulo	Miguel Juliano	1958
BR128	Residência Paulo Nogueira Neto	São Paulo	Oswado Arthur Bratke	1958
BR129	Residência Antonio Cunha Lima	São Paulo	Joaquim Guedes	1958
BR130	Ginásio do Atlético Paulistano	São Paulo	Paulo Mendes da Rocha	1958
BR131	Esplanada dos Ministérios	Brasília	Oscar Niemeyer	1958
BR132	Palácio do Itamaraty	Brasília	Oscar Niemeyer	1959
BR133	Casa Leo Pereira Lemos Nogueira	São Paulo	Carlos Cascaldi and João Vilanova Artigas	1959
BR134	Casa em Itaipava	Rio de Janeiro	Affonso Eduardo Reidy	1959
BR135	Casa em Ubatuba	São Paulo	Oswado Arthur Bratke	1959
BR136	Banco Sul Americano do Brasil S.A.	São Paulo	Rino Levi	1960
BR137	Centro de recuperação Sara Kubitschek	Brasília	Glauco Campello	1960
BR138	Casa Celso Silveira Mello	São Paulo	Paulo Mendes da Rocha	1960
BR139	Residência Roberto Millan	São Paulo	Carlos Millan	1960

BR140	Residência Nadyr de Oliveira	São Paulo	Carlos Millan	1960
BR141	Residência José Bittencourt	São Paulo	Carlos Cascaldi and João Vilanova Artigas	1960
BR142	Casa Família Bernardes	Rio de Janeiro	Sérgio W. Bernardes	1960
BR143	Ginásio de Guarulhos	Guarulhos	João Vilanova Artigas and Carlos Cascaldi	1960
BR144	Garagem de barcos do Santa Paula Iate Clube	São Paulo	João Vilanova Artigas and Carlos Cascaldi	1961
BR145	Faculdade de arquitetura e urbanismo da USP	São Paulo	João Vilanova Artigas and Carlos Cascaldi	1961
BR146	Rodoviária de Jaú	Jaú	João Vilanova Artigas and Carlos Cascaldi	1961
BR147	Casa em Cabo Frio	Cabo Frio	Álvaro Vital Brazil	1961
BR148	Residência Boris Fausto	São Paulo	Sergio Ferro	1961
BR149	Residência Costa Neto	São Paulo	Joaquim Guedes	1961
BR150	Residência Abram Jagle	São Paulo	João Walter Toscano	1961
BR151	Sede Social do Jóquei Clube de Goiás	Goiânia	Paulo Mendes da Rocha	1962
BR152	Fórum de Avaré	Avaré	Paulo Mendes da Rocha	1962
BR153	Edifício Guaimbê	São Paulo	Paulo Mendes da Rocha	1962
BR154	Residência Antônio D'Elboux	São Paulo	Carlos Millan	1962
BR155	Residência Dalton Toledo	Piracicaba	Joaquim Guedes	1962
BR156	Residência Paulo Mendes da Rocha	São Paulo	Paulo Mendes da Rocha	1964
BR157	Residência Siegbert Zanettini	São Paulo	Siegbert Zanettini	1964
BR158	Residência Rosa Okubo	São Paulo	Ruy Ohtake	1964
BR159	Residência Rino Levi	São Paulo	Rino Levi	1964
BR160	Edifício Gravatá	São Paulo	Rino Levi	1964

BR161	Edifício FAM	Porto Alegre	Carlos Fayet, Cláudio Luiz Araújo, Sérgio Moacyr Marques	1964
BR162	Residência Francisco Landi	São Paulo	Joaquim Guedes	1965
BR163	Residência Tereza Martino	São Paulo	Arnaldo Martino	1965
BR164	Residência Jaques Breyton	São Paulo	Joaquim Guedes	1965
BR165	Residência Tomie Ohtake	São Paulo	Ruy Ohtake	1966
BR166	Residência Manoel Mendes André	São Paulo	João Vilanova Artigas	1966
BR167	Casa Manoel Mendes André	São Paulo	João Vilanova Artigas	1966
BR168	Casa Elza Salvatori Berquó	São Paulo	João Vilanova Artigas	1967
BR169	Residência Chiyo Hama	São Paulo	Ruy Ohtake	1967
BR170	Residência Telmo Porto	São Paulo	João Vilanova Artigas	1968
BR171	Residência Juarez Brandão Lopes	São Paulo	Rodrigo Léfèvre and Flávio Império	1968
BR172	Residência Mário Masetti	São Paulo	João de Gennaro and Paulo Mendes da Rocha	1968
BR173	Residência Nilton Schor	São Paulo	Israel Sancowsky and Jerônimo Bonilha Esteves	1968
BR174	Residência Roberto Guglielmo	São Paulo	Joaquim Guedes	1968
BR175	Edifício-Sede da FIESP-CIESP-SESI	São Paulo	Rino Levi	1969
BR176	Residência Jon Maitrejean	São Paulo	Jon Maitrejean	1969
BR177	Residência Gilberto de Souza Meirelles	São Paulo	José Fleury de Oliveira	1969
BR178	Residência Ariosto Martirani	São Paulo	João Vilanova Artigas	1969
BR179	Residência Waldo Perseu Pereira	São Paulo	Joaquim Guedes	1969
BR180	Residência Nadir Zacharias	São Paulo	Ruy Ohtake	1970
BR181	Residência Fernando Millan	São Paulo	Paulo Mendes da Rocha	1970

BR182	Residência Paulo Bastos	São Paulo	Paulo Bastos	1970
BR183	Residência Liliana Guedes	São Paulo	Joaquim Guedes	1970
BR184	Residência Jacob Kipnis	São Paulo	Eduardo de Almeida	1970
BR185	Casa Dino Zamattaro	São Paulo	Rodrigo Lefèvre	1970
BR186	Residência Beatriz Kerti	Porto Alegre	Carlos Fayet, Cláudio Luiz Araújo, Carlos Eduardo Comas	1970
BR187	Casa Juvenal Juvêncio	São Paulo	João Vilanova Artigas	1971
BR188	Residência Janne Ottoni	São Paulo	David Ottoni and Dácio Ottoni	1971
BR189	Residência Milan	São Paulo	Marcos Acayaba	1972
BR190	Residência James King	São Paulo	Paulo Mendes da Rocha	1972
BR191	Residência José da Silva Netto	Brasília	João Filgueiras Lima	1973
BR192	Casa Gerber	Angra dos Reis	Paulo Mendes da Rocha	1973
BR193	Residência Edgar Gonçalves Dente	São Paulo	Edgar Gonçalves Dente	1974
BR194	Residência Antonio Teófilo de Andrade Hort	São Paulo	Decio Tozzi	1974
BR195	Residência Edgard Niclewicz	Curitiba	João Vilanova Artigas	1974
BR196	Residência Fabricio Beer	São Paulo	Joaquim Guedes	1976
BR197	Residência Anna Mariani Ibiuna	São Paulo	Joaquim Guedes	1977
BR198	Residência Nivaldo Borges	Brasília	João Filgueiras Lima	1978
BR199	Residência Max Define	São Paulo	Eduardo de Almeida	1978
BR200	Tribunal de Justiça do Estado do Piauí	Teresina	Acácio Gil Borsoi	1978

SECOND PART

Chapter 4

Modern architecture in India

“The school and the dormitories are a unit, like a monastery. Corridors are avoided by having deep porches, off all the dormitory rooms, where tea is served and things are discussed”.

Louis Kahn on IIM – Ahmedabad.

4.0 Chapter abstract

There were two most important figures that emerged during the period before and after the India Independence in 1947: Jawaharlal Nehru and Mohandas Karamchand Gandhi. Until 1947, they had both have the same goal, which was to free India from colonial rule. The two, however, did not share the same view of the future nation: Nehru aimed at improving the science knowledge, a modern industry, while Gandhi wanted to develop the India growth by a democracy based on agriculture and traditional value. Until 1947 the architecture being built was not Indian, but rather colonial architecture. Especially in Calcutta, Delhi and Mumbai many colonial buildings in British style were completed in few years, designed by foreign architects. But, once conquered the independence, this unfamiliar style does not longer responded to the spirit of a young nation, so it was clear that a new identity even in the architectural sphere was needed. The Nehru's commitment interested also this sector: the period between 1947 and 1964 was characterized by reforms and social policies and the beginning of widespread industrialization through five-year plans. Thus the Indian architecture of the '50s and '60s was an expression of this framework: educational institutions, universities, research laboratories, were built in order to redraw the spirit of a new India. Young architects were there ready to start a new path, some of them went abroad to study the work of great masters, other were strongly influenced by foreign architects that came to India for important projects. The modern era of architecture in India was then ready to start.

4.1 The pre-modern period

Since its first contact with western world in 1498, when the Portuguese arrived in India, the country has always been facing a continuous growth in terms of modernity due to increasing relationship with the main European imperial powers.

Among them the British, since the XIX century started not only to be tax collectors but also to invest in infrastructure and facilities in the whole country. The implementation of radical reforms such as the introduction of the concept of land tenure and connected taxation scheme and the adoption of English language as mandatory for high school started to develop a more aware of its possibilities new social classes.

At the same time, institutions such as the Public Works Department (1855) were conceived in order to accelerate the process of modernization of the country. It represents, together with the India's earliest railway and modern postal service crucial step towards the country development. The technical improvement was thus rapid and necessary to manage this growth having as main goal the construction of a technically developed India under the conflicts of several interest of colonialism.

Under to Public Works Department this was the period of extensive new constructions, irrigation canals planning and many public improvements while at the same time in many parts of the country blood was shed between British and Indian riots groups.

“For James Fergusson¹, the prolific Victorian architectural historian and theorist a self-educated authority on India, the very idea of a modern India was a problem in itself. In collaboration with the newly established Archaeological Survey of India Ferguson was then intensely engaged in documenting the architecture of ancient India and constructing the canonical history and theoretical framework through which this was to be interpreted well into the postcolonial era.

If British architects could learn anything from his herculean scholarship, he argued, it would be to recognize the nature of what was a true architecture in his estimation, uncompromised by cross-cultural miscegenation or irrational historicist mimicry.

These were the sins of the modern style of post-Renaissance European architecture in Fergusson's view” (SCRIVER & SRIVASTAVA, 2015, pp. 29-30).

Slowly, in Since the beginning of '900, probably because of the contamination of English culture in India a reformist movement began to grow and, in small steps, lit up the people towards the way of Independence. On the night of August 14, 1947 India became independent from the British empire. And it was the beginning of a new era, as Prime Minister Nehru said in the speech to the National Assembly that day.

¹ James Fergusson was the author of *A History of Modern Styles of Architecture: being a sequel to the handbook of architecture* (London 1862). In this book he analysed the topic of European Colonial architecture in India, and it was the base for *History of Indian Architecture*, published in London fourteen years later in 1876

Jawaharlal Nehru (Allahabad, November 14, 1889 - New Delhi, May 27, 1964) was one among the most important figures that emerged in this scenario. His main goal has been to establish a country based on knowledge and science with a strong and modern industry.

Well trained in England where he had been studying Law, Nehru despite having spent a long time abroad maintained a strong connection with the India reality and thus proposed a programme which started in 1947, where science, industry and technology found the new nation. A planned economy was based on five-year economic plans with the aim of improve heavy industries and making the most technologically advanced on work in agriculture.

At the same time another man had been working hard for Indian independence: Mohandas Karamchand Gandhi (Porbandar, October 2, 1869 - New Delhi, January 30, 1948). Until 1947, he was completely dedicated to free India from colonial rule. Even if both were trained in the West they did not share the view of the future nation: Nehru aimed at improving a modern and industrialized industry, while Gandhi wanted to grow the India development on a democracy based on agriculture and traditional value.

The assassination of Gandhi on January 30, 1948, marked a further change in Indian history and left Nehru to run the country towards the future.

Nehru abandoned the old English models starting independent and updated programmes based on humanism, tolerance, reason, progress, adventure of ideas and the search for truth. Thus great responsibility falls on universities and institutions: the education therefore was one of the main areas on which the Prime Minister gave leverage to the rebirth of a country for long time oppressed but with great potential ready to be explored.

4.2 Early modern architecture in India

Until 1947 the architecture being built was not Indian, but rather colonial architecture. The most representative buildings of the English crown were the major train stations, town halls, post offices, that is, the symbols of the power of the empire. Especially in Calcutta, Delhi and Mumbai many colonial buildings in British style were completed in few years, designed by foreign architects. But, once conquered the Independence, this unfamiliar style does not longer responded to the spirit of a young nation, so it was clear that a new identity even in the architectural sphere was needed. Even before the independence a large number of qualified Indian architects started to enter the gate of forward-looking modernism. In 1935 Master, Sathe and Bhuta firm were contacted by Tata group in order to design a landmark in Bombay: the New India Assurance Company headquarter, probably one of the first directly or indirectly influenced by Art Deco style building in India.

In the same period, several cinemas were design I the same style, (see Eros Cinema in Bombay), buildings able to explore the infinite possibilities of the corner and vertical decorated façades.



Figure 4.1: *New India Assurance Building* by Master, Sathe and Bhuta firm (1935), a building influenced by art deco style.

Due to population rise in big urban centre, the 1930s have seen an extensive planning of medium density housing scheme which allow designers to experiment new architectural trends and theories. It is worth mentioning the Gold Finch Apartments by G.B. Mahtre in Mumbai, a complex that brings a real modernist exteriors adding an accurate design of interiors where different layout where thought in order to address the cultural needs of people of different background².

A step closer toward modern architecture in India has been the invitation of international consultants to design new buildings for the aristocratic elite. These architects were actually the link between late colonial architecture and the modernism thought coming from continental Europe and US. Among them Otto Koenigsberger, Antonin Raymond, Walter and Marion Griffin were able to leave the most important footprints of modernism on the Indian fertile ground. Architect like Raymond, a Czech-American professional trained at F.L. Wright office created a very cross-cultural experience: the design for a dormitory building in Pondicherry, the Golconde Guest House, can easily be seen as the first real modern building built in the country³.

4.3 First generation of modernist Architects

In the early 1950s many Indian architects were attracted by Bauhaus paradigms and developed a deep interest in modernism. This open-mind condition led some of them to the design theories of the master F.L. Wright. At that time Wright had been receiving a commission to design the calico museum building in Ahmedabad by the Sarabhai family, one of the most important family in the region.

² See: Lang, J.T., 2002. *A concise history of modern architecture in India*, Delhi: Permanent Black.

³ See: Dilwali, A., Ganguli, R. & Vir. Mueller Architects, 2010. *Golconde : the introduction of modernism in India*, New Delhi: Urban Crayon Press.

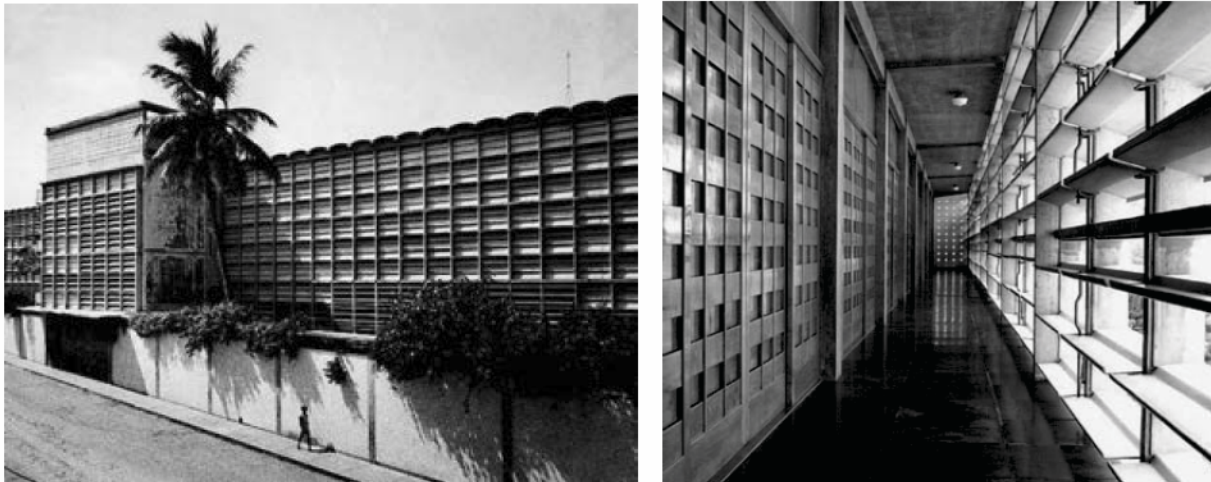


Figure 4.2: Golconde Guest House in Pondicherry by Antonin Raymond (completed in 1942), probably the first modern building built in India.

Even if at the end the building design by Wright was not built, the drawings had a strong influence on younger generation of architects. The first generation of modern architects in India started to experiment Wright and Le Corbusier theories mixing them with empiric solutions based on local context. For instance Gautham and Gira Sarabhai, in 1961, strongly contaminated by Wright ideas designed the NID buildings in Ahmedabad, a building undoubtedly tied up with the master's ideas but bringing also some Le Corbusier innovations (see the structural system)⁴.



Figure 4.3: National institute of Design in Ahmedabad, by Gautam and Gira Sarabhai (1961).

⁴ On the Sarabhais see the interesting PhD dissertation by Elisa Alessandrini: *Ahmedabad, Laboratorio di architettura moderna. Il National Institute of Design (1961-68)*, University of Bologna, Department of Architecture and Urban Planning (2012).

Among the first generation of Indian architects who worked after Independence there was Achyut Kanvinde, Habib Rahman, Gautam Sarabhai, Gira Sarabhai, Aditya Prakash, Balkrishna Doshi, Charles Correa among the best known.

The prime minister Nehru was the main sponsor of these professionals and commissioned important works: scientific institutions, universities, cultural centres, and industries were then built to demonstrate the modernity of the country.

The Indian architects born in the '20s shared an amazing atmosphere of enthusiasm, optimism and the awareness of being invested with the hard mission to build a new nation. Nehru pushed the young architects looking at the West in order to study architecture abroad: most of the first generation of designers thus went to the US for training master's, doctoral or to work at well-known firms, looking for new references, teachers capable of accompanying them to a new phase. Programmes of scholarships were activated to drive the young Indian architects towards specialization course in United States in famous universities such as MIT, Harvard, Institute of Design in Chicago, University of Michigan, Berkeley. Others preferred to being trained by important masters: the Sarabhais went to Taliesin West in 1946; Balkrishna Doshi, had been working in Le Corbusier office in Paris from 1951 to 1954, Durga Bajpai had worked in the office of Alvar Aalto in Helsinki. Probably "The work of the first generation of post-independence modernist architects in India had a profound effect on what followed.

This effect has to be seen in the context of its times. The architecture of the British was politically unacceptable even if its slow three-centuries-long adaptation to regional climates of India was admired. In contrast to what Batley offered, the modernists of the first generation sought complete break from the past and a new vision for the future" (LANG, 2002, p. 58).

4.4 Second generation of modernist architects

The second generation of Indian modernist architects was influenced by the work of international masters that came to India to develop their projects. The works by Le Corbusier and Kahn in Ahmedabad was a sort of big inspirations for the youngest architects, and if probably the French-Swiss master was the most influential due to the construction of several buildings, Louis Kahn was able to leave to Indian colleagues an extraordinary project, the IIM campus, that has been teaching lessons of great architecture for decades. Also some changes occurred in education of architects were a key point towards the creation of a second generation of modernist architects. Teachers such as Charles and Ray Eames were very important to change the way architecture and design were taught in India.

Since the 1950s in this second generation of Indian modernist architects it is possible to see a clear shift from foreign architecture to a more home-born one.

The local inspirations were part of this group of architects design process even if obviously the influence of international ideas was the main fuel for them.

At the same time the work of Indian architects started to receive international appreciation and this really contributed to the beginning of an architectural reform.

While the first generation of modernist architects were still working producing design inspired by the great masters, the second generation was slowly evolving new design tendencies.

Anant Raje, Raj Rewal, Kuldip Singh, Ranjit Sabhiki, Ajoy Choudhury, S.L. Chitale, Utam Jain, Hasmukh Patel, among the others were able to drive this shift for India architecture till the 1970s, during a three decades period into the which a design more linked to local context was pursued.

To solve buildings problems more attention was paid to culture and climate, to heat and dust, and also the social environment became more and more important. India was entering a new era where housing schemes were mainly two: social housing and plotted housing for rich individuals. During the 1960s the main concern of architects was to pursue radical aesthetics able to awake the nation into its modernity, but in the early 1970s many of them felt a new sense of responsibility as environmental designers and problem solvers: that's why the Indian architects in that period began to explore local needs and local context much more than they did previously. By that time it was clear that Nehru's ambitions for India had been overly optimistic.

Europe and Japan recovered from the destruction of the war. India, however, still lagged in establishing a prosperous industrial state. Many problems, including a soaring population, illiteracy, territorial vastness, and isolation of communist, plus political corruption, prevented quick advancement. While the west had been seen as a partner of sorts right after India's independence, it now became a measure of India's economic backwardness.

"A vast chasm existed between the industrialized and developing nations, now commonly referred to as the First and Third Worlds, with the second World, or communist nations, keeping a respectable distance from the third. In addition, it should be noted that modern architecture in India was not always successful. The process of standardization, integral to the modern movement and central to the revitalization of India's construction industry never was fully accomplished in the decades following the independence. In fact the quality of building construction had declined, so much so that by 1960s modern architectures was seen by many as a formulaic way of building cheaply and quickly. There were numerous examples of modern buildings in urban India that gave validity to this exception" (BELLUARDO & ASHRAF, 1999, pp. 13-14).

4.5 Main modern architectures in India

Code	Building name	City	Designer/s	Year
IN001	Golconde housing	Pondicherry	Antonin Rymond	1936

IN002	Gold Finch Apartments	Mumbai	G. B. Mhatre	1937
IN003	Gandhi Ghat	Bankipore	Habib Rahman	1948
IN004	Central Electronics Engineering Research Institute	Pilani	Achyut Kanvinde	1950
IN005	Shodhan House	Ahmedabad	Le Corbusier	1951
IN006	Mill Owners' Ass. Building	Ahmedabad	Le Corbusier	1951
IN007	House Type "5J"	Chandigarh	Pierre Jeanneret	1951
IN008	House Type "4J"	Chandigarh	Pierre Jeanneret	1951
IN009	Sarabhai House	Ahmedabad	Le Corbusier	1951
IN010	House Type "6J"	Chandigarh	Pierre Jeanneret	1951
IN011	House for Minister	Chandigarh	Pierre Jeanneret	1951
IN012	Capitol complex	Chandigarh	Le Corbusier	1951
IN013	B.M. Institute of Mental Health	Ahmedabad	Gautam Sarabhai	1951
IN014	Azad Bhavan	New Delhi	Achyut Kanvinde	1953
IN015	New Secretariat for the Government of West Bengala	Calcutta	Habib Rahman	1954
IN016	Office building for the central Government Account General	Bhubaneswar	Habib Rahman	1954
IN017	Legislative Assembly	Chandigarh	Le Corbusier	1955
IN018	Premabhai Hall	Ahmedabad	Balkrishna Doshi	1956
IN019	Lalabhai Dalpatbhai Institute of Technology	Ahmedabad	Balkrishna Doshi	1957
IN020	Mumbai Indian Institute of Technology	Mumbai	J. M. Benjamin, H. R. Laroia and G. Bijith	1958
IN021	Kanpur Indian Institute of Technology	Kanpur	Achyut Kanvinde	1959

IN022	Tagore theatre	Chandigarh	Aditya Prakash	1959
IN023	India International Centre	New Delhi	Joseph A. Stein	1959
IN024	Government Servant housing at Rama Krishna Puram	New Delhi	Habib Rahman	1960
IN025	Kothari building	Madras	S. L. Chitale	1961
IN026	Delhi Indian Institute of Technology	New Delhi	J. K. Chowdhury	1961
IN027	Rabindra Bhawan Cultural Complex	New Delhi	Habib Rahman	1961
IN028	Arivallabhdas Residence	Ahmedabad	Achyut Kanvinde	1961
IN029	National Institute of Design	Ahmedabad	Gautam Sarabhai, Gira Sarabhai	1961
IN030	Ramkrishna House	Ahmedabad	Charles Correa	1962
IN031	Indian Institute of Management	Ahmedabad	Louis I. Kahn	1962
IN032	CEPT University	Ahmedabad	Balkrishna Doshi	1962
IN033	Islam Gymkhana	Mumbai	Iftikhar M. Kadri	1963
IN034	Gandhi Ashram	Ahmedabad	Charles Correa	1963
IN035	Newman Hall	Ahmedabad	Hasmukh Patel	1963
IN036	Social and Welfare Centre	Mokasan	Hasmukh Patel	1964
IN037	Hostel of Punjab Agricultural University	Ludhiana	Aditya Prakash	1964
IN038	External Affairs Hostel	New Delhi	Habib Rahman	1965
IN039	Shri Ram Centre	New Delhi	Shivnath Prasad	1966
IN040	Pareck House	Ahmedabad	Charles Correa	1967
IN041	Shiv Sagar Estate in Worli	Mumbai	Iftikhar M. Kadri	1967
IN042	Bhaktiben-Hasmukhbhai Residence	Ahmedabad	Hasmukh Patel	1968

IN043	Ford Foundation office complex	New Delhi	Joseph A. Stein	1968
IN044	Apartment tower	Mumbai	Iftikhar M. Kadri and Jivan Manek	1968
IN045	Gujarat State Guesthouse	New Delhi	Achyut Kanvinde	1969
IN046	Inter-State bus terminal	New Delhi	Rajinder Kumar	1969
IN047	Auditorium at Sri Venkateswara University	Tirupati	S. L. Chitale	1970
IN048	Kanchanjunga Apartments	Mumbai	Charles Correa and Pravina Mehta	1970
IN049	Dudhsagar Dairy complex	Mehsana	Achyut Kanvinde	1971
IN050	Lecture Theatres Jodhpur University	Jodhpur	Uttam Jain	1971
IN051	Housing at Malviya	New Delhi	Kuldip Singh	1971
IN052	Readers' Quarters	Ahmedabad	Hasmukh Patel	1971
IN053	St Xavier's Technical Institute	Sevasi	Hasmukh Patel	1972
IN054	State Bank of India	Ahmedabad	Hasmukh Patel	1973
IN055	Otters Club, Bandra	Bandra, India	Iftikhar M. Kadri	1973
IN056	St. Xavier's Primary School	Ahmedabad	Hasmukh Patel	1973
IN057	Sangath complex	Ahmedabad	Balkrishna Doshi	1978

THIRD PART

Chapter 5

Evaluation of topics to be applied

“Technology gives us power,
but it does not and cannot tell us how to use that power.
Thanks to technology, we can instantly communicate across the world,
but it still doesn't help us know what to say”.

Jonathan Sacks

5.0 Chapter abstract

The technological innovation in the field of cultural heritage preservation was, during this last decades, an important tool to support the commitments of conservators and researchers. Nowadays the research for the protection of heritage largely depends on a careful evaluation of the new technologies of investigation and intervention developed also in other areas. These technologies need to be hybridized with the knowledge of architects and conservators and only a gentle process of adapting methods and experimental protocols may allow, in fact, the use of innovative techniques in this field.

Sometimes these technologies are economically uncompetitive if transposed to the cultural heritage preservation field without the right methodology and a proper use. In this chapter the research would like to highlight the possibility of the use of advanced technologies for the survey and condition evaluation of modern heritage. The singularity and sometimes the heterogeneity of the available tools require calibration protocols and ad hoc procedures, which make possible the use of equipment or methods already consolidated. It is, in other words, a matter of use of methods of investigation as much as possible non-invasive and non-destructive, but at the same time specific and highly informative on the state of conservation of these buildings. In this part of the dissertation, great attention was particularly paid to the topics that can be applied to case studies, thus the investigation went through accessible databases and digital archives, BIM model (seen as possible management tools) and the practice of spreading out non-invasive and low cost predicting technologies for cultural heritage preservation

5.1 Technologies for cultural heritage preservation and enhancement

The contributions provided by the ICT in Cultural Heritage sector range from the acquisition and analysis of data, the creation of the digital archives as far as cataloguing, and digital dissemination. “Recently, digitization has attracted increasing interest not only in museology and computer science, but also in economics and managerial literature. Scholars have tried to analyse how technological innovation is reshaping the role and mission of museums as producers and distributors of cultural content and investigate the new business model that emerges” (L. LAZZERETTI, A. SARTORI, 2016).

Since 1970 several collections have been "digitized" taking advantage of the usual photographic campaigns extended to digital format and similarly, later during late '90s it was operated for three-dimensional objects, such as statues, in order to constitute a reference copy of the sculptures exposed to environmental degradation.

In the 1990s the diffusion of digital tools has opened new opportunities for enabling people to select the information contents desired and for recreating immersive and stimulating experiences related to cultural heritage complex.

In the 2000s, the growing of cyber-museology trend has enabled online access to museum collections, allowing visitors to sense the exhibits with a completely new approach. In Europe, the use of technology in the field of Cultural Heritage has been pushed by national governments and the European Union.

This has resulted in the creation of a common digital library (Europeana, released in 2008) that would gather all the collections of European libraries, archives and museums.

Most recently, the focus of the discourse regarding the impacts of IT on CH has shifted from the mere digitisation towards the creation of objects able to act as interactive analyses tools.

In this scenario a development path emerges, leading to an ongoing convergence towards mobile platforms. This new platform is opening unprecedented opportunities for heritage institutions to provide customized interpretive facilities, thanks to a closer integration of different media and functions. Nowadays, researchers can access location-specific contents, tag the artworks, visualize suggestions for further research with other colleagues, or save resources for later analyses.

Over the past decades many applications have been tried through the digital copy: these campaigns have constituted significant result databases of a long process of development of the archives and loading data.

The organization of information within the Data Base Management Systems is today still an operation extremely useful: for instance in designing Virtual Museums or Museums Virtual Networks it must be taken into consideration the fact that a large cataloguing work has already been carried out in whole or in part by institutions and museums. This fact leads, however, to face problems related to interoperability between databases.

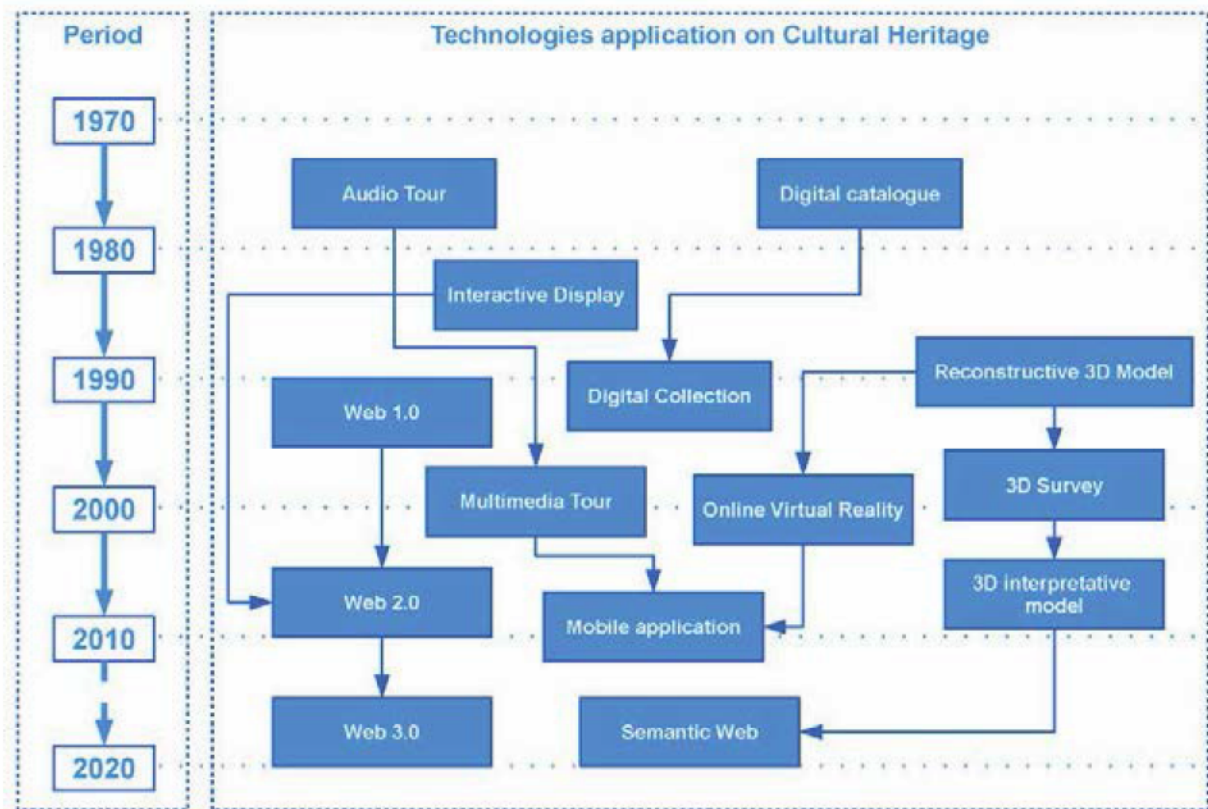


Figure 5.1: Technologies application on Cultural Heritage since 1970.

These problems can appear during the process of access to cultural heritage databases when the latter are made using hard / soft platforms different from the implemented solution used to provide the service. Furthermore there is a problem of conservation of data due to short longevity ICT solution when compared to lifetime of hard documents in archives.

The navigation tools are on one hand the strength of an IT solution on the other side are definitely part of the problem considering the rapid obsolescence of interface solutions.

The ability to access information in a free and direct way, almost involuntary, has certainly contributed to the success of the World Wide Web by removing the barrier represented by the query mask of a database. Among these technologies many applications have been dedicated during the last years to the acquisition of the information by operating both in two and three dimensions. Sometimes 3D data capture scanners were created by consortium and research institutes, in other cases commercial equipment for the acquisition of images or 3D point clouds models have been used.

Clearly one of the discriminating elements is the acquisition process itself, which consists in the "scan" of the object: in this case, with current technology, it is necessary to distinguish between acquisitions completed focused towards a particular state of conservation and acquisitions intended to provide an acceptable representation of the original for dissemination purposes. These considerations led to the idea of creating databases designed to be a permanent reference to the state of conservation of cultural

heritage. Such information can help you to improve the knowledge on the property, assess the accuracy of a restoration work or in other cases it can be used to simulate virtual design operation.

5.2 Creating accessible databases and digital archives

The cultural heritage can be represented using the most suitable technologies. In the case of architecture, they can be used the techniques such as modelling 3D, virtual reality, animation, or digital movie.

All these tools are not gadgets, but digital tools to facilitate the understanding and study of both built or unbuilt projects, offering opportunities of analysis in an immediate way. That's why the real key to a revolution in this field is certainly the use of telematics networks for knowledge sharing.

In fact, they provide access to a wider cultural heritage and thanks to search engines specially designed, you will have access to big data bases, not only with traditional searches but also for information such as images, templates, themes, etc.

All this will offer the student the opportunity to develop surveys of large databases on the net looking for example at all the buildings by a particular architect. The professionals, researchers and students can access information about the works, wherever it is stored, and compare them all similar works.

In contrast to this potential, it is important to highlight today and even more in the near future, the abundance of data on the network generates pathological effects, including uncontrolled proliferation of references and lack of validity and reliability of the information transmitted.

The set of data, paper documents, drawings, photos, is a source, which, if not properly structured, and cleaned up to remove redundant information, it could appear to be out of control both in terms of accessibility and verification of the information accuracy.

Nowadays there is a repeatable model that allows step by step, from conception, composition, until the finalization of the data through a methodology for data cataloguing. Understanding architecture project and being able to reproduce them with digital technologies will also improve the conservation of design process. Actually, the preservation of the architectural projects by the masters is becoming nowadays a crucial point. Very often cultural foundations that manage the archives of the great architects of the twentieth century are not always able to ensure an effective conservation because of lack of funds. Redrawing the modernist architectural projects also means preserving the lessons learnt in terms of architectural and spatial composition. The information system, consisting of sketches, drawings, images, maps needs thus to be understood and represented with all the features it brings, a set of elements linked by hierarchical relations in a sort of conceptualization of reality. The youth students and researchers can play a key role in this process, as stressed by A.M. Ronchi about digital literacy "there is a need to channel the creative energies of young people by promoting digital literacy in the field on new ICT-enable or empowered creativity and expression. There is also a need to create a proactive environment that enhances the overall quality of eContent products. Digital and social divides must be bridged in order to provide access and added value to citizens. Digital technologies and ICT tools provide an incredible

opportunity to encourage growth and prosperity. Digital content and services empowered by broadband communications, both wired and wireless, could have a significant impact on society. One of the first steps in this direction is to promote human networking and the exchange of experiences and skills amongst different groups and communities” (RONCHI, 2008, p. 14).

5.3 BIM model as possible preservation tool

Building Information Modeling (BIM) is becoming increasingly important in the construction industry for the production of 2D CAD-based drawings automatically extracted from the three-dimensional model. This tool requires parametric models in which objects have relationships with others and also brings technical attributes.

The BIM environment allows to work with intelligent objects able to relate to each other, requiring a high level of specialization from the user, with a designer approach. Therefore the creation of construction components from catalogues of producers or ad hoc project libraries has been studied in deep but not as much as the production of BIM models of existing complexes, where the information is primarily to be found (by documentary investigation and essays)¹.

The field of research is moving towards the of HBIM models, intelligent objects with different descriptive levels based on accurate as terrestrial laser scans or high-definition digital photogrammetry.

Historic Building Information Modeling (HBIM), is a new approach for the documentation, and the calibration of restoration works or new construction in historical contexts. This approach is of course referring to the use of BIM technology for modeling of historic structures surveyed with several modern technologies: the HBIM process begins with remote collection of survey data using a terrestrial laser scanner combined with digital cameras. A range of software programs is then used to combine the image and scan data. The survey of historic buildings, and their constituent elements requires methods of data capture able to describe every single detail in an effective manner. For HBIM approach, however, the geometric model constitutes the "table of contents", available to get the information such as the individual components of the system or the degradation of the structural system in order to perform proper interventions, depending on the level of detail available into the database. For sure architectural organism knowledge must be very wide and this requires many efforts to investigate all possible sources of information that an HBIM model can offer. The complexity of the historical structures makes it very difficult for parametric modelling the lack of algorithms and processes capable of precisely reconstruct 3D shapes.

¹ See also: Apollonio, F.I., Gaiani, M.; Sun, Z. (2017). *A Reality Integrated BIM for Architectural Heritage Conservation*, in: *Handbook of Research on Emerging Technologies for Architectural and Archaeological Heritage*, Hershey: IGI Global, pp. 31-65.

Generation and the management of an accurate HBIM can become a challenge when complex because some items can not be simplified with basic geometric shapes. In fact, most of the approaches 3D reconstruction tend to generate meshes from point clouds to create a 3D model by photogrammetry and laser scanning data. On the other hand, 3D reconstructions based only on jerseys are not optimal for BIM because of parameterization and memory issues.

An interesting research about this topic has been carried out at the Politecnico of Milan, Italy, where a research group have been investigating the possible use of NURBS instead of MESHES.

“NURBS are mathematical functions defined in parametric form and can be interactively manipulated to reconstruct complex shapes. The goal of the work is the use of models based on NURBS curves and surfaces for HBIM to provide an efficient solution that takes into consideration the basic requirements of the surveying project (metric scale, accuracy, level of detail, etc.). At the same time, it provides an efficient solution for the use of the model in interactive 3D modeling environments” (BARAZZETTI, BANFI, and BRUMANA, 2016, p 104). In this wide and changing framework, modern architecture, even when accurate 3D surveys are not available, for its intrinsic characteristics is suitable to be represented and studied through BIM approach. The use industrialized components and contemporary materials makes this type of architecture an easy subject for BIM analysis based on documentation found in the archives of the foundations². Anyway, it is worth to take into consideration that the communication processes dedicated to cultural heritage representation sector have a reasonable degree of complexity. Some of the main difficulties in relating to cultural heritage communication process are generated by the fact that usually the work belongs to a different historical / cultural context and was probably located in a different place and not accessible. Thus the attention must be paid to the reconstruction of the original context and information science and in particular the areas of hypermedia and computer graphics offer a fertile ground for developing similar applications. The reconstruction of local environment is another important aspect particularly close to the reconstructions, the so called "spatial contextualization" that is, the ability to insert the virtual model in the exact location without changing any of the spatial relationships between the model and all other objects in the scene.

5.4 Spreading out non-contact and low cost predicting technologies

Many different non-contact technologies can be used to assess the morphology and the state of conservation of cultural heritage. Among these, 3D-scanning devices are the most suitable ones even if limitations are still present, for example, with shiny, mirroring or transparent objects such as waters. The collection of 3D data in cultural heritage preservation fields is useful for a wide variety of applications and it could be also integrated with other technologies in order to improve the overall knowledge about

² See: Gaiani, M., (2013) Analogue to digital conversions: a new life for architectural drawings, in: ANIMATED ARCHIVE, Milano: ELECTA, pp. 132 - 148

the object. Among the non-contact equipment it is possible to identify active scanner, equipment that emits some kind of radiation or light and detect its reflection or radiation passing through object in order to probe an object or environment. Possible types of emissions used include light, ultrasound or x-ray.

Mainly the two types of non-contact equipment are time-of-flight and triangulation.

The time of flight are usually used to scan buildings to produce a 3D model.

The time-of-flight 3D laser scanner is an active scanner that uses laser light to probe the subject. A laser is used to emit a pulse of light and the amount of time before the reflected light is seen by a detector is measured. Since the speed of light is known, the round-trip time determines the travel distance of the light, which is twice the distance between the scanner and the surface.

On the other hand triangulation based 3D laser scanners are also active scanners that use laser light to probe the environment. With respect to time-of-flight 3D laser scanner the triangulation laser shines a laser on the subject and exploits a camera to look for the location of the laser dot. Depending on how far away the laser strikes a surface, the laser dot appears at different places in the camera's field of view. This technique is called triangulation because the laser dot, the camera and the laser emitter form a triangle. The length of one side of the triangle, the distance between the camera and the laser emitter is known. The angle of the laser emitter corner is also known. The angle of the camera corner can be determined by looking at the location of the laser dot in the camera's field of view. These three pieces of information fully determine the shape and size of the triangle and give the location of the laser dot corner of the triangle.

Data captured by laser scanner equipment after on field campaign have to be elaborated in order to create a useful 3D database. These data can be then utilized in order to extract geometric information related to the building (such as plans, sections, etc.) at different scale, depending on the required level of detail. As stated, 3D laser scanner outputs (point cloud) could also be integrated with other source of information, such as high definition photographic images, thermal images or spectrophotometer data (colour analyses). These data are pretty often difficult to be managed due to:

- File size
- Lack of interoperability between survey tool and modelling software
- Elaboration of data

If the representation needed is a 2D drawing (plan, section or elevation) the new functionalities offered by the software help the operator but are no longer enough for a complete description of the object. For this reason the attention is focused on the creation of parametric and non-parametric models inside the BIM process, in order to be able to assign all the collected information to the represented building³.

³ Barazzetti, L., Banfi, F., & Brumana, R. (2016). *Digital Heritage. Progress in Cultural Heritage: Documentation, Preservation, and Protection* (p. 917). Berlin: Springer Berlin Heidelberg.