Università degli Studi di Ferrara | DA Dipartimento Architettura Ferrara | UNIVERSITETI POLIS

Conservation and Enhancement of Indian Architecture

Integration of survey and comparison analysis processes for the conservation and valorization of Cultural Heritage

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Cycle XXXI

International Doctorate in Architecture and Urban Planning

Università degli Studi di Ferrara | IUSS

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PhD Dissertation

Conservation and Enhancement of Indian Architecture Integration of survey and comparison analysis processes for the conservation and valorization of Cultural Heritage

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Conservation and Enhancement. Nowadays one of the most important debate ongoing, that involves every level's actors in field of Architecture, Urban Planning, as well as promoters and stakeholders, is on the connection and interrelation in between these two fields of study. The introduction of the new concept of Industry 4.0 and the continuous need for growing of living standards, together with daily innovations in the AEC world (Architecture, Engineering and Construction Industry), is leading towards new horizons the entire concept of conservation of ancient architecture.

Thanks to the growing possibilities of comparison in between way of living among different parts of the world, the individual and diffuse instinct in economically emerging countries is to reach a better state in the healthy possibilities and wellness. In these nations, the impulse towards a growth of the wellness conditions is usually combined with a conspicuous availability of free land plots and the willingness of moving towards new production areas. Ancient areas of cities were not commonly considered within this progress part of the possible evolution: in certain cases, as a matter of facts, city centres of developing nations became omitted areas, seen as not productive ones.

The analysis of the difficulties that actors as municipalities, trusts, foundations and NGOs are facing because of the quick development and different government directions, focuses this research on the necessity of introducing an inspection methodology for the heritage centres that has to be as less expensive as possible from three main points of view. Economical, timing, easiness.

The aim of the research is to define a documenting methodology that allows the creation of a cataloguing system of areas of not-yet-surveyed historic centres, in order to highlight possibilities towards the definition of conservations' primer focuses. Therefore, the study emphases on urban context with the complexity of an initial organic settlement with two case studies in north India: Ahmedabad, Gujarat, and Jodhpur, Rajasthan.

Dissertation table of contents

Part 1 – Introduction

1. Research field: Documentation for conservation and enhancement

Conservation and Enhancement.

Nowadays one of the most important debate ongoing, that involves every level's actors in field of Architecture, Urban Planning, as well as promoters and stakeholders, is on the connection and interrelation in between these two fields of study. The introduction of the new concept of Industry 4.0 and the continuous need for growing of living standards, together with daily innovations in the AEC world (Architecture, Engineering and Construction Industry), is leading towards new horizons the entire concept of conservation of ancient architecture.

In fact, the push towards a progress of our metropolis and the creation of advanced smart cities in the new areas with zero carbon emission proposes are currently in the centre of a debate that involves municipalities, study centres and professionals. The conception of a new way of living, within a place that can give an answer to all the requirements, together with the desires, of the contemporary society, is conducting the majority of the human efforts towards the definition of new areas to occupy.

Nevertheless, resulting from many factors, including the reduction of distances in between the different part of the earth and, mostly between the different societies, thanks to prodigious and most of time fascinating transformation in the connecting tools of the today's culture, this intent towards a better healthy situation and the diffuse impulse towards a renovated concept of evolution belongs nowadays to all the classes that compose the human community.

As a matter of facts, thanks to the growing possibilities of comparison in between way of living among completely different part of the world, the individual and diffuse instinct in economically emerging countries is to reach a better state in the healthy possibilities and wellness. This brings the construction world towards new peaks of production that are sometimes laudable and sometimes arguable. Composing the differences among these two typologies of path towards the change are many factors. In both cases the urbanization (Un-Habitat, 2003) is a common character, if

the discussion concerns the creation, as previously said, of new smart cities, as well as retrofitting old ones.

One of the risk of this quick process in economically growing countries is the creation of unplanned areas of conservation. In fact, concerning the developing nations, the impulse towards a growth of the wellness conditions is usually combined with a conspicuous availability of free land plots and the willingness of moving towards new production areas. Therefore happens that the first evolution of the cities involves the creation of new suburban decentralized and prolific zones.

Because of this, ancient areas of cities were not commonly considered within this progress part of the possible evolution: in certain cases, as a matter of facts, city centres of developing nations became omitted areas, seen as not productive ones. Some of them has been left without urban planning and regulation for a long time: sometimes the areas were converted into new skyscraper shaped centres, following the ideal creation of an economically tertiary city within the city; sometimes the carelessness converted them into slums.

On the other hand, the growth of touristic quantitative flows in the last three decades is converting the vision of these areas in a part of the economically interesting ones. The word conservation with an omni-comprehensive significance of the term, without a regulation and without a precise background, connected to the historic centres, became part of the common dictionary of investors, construction enterprises architect and urban planners: in many of these nations the position and the role of conservator results quite new.

However, this idea of touristic possible incomes creates the new necessity of refurbish existing buildings: the city centres' enhancement of economically emerging countries towards the creation of a new economy that bases itself on the valorisation of the same historic areas. The significance of "Historic Centres", before the advent of this new concept of heritage, was limited to precise monuments, conceived as important structures that has to be maintained and preserved: this gave the "local perception" of conservation. Nevertheless nowadays, the important of the preservation of the historic city centre is becoming one of the crucial aspects also for countries like India, Brazil and many others in quick development process. Conservation and Valorisation are strictly connected, because of factors as economic interests, policies that trusts, municipalities and privates are following: the conservative action needs funding and the valorisation of the beauties and history of one place is the main

chance to raise funds.

In the process of understanding the right path to analyse, conserve and enhance historic centres in economically growing nations, many study activities have been created and pursued involving research centres from all-over the world.

2. Heritage: same wor(l)d different meanings

The word Heritage is not intended with the same meaning from east to west of the world. An example of these differences is evident looking at the definition of Ancient Monument from the "Archaeological Survey of India[1]" (the word Heritage is not even mentioned):

"any structure, erection or monument, or any tumulus or place of interment, or any cave, rock-sculpture, inscription or monolith which is of historical, archaeological or artistic interest and which has been in existence for not less than 100 years and includes

1. *Remains of an ancient monument,*
2. *Site of an ancient monument,*
3. *Such portion of land adjoining the site of an ancient monument as may be required for fencing or covering in or otherwise preserving such monument, a*
4. *The means of access to, and convenient inspection of, an ancient monument;*

The section 2(d) defines archaeological site and remains as follows:

Archaeological site and remains means any area which contains or is reasonably believed to contain ruins or relics of historical or archaeological importance which have been in existence for not less than one hundred years, and includes

1. *Such portion of land adjoining the area as may be required for fencing or covering in or otherwise preserving it, and*

[1]The Archaeological Survey of India (ASI), under the Ministry of Culture, is the premier organization for the archaeological researches and protection of the cultural heritage of the nation. Maintenance of ancient monuments and archaeological sites and remains of national importance is the prime concern of the ASI. Besides it regulate all archaeological activities in the country as per the provisions of the Ancient Monuments and Archaeological Sites and Remains Act, 1958. It also regulates Antiquities and Art Treasure Act, 1972

2. The means of access to, and convenient inspection of the area"

(Archaeological Survey of India, 2008)

Is it possible to understand from this vision that one of the characteristic that a monument should have in order to be considered as Heritage (as "Ancient Monument" that has the need to be preserved and restored) is the age: 100 years.

On the Venice Charter where is possible to find probably the first (Vecco, 2010) western definition of Historic Monument:

"The concept of a historic monument embraces not only the single architectural work but also the urban or rural setting in which is found the evidence of a particular civilization, a significant development or a historic event. This applies not only to great works of art but also to more modest works of the past which have acquired cultural significance with the passing of time."

(ICOMOS, 1964)

As for these differences in the definition itself, it is possible to identify an apparent problem of recognition or in sharing the meaning of the word heritage in different countries.

With the first definition seems that just monumental objects only, as the Colosseo in Rome (Italy), or the Taj Mahal in Agra (Uttar Pradesh, India), or the Stirling Castle (Scotland), can be enumerate in the list of Heritage sites. However, the second definition let us include a wider dimension of entities: the complete urban setting and its influence in the process of civilization. In this second assumption, the definition of heritage gives another vision. The importance of the object, without taking in charge any "amount" of time.

Meanwhile India is a quick developing country, where the definition of heritage is related to time. This means that the economic development of these countries, mainly named as BRICS (Wilson and Purushothaman, 2003) (in the Goldman Sachs' meaning of Brazil, Russia, India, China and South Africa), will proceed in a certain very short amount of time. A more precise detail on India's economic evolutionary situation is the following:

India has the potential to show the fastest growth over the next 30 and 50 years. Growth could be higher than 5%over the next 30 years and close to 5% as late as 2050 if development proceeds successfully.

Overall, growth for the BRICs is likely to slow significantly over this time frame. By 2050, only India on our projections would be recording growth rates significantly above 3%.

(Wilson and Purushothaman, 2003)

The economic growth of those countries is carrying new needs to the citizens and what is commonly recognized as Heritage is probably not conserved in the best way because of two main reasons:

- the fast development due to the quick incoming of new needs
- the different identification of the concept of Heritage

These two reasons brought in the developing countries and mostly in India itself, the creation of a degradation processes of that places that have not the possibilities to satisfy the new needs, as the historic urban settlements. The economic interest moved outside the historic centers toward the new surrounding areas mainly in the past 30 years: people started migrating to newer areas of the city seeking modern settings and facilities, resulting in neglecting of the ancient houses. Deterioration and degeneration of the heritage resources were further induced by changes in the land use, resulting in the breakdown of the traditional social fabric, pressure on infrastructure caused by subdivision of houses, etc. (Ghosh, 2015)

Due to these differences in the way of thinking the heritage in between the western world and India, it is easy to extend the concept also to the conservation field. As a matter of facts, many of the efforts in the conservation and retrofitting field in India are directed to the preservation of the historic monuments (with more than 100 years, as previously said).

Often the municipality themselves are more interested to restore places “how they were and where they were”, because of the well-recognized essence of the place. The majority of money incomes of touristic places in India are due to national movement of people and not international. Because of this, the typology of conservation or recovery of monument municipality acts is mostly oriented for a national tourism, with the conception of Heritage we previously clarified.

Essentially, it is possible to generalize this concept, but considering the presence of some outliers. As a matter of facts, there are, in the set of offices mentioned before, commendable ones: trusts, municipalities and privates, interested in a more contemporary sense of the Conservation.

The conservation ideologies of the ASI (Archaeological Survey of India) are still based on the Conservation Guidelines that were originally adopted by John Marshall, founding Director General of ASI, in 1924. These guidelines, for example, advocate against the full restoration of ancient monuments and historical buildings. The same ideology is also reflected in the UNESCO’s Venice Charter in 1964. Many of these ideologies are increasingly being questioned by conservationists and historians as being outdated and as not reflecting contemporary approaches to conservation.

(Rajadhyaksha, Radhika and Tenkayala, 2013)

3. The aim of the research

The aim of this research is to understand, basing on literature and on field quantitative and qualitative documentation, the most appropriate methodology of analysing historic centres in economically emerging nations, in order to prime a conservative virtuous processes between the institutions that have possibilities and willingness to pursue this aim, and the old city centres themselves.

The research structures involve multidisciplinary aspects laying in between the conservation and the analysis methodologies: a first analysis of the state of art on conservation actions ongoing and the definition of heritage concept for developing nation, that has different aspects in between different theoretical conservation backgrounds, highlights possible interstices of dialogue that have possibility to prompt the enhancement process. The analysis of the difficulties that actors as municipalities, trusts, foundations and NGOs are facing because of the quick development and different government directions, focuses the research on the necessity of introduce an inspection methodology that has to be as less expensive as possible from three main points of view. Economically, because the majority of funds of the heritage-interested actors are devoted to the continuation of the actual economically growing trend; nevertheless, these entities recognize the increasing need of heritage conservation, moreover in the situation where the heritage tourism is the central focus of their income. Temporally, because the process of losing heritage features inside the old city centres, due to apparently valid and actually infectious inhabitants' actions, is becoming daily quicker. The economic new trend, combined with new needs, that brings not planned solutions, and the increasing willingness to have a part of the growing economical possible incomes, is boosting the construction works inside the city centres to accelerated levels. Last point of view is the simplification, because of the introduction of a new methodology in areas that have most of times limited backgrounds in the field of analysis propaedeutic to the conservation. The simplification of the methodology is one of the focusing point of the study for another reason that regards the feasibility of the method: in fact, decreasing the level of complexity of the scientific approach it would be possible to adapt the outcomes to deal also with the study of other contexts with similar peculiarities.

4. Subject, phases and limitations of the research

Subject

The decision to examine the field of construction and conservation, to analyse the behaviours of actors and to investigate the most appropriate methodology of study historic centres, and to elaborate a theory that can eventually become feasible on other territories need some initial clarification.

As for the aim of the research, to define a documenting methodology that allows the creation of a cataloguing system of areas of not-yet-surveyed historic centres, in order to highlight possibilities towards the definition of conservations' primer focuses, the investigation has to be applied on a high-dense context. This will bring the major number of problems in the definition of the issue of "what to conserve – enhance". A highly dense context, or high dense urban environment could be considered as an attribute composed of an elevated level of urban metabolism or pressure: concerning a study on the conservation of old cities with the previously described factors, the concept of dense consider a wider number of attributes. The architectonic historical stratification of a city, because of consequential eras that concerns a process of overlapping of different architectural typologies, as the advent of new conquerors or colonialisms, different layers of the typical hierarchical structures that creates a morphological variation in the building asset, dimension and usage, are most of times some of the density factors this research treats.

One of the crucial premises of this research is the following: in case there is the possibility to find an analysis model of a high dense context, it will be possible to simplify the same for less complex urban centres.

Therefore, the study focuses on urban context with somehow the difficulties of an initial organic settlement: the however planned composition of an town centre would shift the feasibility of the research just on (future) study cases that have an initial planning of the settlement. The identification and the focus on non-planned structures of the study gives the possibility to apply the same methodology also to planned one. As a matter of facts, the study has the basis on an initial apparently chaotic situation, with some new characters that could be recognized as an

attempt to re-construct somehow a standard. This willingness came just some few decades ago, with a vision of transformation of historic centres into new areas, with sometimes an insane sense of westernization that only in certain cases is giving back commendable examples of an integrated urban plannings and the local traditions. In other cases the push towards the westernization, because of a lack of monitoring possibilities or incorrect readings of the historic context, is creating a punctual and not planned over-westernization in scale that have nothing in common with the ones taken as examples. Advancement and growth, without development and progress in research, are rarely good inputs for a methodical and consequential conservation of the heritage of a whole city centre.

For these reasons, the research focuses on one of the quickly emerging nation, which is facing problems, but, on the other hand, which has the willingness towards the conservation of over-layered heritage centres, that could be some of the future most important incomes economy of the country: India. Of course, it is not right and impossible to generalize the debate over all the country, that is why the premises and the study inserted in the State of the art is focused on old centres that face problems in the management of the heritage structures of the old cities.

Phases

The definition of operative methodology to check precise characters of Indian heritage centres that leads to a dissertation on the qualitative and quantitative indicators, with the aim of highlighting problems and giving possibilities to analyse the primer actions for a renovation, was developed in the following stages.

The analysis of the State of art focus on the present situation of the construction field in the heritage areas and the definition of the heritage concept in the economically evolving nations: the research examines differences in the care of punctual (heritage recognized and listed) elements and in the city whole structure. In this scenario, an examination of the tendencies that creates the problem of preservation and enhancement of the old centres gives a wide vision on the issue of the quick changes of citizens' needs and willingness. This, together with a lack of municipalities' monitoring power on every construction work, brings the majority of the documented case of this research to an apparently evolution in the situation of the inhabitants,

which, finally seem to be part of the new economic trends. On the other side, the inspection will highlights problems in the whole urban structure that the unplanned and non-monitored process of development is implying.

On order to understand if it is possible to find comparable urban characters in between the period before the last decades' development and the current situation (after three decades from the beginning of a massive liberalization of the economy) a literature study shows the catalogues that have been done in the past from certified bodies on the situation of old urban centres. The aim of this part is the identification of prominent changes in the characters of the historic cities that creates current disadvantages in certain areas. The analysis of these mutation's characters allows the creation of a set of indicators that can be used in other areas also, having the same accuracy of results.

On the other hand the research focus on the identification of the typology of actors that have possibility to prime a mutual requalification that can deviate the actual tendencies of restructuration towards more conservative approaches. In that part the study highlights limitations and opportunities of Municipalities with the connected sub-bodies, then NGOs, Foundations and Trusts.

After the inspections on the state of the art and the punctual description of the proposal of the research, the methodology of approach to the heritage centres in emerging nations is divided in the explanation of the concept of:

- analysis of urban models and identification, due to the literature review and on-field documentation, of different elements that compose the heritage body
- definition of methodology to approach the identification of these attributes
- inspection of relational function that are causes of the modification in the relation in between the heritage listed and recognized areas and old city centres

Equipment part introduces some possible tools that leads to the adaptation of the illustrated methodology: with the explanation of some partial case studies, the research shows the application of precise technologies. The final step of the study is the complete application of the methodology towards the identification of veracity index that comes from the precise clusters' samples choice.

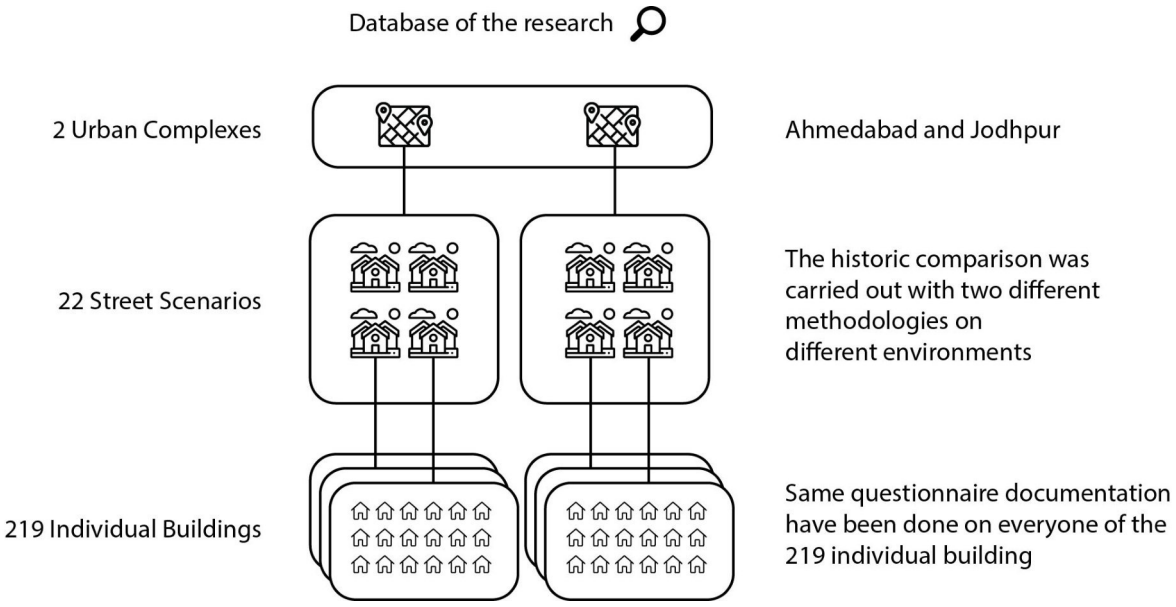


Figure 1: The image is a schematic representation of the quantity of data surveyed in the creation of the research.

Limitations

The domain of the research has some limitation because of the difficulties in finding literature on the field of conservation in India that regards the conservation of normal and standard buildings in heritage cities. The review of previously written essay or studies and the entities that undertook the challenge of creating a catalogue of the old townscape is analysed in the chapter 6. Catalogues of historic heritage in India.

On the other hand, this partial lack of information was replaced with a deep and long analysis on field that started with a research experimentation of 2012 and that found the turning point in 2017, with a second survey and the comparison with the five years older documentation.

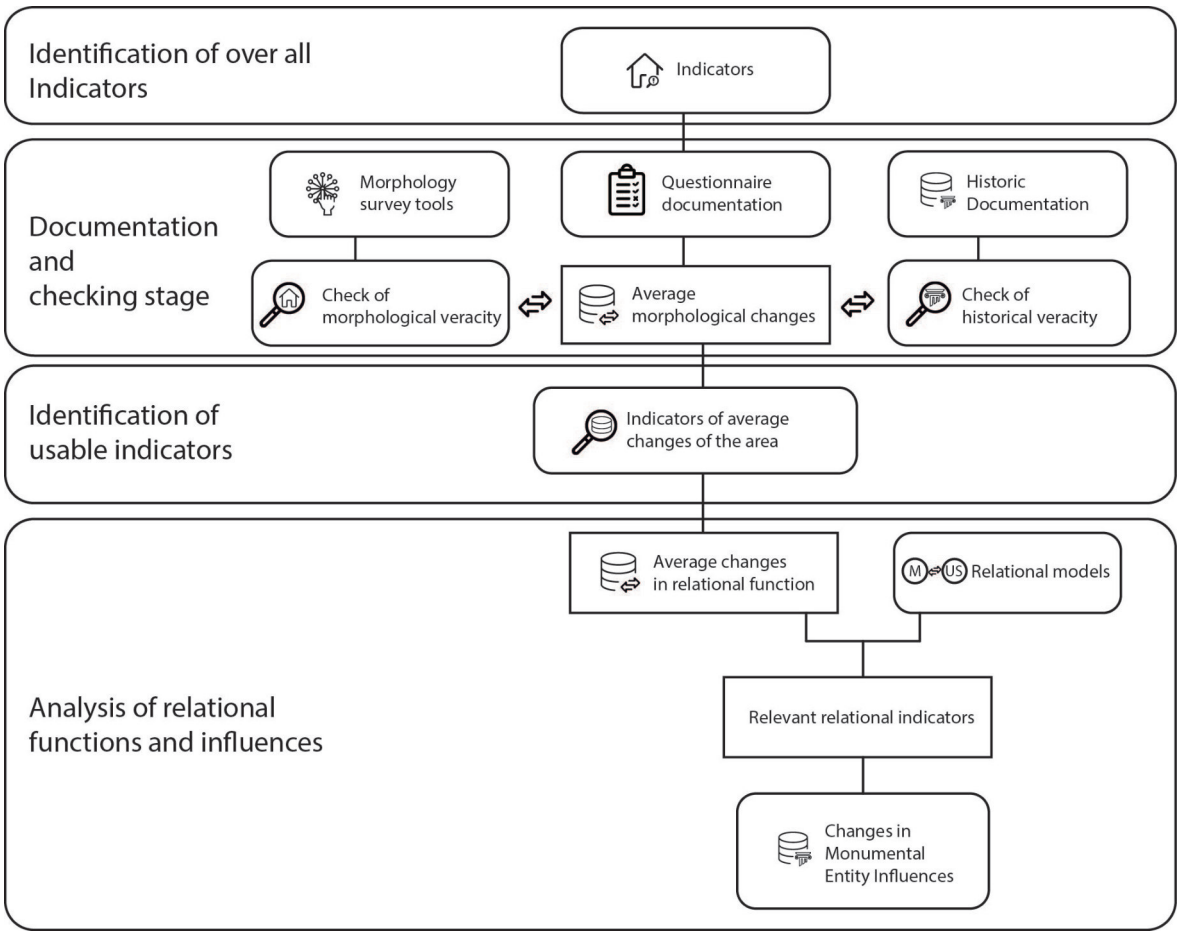


Figure 2: The scheme represent the idea of mixing different steps of check thanks to different tools.

Nevertheless, in order to create the investigation and cataloguing methodology many international reviews on the field of new technologies and procedures has been examined. Therefore, it seems to be important to say that the modern survey technologies of 3D laser scanning with the point cloud study, as the BIM (Building Information Modelling) and many others, were taken initially under consideration in order to use them in the creation of a unique omni-comprehensive methodology: that would have led from the beginning of the documentation processes till the completion of the process.

However, the literature research highlighted the high number of different tools, together with the need of highly skilled technicians to operate with those specific tools. Because of this reasons, in order to respect also the initial criterions of easiness / cheapness / quickness, the research adopted the theory of Bootstrapping applied in architecture: Bootstrapping is a term currently used in business to refer to the process of using only existing resources. The decision to examine the research with a Bootstrapping vision is necessary in order to respect the criterion previously

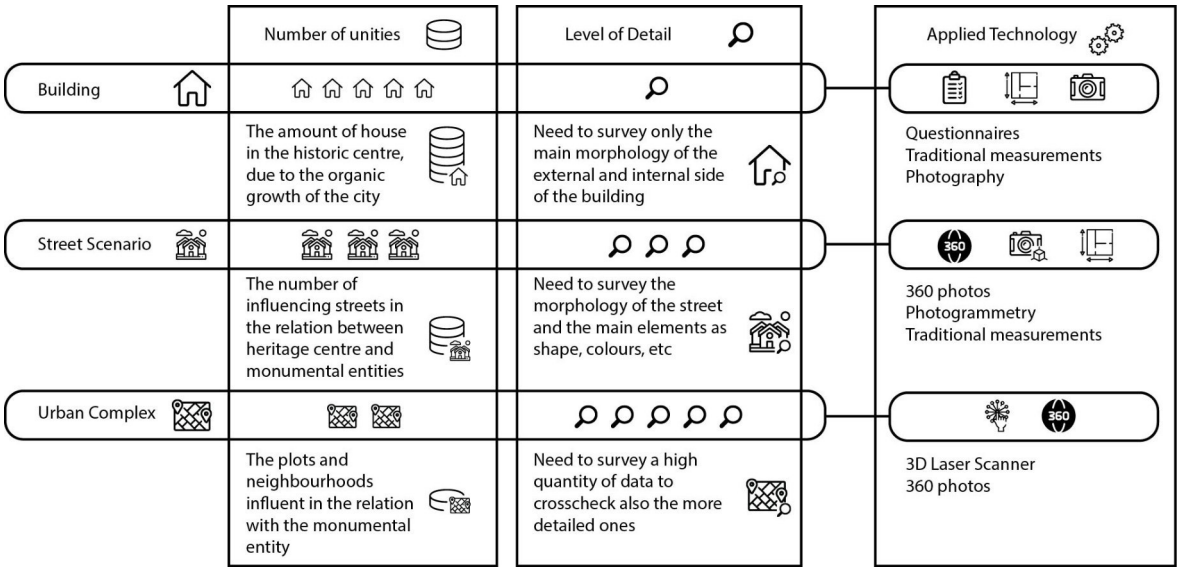


Figure 3: Tools adopted in the research and detail needed for different scale of inspection. The technologies were chosen in a Bootstrapping composition way

remembered. The usage of free instruments, to create the tools for the application of the methodology of documentation, decrease considerably the initial investment, in order to prime the establishment of research centres that have the possibility to develop the present research on a more institutionally recognized path. In fact, the limitation caused from the decision of application of Bootstrapping theory on the architectural field are a limited possibility to apply more precise technologies and have a more precise data.

Nevertheless, in order to balance this initial disparity, a veracity index of the resulting data is analysed and inserted in the checking stage of the documentation: these morphological checking actions have been created with a cluster determination and extraction of representative samples. The operation introduce compensation factors in the documentation that allows to apply the Bootstrapping theory with more monitored and correct results. On the other hand the usage of “only existing resources” allows a continuous change and improvement of the same towards even more precise results, at every change of one of the adopted methods.

PART 2 – The state of the art

5. Issues in preserving heritage in an emerging countries: the Indian urban scenario

In the field of heritage preservation in emerging nations the usual first step is the identification of the quality and quantity of heritage sites.

This means the cataloguing of historic buildings (Brusaporci et al., 2012) that are icons of identity of a place and its past, which have been altered in many places along emerging nations because of some reasons: new urbanisation or extension of settlements, with integration of functions that solves apparently new needs of the population, are creating the problem of preserving without devitalizing some areas.

This chapter introduces the problems of the preservation of heritage urban sites in emerging countries focusing on India case. Urban development processes followed in places like India after the independence caused dangerous and very quick loss of heritage as intended in western countries. Many efforts to protect that heritage has been carried out all over the world, coming from developed countries, and from the emerging nations also.

In India the body named Archaeological Survey of India (ASI), together with other state's departments, are already protecting almost 10.000 monumental structures (Archaeological Survey of India, 1998). However, for an extended country as India is, that is a very small piece of the entire amount of monuments. In 2005 was published in India by the Ministry of Urban Employment and Poverty Alleviation and Ministry of Urban Development the "Jawaharlal Nehru National Urban Renewal Mission" with the following Mission Statement:

The aim is to encourage reforms and fast track planned development of identified cities. Focus is to be on efficiency in urban infrastructure and service delivery mechanisms, community participation, and accountability of ULBs/ Parastatal agencies towards citizens.

(Ministry of Urban Employment and Poverty Alleviation & Ministry of Urban Development, 2005)

Inside the jnNURM (as it is normally named) is it possible to read that one of the eligible sectors that can be assisted tanks to that document by the government is the

(7) Development of heritage areas

Therefore, the preparation of lists, a census, comprehensive of all the areas has been undertaken from that moment by the local bodies, that moves under the guidance of the jnNURM rules and structure, within the creation of City Development Plans and many other instruments. However, the efforts was not enough to set clear directions in the heritage preservation of urban areas considered as historically important sites. The jnNURM has been followed by many research and studies (Ghosh, 2015) on the city old centre preservation, based on the same methodology. However, the amount of heritage sites and the quick evolution of the country are not allowing the correct and complete conservation of those areas. Some of the problems are connected to the decentralization of powers (74th amendment of the Indian Constitution) to the Municipal Bodies that have not the complete monitor on the heritage centres (see chapter *5.3. Lack of monitoring from municipality and weakness of urban planning*). Some other places have moved towards the conservation setting up Heritage Cells inside the Development Cell of the municipal corporation (see chapter *7. Actors of the conservation and enhancement in India*).

5. 1. Site works management and levels of criticality

One similarity for all the emerging countries as India is that the construction market is quickly growing because of many factors: most evident is the investment boost in the development of the sector. The budget allocation for infrastructure by government has been increased 1.5 times in 2015 reaching 2.8 trillion Indian rupees as annual budget (more than 33 billions of euros). Of course this kind of investments regards public infrastructures as streets, railway new lines and new development of urban supplies (DMG events India, 2015). The expectation of growth is 7-8% annum for the construction industry in the next 6 years.

However is evident how the high level boost influences all the sectors in the construction field: the possibility to find low cost materials and the basic construction knowledge, the easy employment in an enterprise and the reduction of transportation costs are just few of the factors that can influence the little environments. However, in order to better analyse the growing economy in the construction works in emerging country, this chapter contains a comparison between the influential factors in the cost for the building sector in emerging nations and the developed ones.

In fact, the realization of a conservation or a “retro-fitting” construction work in the emerging countries has on one hand some similarity and on the other some differences in comparison with the western nations.

Regarding the typology of buildings we are taking in charge for this study and the difficulty to understand the first-construction period of each structure the chapter *11. Analysis model for identification of new and old elements in the heritage city centres of emerging countries* introduces some possibilities of analysis.

The aim of this chapter is to evidence the main factors influencing the construction world in the heritage centre of small-medium size Indian cities.

It is possible to catalogue, as a normal procedure in western countries, the total construction cost into three additive groups:

- Technical construction cost, which comprehends the construction materials, the employers’ fees, rental expenses and transportations

• Construction cost, which comprehends, together with the technical construction costs, profit of the enterprise, workers safety care costs, leasing for workers

• Production cost, which comprehends the Construction Cost and all the kind of taxations.

Now we analyse what are typical modification in Indian-subcontinent to the complete production costs that makes a substantial variation of the complete investment regarding the old city centres' conservation works. However, to justify some of the followings, we refer to the chapter *5.3. Lack of monitoring from municipality and weakness of urban planning* with the explanation of municipal bodies' difficulties towards a control of the development of construction intervention.

Most of times for little intervention or not evident ones, the payment of taxes is reduced and, sometimes, illegally avoided: this is because of a willingness to minimize the costs of the construction operations. However, this allows the owner to not declare at all the ongoing works. In this path is possible to understand that all the typology of interior works are allowed in the city centres. In fact, as this research shows in chapter 14. Morphological variation: the problem of time, cost and expertise for the survey, the percent of construction works that made a variation inside the house-forms that does not touch the main façade is very high in the last decades.

Another element that creates a cost negative variation is the reduction of employers' fees: in fact, a considerable debate has been carried out on the consequences of the introduction of the Neo-liberal Economy trade in eastern developing countries that brought an opening of economic barriers in developed ones towards the creation of a new class of skilled labour mostly. On the other side a study from 1995 shows that the reduction of the tariffs and the elimination of the requirements for importing the licence augmented the relative wages for skilled workers in developing countries by 23% during the period in between 1986 and 1990, while the increasing of the wedge was minimal for less skilled workers. (Un-Habitat, 2003). This brought an enormous difference in the cost of the service by skilled and not skilled workers. The same factor influenced artisans and raw materials.

5. 2. Exploitation of the historic city centre for economic investment: the touristic pressure

The direct contribution of Travel & Tourism to GDP in 2016 was INR 4,809.8 bn (3.3% of GDP). This is forecast to rise by 6.9% to INR 5,141.1 bn in 2017. This primarily reflects the economic activity generated by industries such as hotels, travel agents, airlines and other passenger transportation services.

(Hajdinjak, 2018)

Tourism is quickly growing and the influences on the economy is spread all over the multiple levels of Indian society. Of course, it is easily possible to find a recorded growth of touristic affluence in the most important Monumental Districts. Therefore, in heritage tourism field the role of Trusts and NGOs is becoming crucial, and nowadays mandatory, to collect all the data on affluences and typology of tourist. (McCamley, 2016)

A general assumption coming from T*ourism and Poverty, Principles and impacts in developing countries* (Spenceley and Meyer, 2012) is that the Community Based Tourism is increasing and it's giving year by year more possibilities to the growing number of managers and initiative developers in the touristic business. However it is important to analyze that the responsibility toward heritage is growing on the same line and in many fields: financial management, monitoring of conservation works, market accessibility, inclusivity, advertising and others. By the way many times happens that not skilled operators have the task to afford this kind of challenge.

In construction field, the previous assumption generates two inferences that have to be analyzed in order to better understand the environment this research studies: the matter of time and money. In fact, the most common conservation operations in heritage centers in the Indian subcontinent are affected by these two factors together with the willingness of creating new economic incomes. This happens also within areas with apparently no relations with the heritage sites.

The mutual reduction of time and costs in construction field is evident: in fact, setting

as a constant factor the other variables (as workers' skills, quality of construction and others), it is possible to assume that

- an increment of economic investment means a reduction of the time of the on-site works.
- a decrease of economic investment means a growth of the times
- an increment of time means a decrease of economic investment
- a decrease of time brings an increment of money investment

However just taking in care time and money it seems necessary to introduce the future income: with a reduction of time the main idea is that the economic income comes quickly. Nevertheless, this is connected to a higher initial economic investment. If we look on a wider range, it is possible to understand that the reduced possibility of monitoring from the municipalities and corporations that should overview all the construction processes in the city centers, open the door to the possibility of having a quick low quality and not planned development in a cheaper way (see chapters *5.3. Lack of monitoring from municipality and weakness of urban planning* and *11.1. Definition and reason of encroachments' problem*).

On the other side, the influences of Monumental Areas are increasing towards the nearby areas because of the rising level of hygiene requested by the touristic incoming (increasing the foreigner quantity).

Conversely, it is possible to divide into some factors the total investment for a renovation of a building in a "not completely monitored" environment: the design process, the construction material and the "enterprise" that takes in charge the on-site works. Most of time the enterprises have very few operators and technicians, with very low know how level and sometimes the role of foreman or supervisor is omitted.

In every one of these factors is possible a reduction of cost, because of the lack of possibility of monitoring by the inspection bodies: the design process in the worst case is completely avoided, the materials are low cost ones and the enterprise is

chosen with the lower offers method.

As a matter of facts, it is not possible to generalize to all the works going on this principle because of some new ideas that are bringing successful cases in the historic centres bringing awareness actions that influence surrounding areas:

Some new ideas are getting a little foothold:

- having a simple design but functional and observant of traditions, that can ensure the natural ventilation thanks to vernacular knowledge;
- use of low-maintenance construction materials, that can include the use also of local materials, and the durable ones;
- use of prefabricated materials in order to save money, but in peculiar parts that allows the use of modern technologies;
- ask to professionals a consultation on the works to make all the previous work together.

Nevertheless, the above-mentioned cases are very rare and leaded on by some NGOs and Trusts in the heritage centers[2] . However, this symbolize that the possibility to approach the theme of refurbishment and conservation by a different perspective is already there: some of the conservation networks as the Indian National Trust for Architectural Conservation of Heritage and others are moving forward on awareness processes in order to enhance that little excellence cases that follows the new way of refurbish an existing building in the historic center, highlighting the economical saving (and incomes) after a little delta of period.

However, coming back to the problem of time, the majority of cases shows that the duration of the awareness processes is wider than the need that owners have to convert the building, making quicker the process of silent destruction of the heritage centers then the one of a planned conservation.

[2] One can be the case of Toorji Ka Jhalra, Toorji's Step Well in Jodhpur from JDH – Urban Regeneration Project that influenced the sorroundings keeping a healthy and clean environment. The investment in this area has been done by NGO with the approval of the Municipality of Jodhpur. Another one, that is becoming a spread intervention is being done by the Mehrangarh Museum Trust, that is restoring some of the building in the Brahmapuri area, the oldest area in the city: however this second case, because of an average quick change of the building set all over the area, is influencing little parts of the street scenarios.

5. 3. Lack of monitoring from municipality and weakness of urban planning

There are many actors having a role towards the preservation of cities' heritage in emergent nations and they are categorized within different typologies of internal organizations: municipal corporations, NGOs, Trusts and many others (see chapter *7. Actors of conservation and enhanvement in India*). Actually, it is difficult to define for every kind of institution a comparable activity or the boundaries of actions' possibilities. As in the western countries, Municipalities have facilities in the involvement of the community towards activities, conversion of spaces, changes in the shape of places that brought inevitably a change in the use, or impose some legislation in order to take care of heritage sites.

Nevertheless, for municipalities itself it is difficult, in developing countries, to focus on durable actions because of different causes. Most of times members of public authorities are subject to quick change, for example in India Municipal Commissioners changes for Government norm every 3 years: this is recognized as one of the main problems of undertaking a durable project or purpose. In addition, the main target of the public bodies in a developing country is to rise the value of the land and create a productive environment that make higher the income for pursuing the development. (Johnson (ed.) and Johnson, 2015). Trusts and NGOs are also subject to the municipality's decision on urban structures, façades, usage destinations and many others: the reason of this is the importance NGOs have in emerging nations (Sheth and Sethi, 1991).

Because of this, the influence of NGOs, together with the Foundations, are wide in developing countries. Most of times the responsible people of this bodies holds the position more time than the municipal members that are in charge of the heritage cells.

As explained in "*Explaining Cooperation: How Resource Interdependence, Goal Congruence, and Trust Affect Joint Actions in Policy Implementation*" (Lundin, 2007) one important cornerstone that connects municipality's, NGOs' and Trusts' targets

is the “confidence” in between different bodies.

The effect of congruent (or diverging) objectives on inter-organizational cooperation is dependent on the level of trust. How similar or different their priorities are is only expected to affect cooperation when organizations trust each other.

(Lundin, 2007)

In fact, it is possible to define in emerging countries a line that divides social oriented and economically oriented public local bodies. Usually the feeling that heritage can also be an investment for the future, that brings the willingness of revaluation of the same because of its importance, is connected to the duration in charge of people that can take important decisions. In fact, municipal commissioner (see chapter 7. Actors of the conservation and enhancement in India) and council members in India are changing very rapidly, depending on the government willingness. Many times commissioner, which are the ones that are the final decision maker on the annual budget, are moved from city to city because of skills and needs (this happens mostly in the little/medium sized cities).

This is one of the main reason of the lack of stability in public structure that can act with one precise and consequential direction: it is possible to highlight this kind of situation along the whole Indian subcontinent.

Meanwhile the interest of the government can easily change, as it is common for the growing countries: the search for an import-export trade have more importance year by year. In the chapter “The Conditions of Growth” of the Goldman Sachs report of 1st October 2003 (Wilson and Purushothaman, 2003) one of the main factors documented that is an indicator of stability, which set the country in a growing situation, is the promotion of export policies. Export policies are production based. In that survey this factor is called “Openness”.

Most ULBs in India do not have the capacity to promote cities as ‘engines of growth’. The local agencies have weak institutional capacity to plan for spatial, social and economic development, have unstable revenue streams, and low capacity to plan, mobilise resources and implement urban infrastructure projects. There is a need for strengthening of ULBs to play a pivotal role in national economic growth.

(Johnson, 2015)

However, in emerging countries, as we said, stability is very difficult and the reason is in the quick changes existing in the workforce of public authorities. Concerning this research, the main action undertaken by NGOs and Trusts is the purchasing of goods and their renovation, with the approval from municipal corporations. In that kind of environments, the actors of conservation and valorisation have the possibility to show the population how to conserve the building in a proper way, following the new needs of the inhabitants of that area. Nevertheless sometimes happens, and this is mostly visible in the city centre of Ahmedabad, there are many abandoned buildings that have been in legal family dispute for long time. In that cases the trend of the organizations, when possible, is the same: purchase and conserve. However, the economic investments of NGOs and Trusts are not enough to buy and work on a wide range of buildings. Heritage cells of municipal corporations are creating new urban plans that contains many indications (Ministry of Urban Employment and Poverty Alleviation & Ministry of Urban Development, 2005), as a western building code, but the awareness of the population, together with the impossibility for the commissioner to monitor the situation daily and for long times are vanishing the feasibility of these codes.

6. Catalogues of historic heritage in India

This section introduces the main character of the catalogues and the reports of the typical house-forms in vernacular housing and commercial construction in India. The research analyses here the different typologies of documentation campaigns already undertaken and the possibility to understand the historic buildings' morphology thanks to a comparison in between old and new surveys.

Before define the attributes that are crucial for the definition of local ordinary building, some clarification are important. First, the periods the Indian states inside the federation were subject to foreign affections are different, and the architectonic modification came from different moments. Many publications describes in detail all the period and the inclination of architectonic styles gave from them, as (Tillotson, 2001), (Khosla, 1991), (Havell, 2008) and many others. In addition, Indian old cities' characters changes geographically mostly because of the differences in temperature and on the whole set of environmental aspects.

Nevertheless, the composition of the houses changes in the same environment case by case: the main reason is the initial organic composition of the urban settlement. In the two reports "Urban Conservation, The walled city of Ahmedabad" (Jain, Jain and Majmundar, 1989) and "Lok-Kshetra: Heritage Conservation Zone, Jodhpur" (Jain, 1989) both promoted by INTACH (see chapter 6.1. Indian National Trust for Art and Cultural Heritage Reports), is shown the shape of the initial urban settlement of two different cities that can rightly symbolize an average set of Indian cases. It is possible to understand features of initial aggregations, which were born nearby important area as a Fort (in the case of Jodhpur) or as a river (the case of Ahmedabad).

However, main characters of Indian houses are on average, as per the typical morphology of every country with few environmental differences in between zones, the same. Composition can be different, because of the external climate characteristic, but the majority of the spaces are similar for usage and, sometimes, disposition.

The traditional built structures in the north of India are mainly two or three storeys high with terraces, courtyards and ottas (semi-public sitting spaces in front of the entrance of every house, covered by a balcony that extend the second floor on the street). The high profile of the structure and the narrow streets make the environment climatically lower by temperature. The typical residential buildings are divided into two correlated kinds: the lonely house and the sharing wall one: both of them are called Haveli. Historically the word Haveli came from Arabic Hawali that means “partition” or “private space”. In fact sometimes the Haveli was a part of a bigger neighbourhood, named Pol or Haveli itself.

One of the main feature of traditional Pol is the “chowk” (or courtyard is the focus of all the activities of the house, connected also with religion functions) that in the same time connect spaces and gives privacy to different Havelis. The chowk composition and disposition inside the family house creates an environment that takes advantage from a natural ventilation and decrease the temperature. (Choi and Lee, 2014)

A long bibliography is available on the Indian house-form as (Jain, 1994; Pandya and Vastu-Shilpa Foundation for Studies and Research in Environmental Design., 2015) (Panicker, Baroda and Newcastle, 2008) but in all of them the natural ventilation is a crucial point.

Nowadays the development of new supplies that allows some variation in the traditional shape of the house towards the creation of an apparently different living quality: for example, one of the possibilities is to close the windows and to install an artificial cooling system inside the house. This creates a huge variation of the internal shape on the traditional houses and also in the relation with the neighbourhood (Subramanian, Ramachandran and KUMAR, 2017).

These changes are creating an average alteration, because of the diverse connection street-building, in the relation in between different environments, somehow physically “disconnecting” them. It is possible to mistake this process with a movement toward a higher level of privacy: but many debates has been done around the theme of semi-public spaces in India (Vanka, 2010) and at the end seems clear that public spaces are considered as traditional and, many times, heritage in the Indian subcontinent.

The dealing in between the indoor comfort and the preservation of a traditionally based community space is very important and in the centre of many controversy. The problem is generating also many results and answers: some scholars (Panchabikesan, Vellaisamy and Ramalingam, 2017) shows that the potential of vernacular know-how applied to modern house with contemporary technologies could offer many possibility without changing the shape of the traditional building, preserving the tradition of relationship in between spaces and, meanwhile, rising the hygienic level.

6. 1. Indian National Trust for Art and Cultural Heritage Reports

The Indian National Trust for Art and Cultural Heritage (INTACH) is a well-known nonprofit charitable trust registered for the first time as a society in 1984 in New Delhi with the intent of stimulation and awareness spread on fields of conservation and valorization of heritage in India. Nowadays is the largest membership organization all over the country dedicated to conservation (Sinha, 2008) (INTACH, 2017).

The creation of a census of the city heritage has been undertaken in the period in between the last years of 80s and the first of 90s by INTACH. In order to do that, following the mission's criteria of the organization to "Document unprotected buildings of archaeological, architectural, historic and aesthetic significance, as well as the cultural resources, as this is the first step towards formulating conservation plans" a census that regarded three cities has been created as a case study. The three cities were Jaisalmer, Ahmedabad and Jodhpur. In those cities, some of the main traditional characters inside the old centers were documented: Street and Squares; Residential areas and houses; Infrastructures; Social Aspects; Important Historic Buildings and others.

This research will focus on the case study of Jodhpur and Ahmedabad as case study, so this section will introduce the main aspects of the documentation done within that two.

The Jodhpur Report was named "Lok-Kshetra: Heritage Conservation Zone, Jodhpur" (Jain, 1989)[3] and the one on Ahmedabad "Urban Conservation of the walled city of Ahmedabad" (Jain, Jain and Majmundar, 1989) . The heritage areas of Jodhpur, the blue city of Rajasthan, and Ahmedabad, the center of the new economy of Gujarat, have been documented thanks to the help of other institutions as Mehrangarh Museum Trust (Jodhpur) and Ahmedabad Municipal Corporation.

[3]Both the documentations were proposed by the Jain Associates office (settled in Ahmedabad) to the INTACH.

Even though the papery format and the scale of representation, the documents are high quality representations of the characteristic and features of the urban structure in that moment of time (late ‘80s) and the typical house forms of certain areas. The survey has been carried out in a short period of time and includes a limited but exemplificative quantity of study cases. One part of the documentation has been conducted for each city historical development stage.

However, one of the problem in creating a methodology to approach to the whole heritage city of Jodhpur and Ahmedabad to exemplify a representative index of possibility to document towards the conservation and valorization of Indian heritage, is the difficulty to find the same type of documentation for the other parts of the city. The research, in order to solve this problem, introduce the use of another documentation methodology (and propose an approach that determines the veracity of the data) to recreate a valid documentation of the old and new architectural elements on the other parts of the cities (see chapter *11. Analysis model for identification of new and old elements in the heritage city centres of emerging countries*).

However, in order to find a base for the creation of the case study database on what is to preserve and how to deal with it, this part focuses on a deep analysis on what has been documented during the late ‘80s. During the 80s, as already said, the Indian National Trust for Art and Cultural Heritage decided to sponsor the idea of the architects Kulbhushan and Minakshi Jain (Jain Associates) to individuate some areas as “heritage zones that need conservation”. In the preface of the “LOK-KSHETRA, Heritage Conservation Zone, Jodhpur” is written as follows:

“*These areas could be those historic cities which are full to the brim by the people or those abandoned ones […]. INTACH has now initiated the extension of the Heritage Conservation Zone idea to incorporate people and their occupational patterns. Traditional crafts and life-style of people in heritage areas becomes an important aspect of conservation efforts.*”

(Jain, 1989)

The reports main aim was the documentation towards the conservation of characters of the old cities with architectural value for a revitalisation of heritage buildings, emphasising continuity with change.

Lok-Kshetra consists in a detailed report of all the main features of the old city of Jodhpur and it concerns the following chapters:

1. Introduction

2. The Fort Mehrangarh: in this section is described the Fort from many point of views: historical features, morphology, compositional elements, different space usage and an initial survey of the plan of the Fort complex

3. City Walls and Gates

4. Water Sources

5. Streets and Squares: these are two of the most important character that this research analyses in order to understand variations of urban pattern. Many of the areas that has been documented regarding Jodhpur for the creation of this research are the same of this report in order to better control the variation factor and to have a certain data on the modification of spaces.

6. Residential Areas and Houses: in order to understand urban pattern of old houses this chapter contains a detailed report on the vernacular built environment of the historic city that starts from the analysis of the whole street surrounding of different main narrow road typology to the compositional aspects of single house forms.

7. Infrastructures

8. Social Aspects

9. Economic Aspects

10. Important Historic Buildings: in this report is present a short description of the main historic and important buildings, with one photo. The material we have from this report on that building is not sufficient to have important information on the morphology and the shape the building had in that moment of time.

11. Problems

12. Recommendations

The surveyed data were catalogue in the following order:

Aggregative public spaces (squares)

- Map of square
- Asset of Facades
- Composition of houses
- Period of construction
- Functions
- Description

Residential Areas and Houses

- Map of the plot
- Location
- Functions
- Detailed plan with section of some of the houses inside the plot
- Description

Thanks to these data, it is possible to have an overview of the main characters of the urban context in the moment of the documentation. In chapter *12. Comparative methodology to analyse variation of building in time*, the research analyses the methodology to highlight modification in time thanks to a new survey campaign conducted in the two cities in 2016 and 2017. Thanks to this, it will be possible to catalogue how the influences of inhabitants' new needs invested the shape of the city and its heritage, highlighting the most affected areas and the average variation of the morphologies toward a definition of an intervention methodology.

6. 2. Existing Historic Data archives

Definition of technologies that are useful, available, usable and that gives working data in developing countries is not simple because of many influences. Many researches has been carried out by European Universities and Specialized Research Centres in different fields (see (Cristian and Nayak, 2001; Balzani et al., 2015)) as the analysis done together with Casa de la India in Valladolid (Kumar Rai, 2017) and: thanks to many interested local institutions, researchers had the possibility to study on-site. Nowadays this brought the research to a possible classification of different study cases. On the other hand, the problem should be shifted on the possible usability of technology on different typology of case studies, understanding how and what to document.

In chapter *12. Comparative methodology to analyse variation of building in time* the research defines a way to highlight, thanks to old surveys analyzed in chapter 6. Catalogues of historic heritage in India, the changes that spontaneous architectures and annexed encroachments (see chapter *11.1. Definition and reason of encroachments' problem*) created in the environment of the city. However a big problem scholars are facing in order to understand the methodology of intervention to adopt on restoration, retrofitting and common structural stabilization interventions, is the lack of information on the original feature and shape of the building typology they are working on (Ghosh, 2015).

As a matter of facts, the post-colonial period in India brought a visible mix of styles and deferent influences from all over the world. Moreover, western influence changed the shape of old towns: as it is possible to see in the Manak Chowk area in ancient Delhi center, or in nearby the Gateway of India in Mumbai, the tradition has been sometimes mixed with another tendency and did generate a new style (sometimes with functional results). However is crucial to take in mind that the difference in between the above mentioned case studies and the most common situation is due to the urban planning actions promptly undertaken.

On the other hand many unplanned plots are present in the historic centers of the little-middle size cities. As we already analyze in chapter *5.3. Lack of monitoring from municipality and weakness of urban planning* many difficulties are generating a lack

of monitoring from the municipality on the development of the old city centers. In the city center of Ahmedabad, for example, house owners are subtracting facades to be sell in other parts of the country, adding encroachments, creating new concrete car boxes etc. The lack of documentation on the previous state of the building is generating the possibility to convert the street scenario and then the urban complex's asset.

The challenge to face in the next years is a complete conversion of the heritage areas into new ones, because of the lack of documentation preparatory for the creation of good quality urban planning and architectural conservation.

In this scenario, some researches have been done, but few ones are on the possibility to define a methodology of discerning new and old structures, together with the influences of the average variation in time on the heritage aspects of the entire area.

On the other side the situation of the conservation of monumental recognized elements is very different: many documentation campaigns has been completed all over the years mostly on listed areas, structures, and buildings: military structures important for the ancient kingdoms, temples and religious structures are some of them. As a matter of facts is possible to find many documents that contain old drawings and surveys of that kind of architectures. In fact, and someone suggest the reason if this is possible to find in religion believes, temples are the most preserved elements in the old cities. Together with the water bodies, as wells and water tank old structures, religious buildings are continuously under restoration. Actually the restoration works are accomplished by local employers: this kind of "restructuring works" have different intent of what is considered as a conservative restoration in Europe.

In fact, the "restructuring" of temples, which are inside city centers, is mostly promoted by the community itself, which invests money on the restoration because of religious beliefs. The main scopes of that kind of restructuring are two: the structural safeness of the structure, and the recreation of new elements "as they were" before the damage. This happens mostly for the decorative parts. The restructuring is not conceived as a conservation of what is already there: as it is happening in many places like Japan and China, it could be possible to consider this process as intangible heritage one.

7. Actors of the conservation and valorization in India

In his speech for the occasion of the opening of the World Heritage Committee session (Helsinki, Finland, 11 December 2001) Mr. Henrik Lilius, the President said:

To strengthen the legal basis for heritage protection and for heritage conservation to become a vector for socio-economic development, a spirit of cooperation and genuine partnership with all sectors of society will be required. I think that we must continue to explore new forms of partnerships with the key actors of heritage conservation: local and regional governments, development co-operation agencies, universities, private foundations, the corporate sector and the growing number of NGOs.

Basing on this, which gave us the most common sense of “Key Actors of Heritage Conservation”, it is possible to highlight some specifications. Focusing mostly on the key actors working now in the field of conservation and enhancement of the heritage in growing economy nations it is possible to define a set of actors:

- Government institutions
- Development agencies
- Universities
- Foundations
- Corporation in the conservation sector
- NGOs

For the scope of this research, it is necessary to highlight and study in this group only the ones that are strictly in touch with the world of conservation and that can influence directly and rapidly the process of renovation and enhancement. The poor monitoring power at a government level in quickly growing economies brings a lack of supervision on the heritage centers’ urban form developments. All the procedures that connect the initial government decision to the final application in the city are very complex and composed by many steps, most of all if the new law, which the active level of the hierarchy has to recognize and apply, is not a quickly fruitful one. Moreover, in the second half of the past century governments of developing countries focused the attention on the problem of the creation of new settlements

and houses for new inhabitants of the growing cities. This was one main causes of the avoidance of regulation by the inhabitants. Therefore, this brought also, in a second moment, the evidence of infrastructures' lack, insalubrity of locations, poor quality of the constructions. Meanwhile there was the importance gave to the modernization venture by the government: in any cases, all this made them think that just the "new" was worthwhile. Nowadays the growing economy countries' governments, due to this historic background, are giving very little attention to the transformation of the historic centers, which are pushed towards a modernization without rules. (Steinberg, 1996). This are the main reasons this research is not focused on government's actions: however, it is impossible to avoid talking of the local government institutions and their influences on the other actors' decisions and behavior in the field of heritage preservation. Because of this, instead of the central government, this research examines municipalities, municipal corporations and heritage cells inside them.

On the other hand some actors are included in the research as active ones and not just for the influences they have on other's behaviors[4]. NGOs, Trusts and Foundations are three of the most important actors regarding the heritage conservation and enhancement. Indeed we need to note one distinction: NGOs are created when citizens, voluntarily come together, driven by a common motive or interest, be it at the national, local or international level. This typology of actor works not with an objective of profit making, but for a social cause, for some public good. On the other hand Trusts are legal arrangement pursuant to which one person (the "grantor" or "settlor") entrusts assets to another person or organization (the "trustee") to manage for the benefit of others (the "beneficiaries"). Now, this is an oversimplified definition, and with certain types of trusts (such as the revocable living trust), a single person can serve as grantor, trustee, and beneficiary; but, this provides a good foundation for our discussion of charitable trusts. On the other hand, private foundations can accept contributions from multiple donors. As a result, families seeking to establish a lasting charitable legacy, allowing family members' gifts to be pooled and then distributed to outside organizations (or used in-house) at the direction of the foundation, often use private foundations.

[4]Is it possible to confuse in between development agencies and corporate sector, but it is needed to remember that an agency is a particular kind of company, which serves as an intermediary between clients and corporation indicates a particular kind of business dealing in a specific product. Sometimes happens that corporations collaborates with other through agencies: because of this it can happen that the same owner or promoter of the corporation is himself the director or the owner of the agency.

7. 1. Mission and "Criteria" of different Actors

When we talk of actors in the field of conservation of heritage, it is quite easy to find the common Mission of preserving the ancient operas. If we check all the NGOs or Trusts' statements it will commonly possible to read: our aims are heritage protection, develops clear and sustainable policy options, engages with government, business and civil society, communicates its ideas to the widest possible audience, undertakes specific conservation projects, and facilitates research and training.

In her book "Money vs mission, do we have to choose when it comes to heritage?" Lara Ann Samuels writes "*With public funding falling and greater focus being placed on economic sustainability, income generation is becoming more of a priority for many heritage organization. However, there appears to be a wariness of consumer-focused activity in UK heritage sector; many professionals are perceiving it to be contrary to their mission of safeguarding the Nation's heritage*"

(Samuels, 2008)

Than that study gives theory on the wrongness of this thought and tries to context it. However this idea is much more difficult to discredit when the main focus of the research is not on a developed country, but, as in the case of this study case, on an emerging one. In fact, the risk of enrichment willingness is higher in a developing society:

"[…] *while many of the poorest countries have considerably increased their output of wealth since 1945, the poorest people have grown no richer and have sometimes been thrust into even deeper poverty*."

(Lipton, 2017)

This perception is nowadays higher but not proved or real in all the possible contexts. During the surveying period propaedeutic of this research, many organizations has been met: no one of them is acting with an enrichment purpose: the aim of the organizations (Trusts, NGOs, Foundations and Agencies) is towards a preservation of the heritage, in order to lead to the future situation of the country as fully developed, in the best way. Sometimes, as per in the case of Jodhpur Mehrangarh Museum Trust, or Nirmala Bakubhai Foundation in Ahmedabad, the aim is directly connected

to the increment of the life quality of citizens. On other cases, as per Ahmedabad Testile Mills Associations or City Heritage Centre of Ahmedabad, the influence to the inhabitants that live in the neighborhoods of the study cases, is felt with a double step (creation of new economic models/renovation of infrastructures/higher the quality of the inhabitants' life) and not in a direct cause-effect way: however actors' actions influences are visible on many different levels.

Nevertheless it seems to be necessary to say that in the past 50-60 years governments and international agencies focused their attention on the new settlements problem, built in both non-authorized (informal) and formal way. However, the two are affected most of time by various issues: lack of infrastructure systems, poor quality of structures and so on.

Quantitatively, these housing areas usually overwhelmed the pre-existing city. By the 1970s, the vast majority of the housing stock in most large cities in the developing world was less than 25 years old. The older housing stock was, therefore, considered insignificant in terms of the scale of the housing problem. (Steinberg, 1996)

Meanwhile the heritage centres has been treated as a waste land that has to be treated as an opportunity to install a new productive centre or value them as per their land use possibility, as it is easy to label them as slums.

That is why all the actors that have the possibility and the vision to value an historic centre as an important charm pole are now moving in order to avoid the loss of attracting heritage for different reason, depending on the actor's aim.

It is possible to divide into two different typology the subjects that are now involved in the rehabilitation of heritage centres in developing countries. The set of public and the set of non-public ones. Final targets of the intervention and operation that public and non-public bodies are following gives very similar, but deeply different, outputs: municipalities and public corporation should have as main aim the creation of a better situation to the citizens. At the same time non-public organization most of times are searching ways to grow their business, that can be useful for the productivity of the area and sometimes this can also happen through a good enhancement and conservation of the heritage sites. Of course, it is not possible to spread this concepts for all the circumstances and places: the productivity of a place in the "developing environment" most of times looks more important than the apparently difficult and useless restoration of historic centre.

7. 2. Municipal Corporation, Municipality and Heritage Cell

ULBs in India are the Urban Local Bodies that are defined in only three categories:

- Mahanagar nigam (Municipal Corporation) is the ULB that is present on the big established urban areas.
- Nagar palika (Municipality) is the ULB that occurs on the small urban areas.
- Nagar panchayat (notified area Council, City Council) is the body that is created for transition areas between the rural and the urbanized status.

Municipal Corporation (MC) distinguish itself from the Municipality by autonomy: the important size of land and the large population make the MCs need more permanent decision power. On the other hand, the Municipalities do not have the same kind of autonomy and important decision has to be taken through Directorate of Municipalities or the Collector of the District. The control is higher from the government side on Municipalities than the MC. In this vision, it is easy to understand that commissioners are changing rapidly, due to the lack of interest by the government through some actions that are less valued then industrial development.

Landowners/landlords, speculators, government administrators, big construction companies, and many public agencies have vested interests in re-development and will fight to protect their stakes for modernisation. These groups have their political allies as well. (Steinberg, 1996)

Additionally,

many ULBs are not in charge of urban planning. Moreover, Metropolitan Planning Committees (MPCs) and District Planning Committees (DPCs) have not been assigned a clear role in the preparation of regional and urban plans. The 74th CAA has mandated the State Governments to constitute MPCs and DPCs, which are responsible for the preparation of Metropolitan Plans and District Development Plans. (Johnson, 2015)

The active arm of the municipality is different depending on the needs of the area. Sometimes the Municipality itself establish an inner inside structure Heritage Cell.

Other times happens that the Development Authority of the Municipality created a Conservation Society. This happened for example in Mumbai, with the Mumbai Metropolitan Region Development Authority (MMRDA) that "*constituted a body MMR-Heritage Conservation Society for creating awareness in heritage conservation and support for preservation and development of natural and built cultural heritage*." (Rajadhyaksha, Radhika and Tenkayala, 2013)

Focus of this kind of structures, internal or dependent but external from the Municipality or MC, is the conservation of the existing heritage and right use of vacant lands inside heritage sites. One of the best working Heritage Cells (emanated by the Development Authority as an independent body) already existing at the moment is the Ahmedabad's one.

The Ahmedabad Municipal Corporation (AMC) is the first local government body in India to establish a dedicated Heritage Cell with adequate staff and budgetary allocation. The AMC Heritage Cell has been instrumental in accomplishing several conservation projects and in involving the community by innovative awareness programmes.(Ghosh, 2015)

One of the first laws that that cell introduced in the Regulations of the Old City answers to the need of having a Census of the heritage property, prohibiting the demolition of them without permission of the Cell. This idea, that seems to be obvious in a European vision, is not as easy in Asian developing countries. As a matter of facts, it is nowadays still difficult for the municipality to have a supervision and keep monitored all the development in the old centres. Inhabitants, with changes of needs because of changing of times and technologies, are of course not asking something like the "permission to build" to Municipality or Heritage Cells. Let us take one example: the need is to have another toilet in the house because of the division of a property into two, the inhabitant just start built that inside and no one will be able to avoid this process; if he asks permission to the authority, all the process will be much more expensive and longer. On the other hand, the most important issue this places are facing, that affects inhabitants also, is the lack of hygiene that could have been avoided with a right answer to the need.

From the needs, but with a lack of money, avoiding the laws, searching a solution without a general planning to complete the construction, but creating other problems.

Every Municipal Corporation in India is administratively headed by a Municipal Commissioner, who is the de facto head of the municipal corporation, the form of government which is usually granted to a city of more one million in population. While a mayor is elected to serve as the titular head of a municipal corporation, a municipal commissioner is appointed by the state government from the Indian Administrative Service and mostly from State Civil Services to head the administrative staff of the Municipal Corporation, implement the decisions of the Corporation and prepare its annual budget. (Municipal Commissioner (India) - Wikipedia)

7. 3. NGOs and Trusts

Along with public bodies, the other category that is easily possible to identify is the one of Trusts and NGOs in general. Most of times, this kind of organization collaborates with public entities, in order to define collaborative targets and shared aims. In fact, in presence of Municipalities or Heritage Cells, this institutions works in strict contact with them and sometimes they are the most active part inside the city actions because of internal less bureaucracy. Of course, there are some differences in between these organizations and the main division is dictated by the reason this NGOs and Trust were born.

Speculation of historic centres or heritage in general is growing in emerging countries because of the different vision stakeholders have. However, most of time the speculation is bringing indirect advantages for surrounding areas and the investors are now understanding that in certain situation conservation and rehabilitation is the best way to recreate tourism in heritage places. Nevertheless, some different and much more negative approaches of pure speculation exists and we analyse this concept in this part because sometimes happens that ONGs and Trusts are involved in this situations. It is possible to find some examples all over the Asia continent: huge hotels or malls that appears suddenly in the historic city centres due to a lack of regulation of monitoring possibilities from the municipality. One of the possibilities to avoid this kind of “destroying development” is the creation of a set of rules. In Europe this started after the World Wars and found an important step with the Venice Chart. Of course is important to take in mind the difference of environment between Asian Countries and European ones. Nevertheless some places are working on new rulesets for the historic centres.

On the other hand it is also clear that the first actors (also because of less bureaucracy as this research already underlined) or operators that tries to have a different approach on the heritage and that have the economic possibilities to afford it are indeed Trusts and NGOs. In some countries the new rules for historic areas that have to be protected, are written just because some investor pioneer has

[5]City Heritage Centre, Ahmedabad, is a NGO promoted by a group of entrepreneur that works inside the old city of Ahmedabad towards the preservation of old Haveli and conversion with new functions. The operation brought a revaluation of the area nearby with street supplies and creation of new and clean parking areas and other community useful spaces.

previously enhanced a little part of the city and then he created an NGO for that aim. It is possible to find this kind of process for example in the old Ahmedabad, Gujarat, India: there some investors[5], with a wider view, bought one old house and converted it into a “Heritage Hostel”. They decided to have some influences concerning the hygiene quality in order to respect western standards and create a comfortable area. In order to archive this goal in the best way, sometimes it has been necessary the dialogue and the relation with western guest and professionals. Moreover, this is very important because there is also the other side of the coin. In fact, some other investors, or common citizens, looked at the good operation done by the first one, and decided to convert their houses into a hostel, but without the real knowledge on how to change properly the structure of the house: sometimes altering them in a no more liveable way.

On the other hand is possible to count a many Trusts that are already working on the heritage sites. In developing countries usually happens that Trusts have an important personality as patron. This is evident in India. In many cases former Kings and Rulers became right now investors-benefactors with a huge economic power inside the city and they have a continuous dialogue with the MC and Municipalities. Nowadays Maharajas are owner of lands and heritage sites and, most of times, they decided to convert some of the sites and property and create by them a new kind of profit. This decision could have been negative in some situations, but sometimes this wider vision allowed professionals to work on the heritage, preserving and enhancing[6].

Meanwhile there are other trustees that works in the Indian Territory:

The Indian community has formed a number of social, cultural, and political organizations. Almost all wealthy Indians in the United Kingdom have individual trusts or charities for projects pertaining to health, education, or infrastructure in

[6]Heritage restoration sites needs an urban requalification plan, in order to make the area able to absorb a new kind of tourism that the intervention itself will generate, as per the study case of Jaipur. The conservation process that involved the entire area of the city was promoted by the Unit Trust of India and leaded by M/S Jain Associates, from Ahmedabad. The attention to the traditional use of local materials and methods of construction, together with the research of new way of restore some parts with local artisan have been the focus point of the whole renovation process.

their home states and villages in India.

(Young, 2010)

Therefore, possibilities of this kind of bodies regarding heritage sites are wide also because of the capacity building operations pursued. In fact craftsman, engineers, architects are now integrated in the workforce inside the trusts. This behavior is creating a new class of experts inside the institution that is passing down all the know how on the heritage: how and what to do in order to preserve in the best way the good. As a matter of facts, capacity building should be an important component of the program (Johnson, 2015), for the key considerations of a renewed urban strategy in India. Sometimes it happens that local actions of renovation and conservation are leaded on together by a join venture of Trusts and Urban Local Bodies.

The feeling is that capacity building promoted from the municipal bodies can bring a diffuse alleviation of poverty.

(Johnson, 2015).

7. 4. Universities and Specialization Schools

Nowadays, also due to the growing importance of Trusts in the revaluation of the heritage cities, universities are having more and more importance in the revaluation and valorisation analysis processes. One of the most important tasks that is now fulfilled by the instruction bodies as Colleges and Universities, is the understanding of the connection between needs that come from other actors (as municipality, trusts and inhabitants) and make proposals of vision for the requalification of heritage sites that are under the power of these trusts or municipalities. In a quickly growing environment there is the feeling that the new ideas come from new minds.

The Ahmedabad Municipal Corporation, Ahmedabad University and local volunteers continue to explore the ways to institutionalize and popularize the heritage restoration and promotion. One such effort has led to the collaboration between the municipal corporations and the universities of Ahmedabad and Valladolid.

(Grjialba Bengoetxea, Grijalba Bengoetxea and Merino, 2016)

Therefore, it is possible to say that, thanks to educational bodies, the creation of “network of development” becomes possible with the following passages: universities propose a renovation and conservation paths that involves municipalities and trusts, basing on inhabitants problems.

PART 3 - Proposal of the research

This research aims to the definition of a methodology to approach and study the cultural Indian architectonic heritage in order to conserve and enhance it through an integrated analysis of documentation and comparison of influences.

Nevertheless the methodology have to be proved for a number of case studies that allows to suppose the validity for other areas and cities in emerging countries with the same prerequisites. The analysis of the city centres' average changes needs to highlight the main factors of the developing processes of the urban scenario: this has to be intended in a duplex way. The first one is the approach of case studies that have some previous documentation in order to analyse the main changes happened in between a certain period of time. This kind of comparative study allows to understand the main changed factors that influenced the entire area. As underlined in chapter *6. Catalogues of historic heritage in India*, data are available for some study cases: comparing the 89's situation with the present one it is possible to understand the average changes in house forms then of the street scenario and subsequently of the entire area. The proposal is to understand the average changing factors that are clear in areas that have been surveyed during the late 80's and to define a methodology to document the same indicators in areas that have not an old literature on or a detailed documentation. This analysis will examine the morphological factors that influences in a certain area the stressing points (brought by the not correct development of the buildings inside the old city centres) for the well living of inhabitants and meanwhile the influences on the heritage recognized areas. This last point is quite important because, as analysed in chapter *7. Actors of the conservation and enhancement in India* the most common way to preserve and enhance Indian city heritage centres is the involvement of actors that have the possibilities (economic and knowledge) to do it in the right way, activating a mutual and qualitative restoration process between urban areas and monumental entities.

However, as the chapter *6. 2. Existing Historic Data archives* introduced, the problems of creating or trace a database, or simple documentation, on ancient house forms in the scale of detail needed for the aim of this research, is a difficult resource to find. This is one main reason the research examines two cities that have a database of historic surveys as Ahmedabad, (Jain, Jain and Majmundar, 1989), and Jodhpur, (Jain, 1989).

We can summarize the main questions of the following part of the research:

1. Is it possible to find a relation in between variation of house-forms of the heritage cities and their influences on recognized monumental entities in order to create a mutual conservation and valorization methodology?

2. How is it possible to demonstrate the quantitative usability of this methodology for many case studies, and not just the ones that have a previous documentation?

3. How to analyze a single case study? How to define common Indicators?

Last but not least is the definition, in the methodology of a veracity index: this means that the methodology that is tested on areas that have already a documentation, have to be double-checked on the same areas, but without the proof of the ancient reports. This allows to understand if the contemporary documentation, created without the comparison with the 80's surveys but with different methodologies, is valid and how high is the percentage of veracity of the collected data. This veracity factor, in order to make the methodology valid for other situations, have to be acceptable basing on the indicators chosen in the comparison stage.

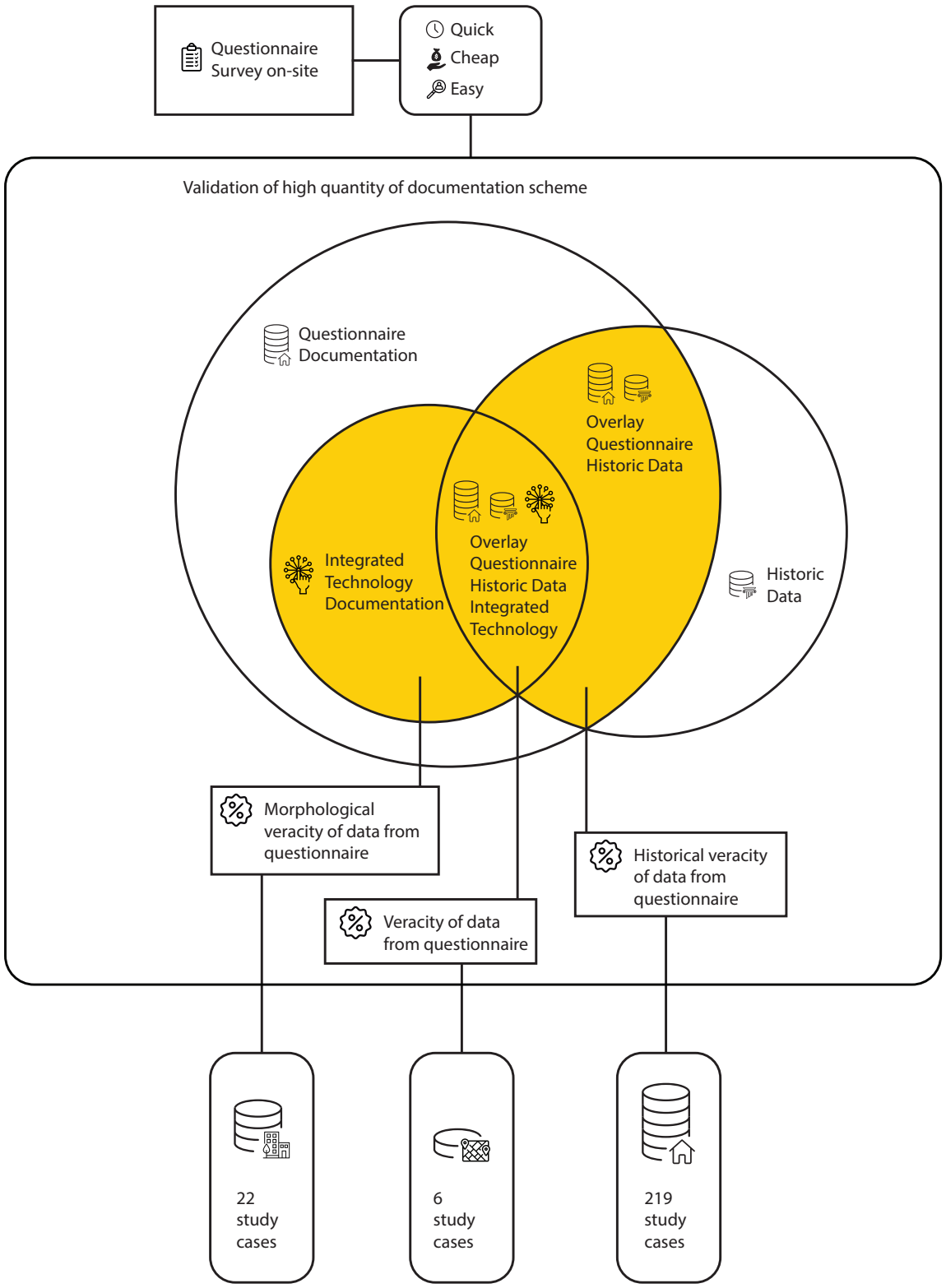


Figure 4: Diagram of quantity of data and validating system from the low definition documentation (questionnaire) to the historic and morphological percentage of veracity of surveyed data

8. Development processes in Indian Urban Scenario

In order to understand and define the relation indicators between heritage recognized areas[7] and the city centre of the Indian cities, the research focuses on the definition of the processes that is conditioning nowadays the urban scenario. The increment of tourism of the last years in Asia and India also (Hajdinjak, 2018) is boosting the willingness of having new incomes from the growing new economy. The possibilities of invest money in new activities are increasing at every level.

UNESCO itself promoted the 'Indian Heritage Passport Programme' that brought to the forefront heritage based tourism as a vehicle for local development. (Ghosh, 2015). However the possibilities are not same at every level (see chapter *5.2. Exploitation of the historic city centre for economic investment: the touristic pressure*) and sometimes the architectonic and urban modification, towards the creation of new receptive or commercial functions, generated by this new economic movements are completed in a certain way that creates problems at different levels, as viability or hygiene. Moreover, the decreasing levels of hygiene and the congestion of viability change the entire environmental situation into a new one implicating situations of lack of wellness for the citizens. Many times happens that high investment possibilities bring owners to demolish and recreate the whole construction, replacing the ancient structure with a more stable one. This process last longer and brings the necessity to include in the process expert and gives to the municipality the chance to monitor the process in the proper way (see chapter *5.3. Lack of monitoring from municipality and weakness of urban planning*). The high investment conversion, or new construction processes, force the owner to deliver to the municipality (the municipal corporation or the city development cell) the design plans and all the needed documentation since the demolition approval process.

In this case the municipality have the power to approve or not the intervention. On the other hand they can plan the area next urban intervention in order to provide the approved structure with the right infrastructures. This means the creation of drainage systems, electrical supply and all the others, to be paid in a shared way,

[7]As "heritage recognized areas" has to be intended the ones that are already listed in government catalogues, as the ASI's ones (Archeological Survey of India) or INTACH's ones (Indian National Trust for Art and Cultural Heritage)

together with the owner of the intervention or the promoter in a regulated way. This legally approved process avoids very often the possibility to have a reduction of hygiene qualities and rises the level of urban scenario and the influences on the surrounding area are of better viability, with a good hygienic level. The better viability is due to some request the municipality can advance of creation of parking areas or other intervention in charge of the institution of restoring old systems, electric or water supplies.

However the quantity of the aforementioned cases are very few in the city centre of little and middle sized cities, according to the documentation of this research. In fact, regarding the structure in the city centres we can say that the total data is around 5% of surveyed cases. Mostly this is due to the complete demolishing of the old building and reconstruction of a new one.

On the other side there is the field of conservation works. This means the conversion of an existing building in order to host other profitable functions. As discussed in chapter *5.2. Exploitation of the historic city centre for economic investment: the touristic pressure* the needs of stakeholders are most of time to have a profit with low quality works due to little investment and shortness of time in order to gain profits as soon as possible.

Actually, before discussing about the most important group of actors in term of quantity in the surveyed historic centres, high investment restoration works are now present in that kind of old centres because of actors that, most of time, are not yet inhabitants of the old city, but that have a vision on the possible touristic investment and profit cycle. It is wrong to put all of them on the same page, because the aim is completely different: the investment for economic return is a common factor, but the relational function (the influence the restoration processes have on the surrounding areas) is completely different case by case. However, for this kind of investments, the visibility is very high and the possibility of monitoring the intervention from the municipality is evident, together with the creation of right infrastructures for the restored area, encroachments controls and all the other measures that give back a good quality of the urban scenario. Sometimes in that kind of operation where stakeholders have the touristic vision of investment, the street is provided with urban furniture from the same investor: this kind of operation most of time are primers for a concatenate requalification.

However, what is happening in the majority of cases, according with the

documentation created with this research (85% of the total surveyed case study), is that the municipal corporation has not the chance to monitor the ongoing works in the heritage centres and the freedom of the stakeholders let them work in a fast and not controlled manner. In these cases the planning is not requested and mostly avoided because considered as not necessary for the construction works they need. However evident problems come with the lack of infrastructure the restructured constructions need: electric supplies, drainage covered systems. These shortages create a street scenario full of encroachments and most of time with hygienic and cleanliness problems.

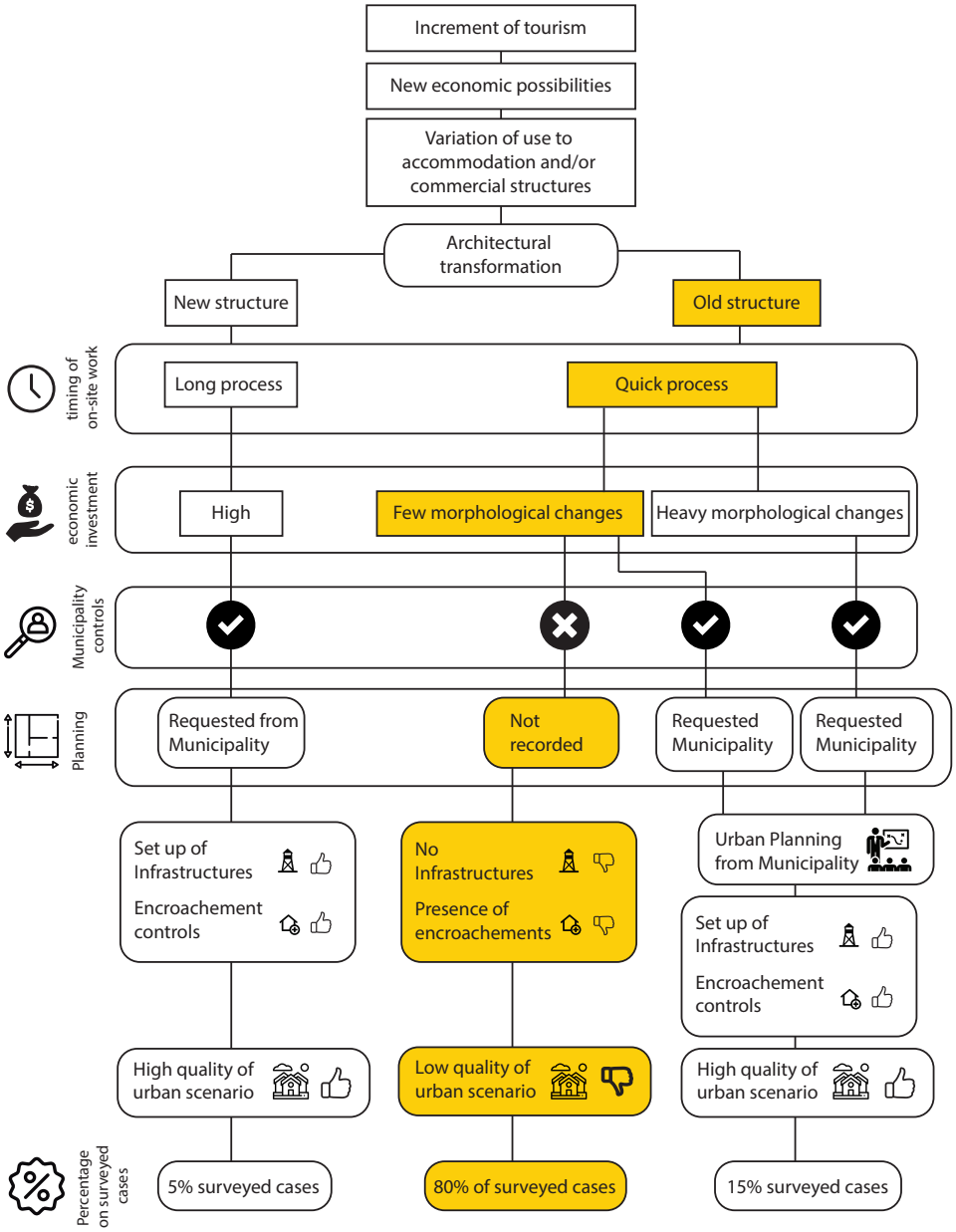


Figure 5: The diagram represent the documented situation of restoration average processes in the historic centres. As a matter of facts, it is important not to intend the restoration as in western countries but as a restructuration action

9. Creation of Indicators

This part introduces the choice of indicators used in order to understand interactions that exist, starting from a mutation of composition of street scenario in the historic centers of Indian cities.

The prerequisite for this comparative methodology in between different steps of the construction in time to create databases of changes is the knowledge of initial shape of the building itself: this is because of a recurring lack of bibliography on the house-forms in specific cases and cities. This is the reason why the creation of a standard methodology of analysis based on a sufficient number of case study is important. Some of the possible documentation methodologies and tools, based on the Indian environment and diffuse possibilities, are in PART 5 of this research.

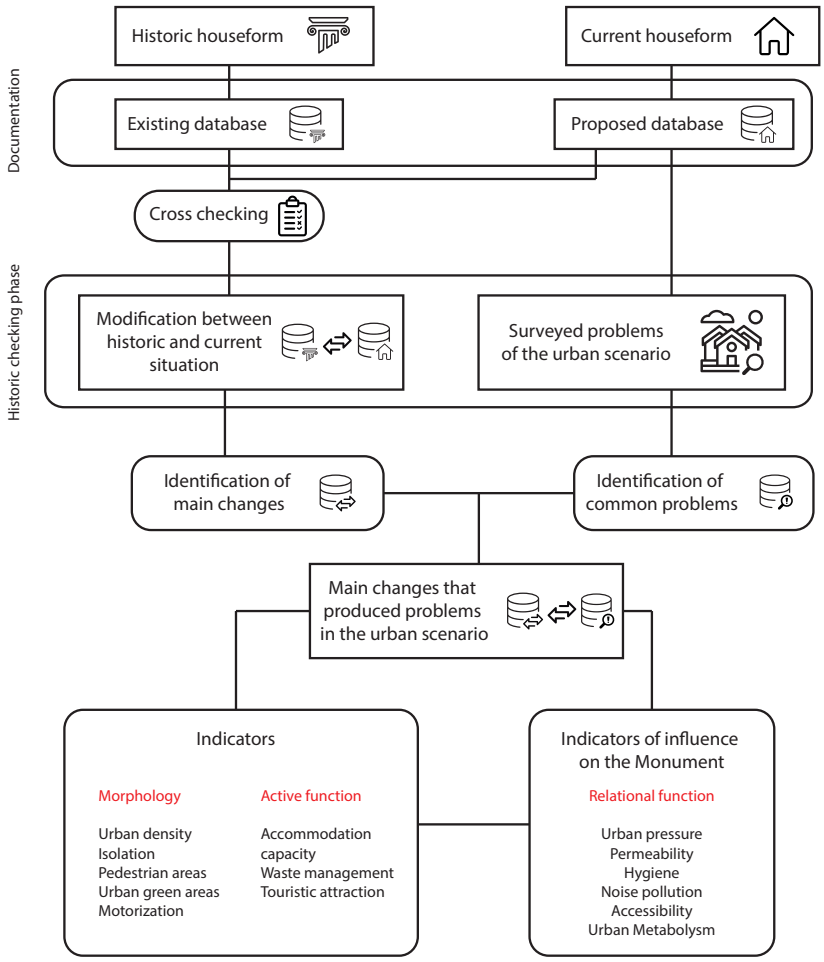


Figure 6: The diagram shows the methodology followed in this study to analyse the comparison in between historic and current buildings in the historic centres and to create indicators: the indicators are distinguished between Morphological, Active and Relational.

However the interpretation of data is the second step of the analysis: how is it possible to find a common language in order to read different environments? The answer to this question could be difficult because of many factors: size, composition, details and many others.

The methodology created in this research do not analyses the quality, but tries to find a way to read an average variation data.

As the research will introduce in the chapter related to the adopted instruments and tools (PART 5), the study follows two parallel directive: one with the presence and second with absence of an old documentation on the building. The analysis methodology, thanks to integrated survey technology, gives the bases in order to understand the initial shape of the house. As the research shows in chapter *12.1. Variables of change: the main features to document* the documentation has been conducted, in order to prove its validity, in comparison between new extracted data on initial house-forms and old databases.

However, the final possibility is to have a clear profile of the initial house-form together with the today's one. The creation of two databases of the same study cases (the first with the initial shape of the buildings inside a certain area and the other with the current one), gives the possibility to check the average variations: presence of new rooms and walls, variation of openings and vernacular decorative and structural elements, addition or subtraction of volumes. Thanks to this, taking in mind that the variation of house-form is independent by the size but influent in different way towards the surrounding areas, was possible to check the relation in between the presence of problems that involve the entire area and the morphological variation tendencies of the same.

Thanks to the analysis of more than 219 case studies on individual houses, 22 case studies on street scenarios within 2 city complex, and due to the creation of a relation in between all the documented buildings and relational systems, it was possible to define a list of average changes in house-forms that produced variation in the urban scenario also towards the recognized monumental entities. To understand how it would have possible to read these changes, many indicators have been tested (more than 30, a total description is in chapter 12 and 13 of this study).

Basing on the previous dissertation the research divided the indicators into three main groups:

- the Morphology ones, that describes the composition of the variation in the building
- the Active Function ones, that concerns the reason of the creation of that variation
- the Relational Function ones, that shows the influence on the surroundings of the previous shape in the process of variation

To understand the usability of indicators and, on the other hand, the ones that have no mutual influence in the dualism monumental entity / surroundings, the research explores more than 50 areas leaded on in the last 5 years involving Universities[8], Trusts[9] and NGOs[10], which highlight issue, problems and sometimes solutions. Due to the use of these indicators, the aim of the study is to create a model of comparison in between two different environments with different approaches to the preservation from the actors involved in order to understand the good ones directed to a transmissible conservation.

[8] University of Ferrara, Department of Architecture; CEPT University of Ahmedabad

[9] Mehrangarh Museum Trust of Jodhpur; Ahmedabad Textile Mill's Association

[10] JDH – Urban Regeneration Project of Jodhpur; City Heritage Centre of Ahmedabad

10. Relations between systems

The analysis of a system of relationship between different environments is another step of this research. The analysis on this part focus on the possibilities and typology of influence in between different scale of urban heritage. As we already know the study concerns the idea of having different heritage levels: this is not concerning the importance or the proportion as normally known, but the level of recognition the entity have.

The identification of aspects that lead to a definition of different grades comes from the final use of the catalogue itself. As we already underlined in the previous chapters the aim of the research is to identify a methodology to conserve in the most appropriate direction, towards the enhancements for citizens and preservation of heritage city centres, includes the identification of possibilities to recognize a mutual relational system between the recognized heritage elements (areas that already are registered in the heritage archives) and others that are not but that can potentially be part of the recognized heritage entities. To create a categorization that shows this differences is important to understand that the matter of scale is not strictly important. Much more important is the potentiality of relation of an entity. These are the main reason the catalogue created to pursue this research is divided into 3 main groups. The categorization that has been followed is due to multiple reasons.

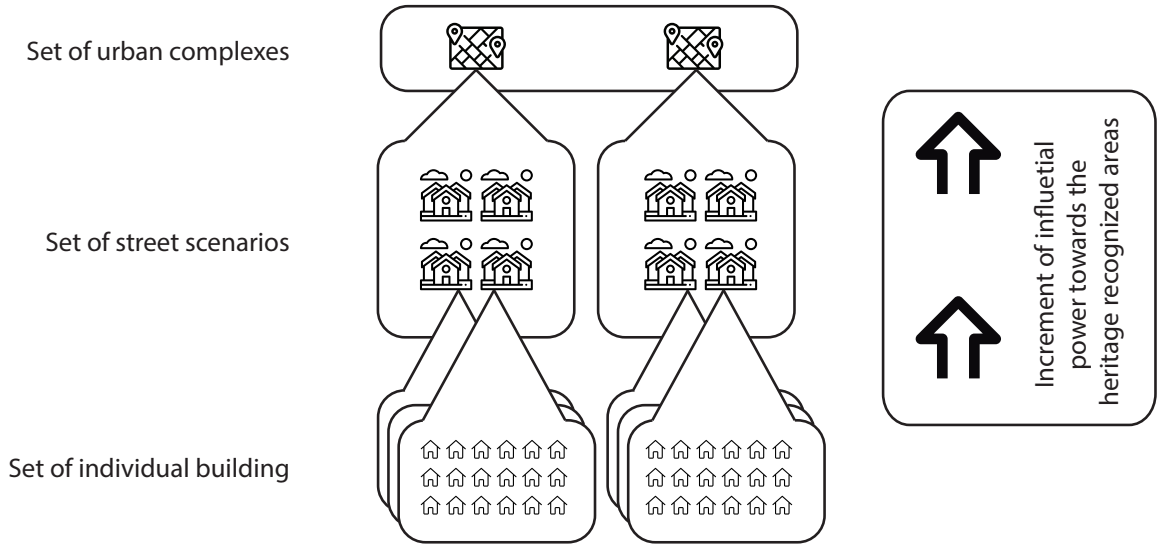


Figure 7: Quantity of documented case studies of the research: a big part of the deductions of the study are based on the quantitative documentation because of some reasons, one is the lack of literature on this field

First, as we said, is the level of recognition of the heritage area or entity. The single house or single commercial building is not formally considered (apart from some special case, as for example, the residence of an important personality of the city) as heritage entity because of itself. Actually it is recognized as a part of a unique body that is the area, or the neighborhood.

Areas or neighborhoods have, by the way, an important relation role that is crucially important: it is important to highlight this characteristic as another important one for the second group. The potential of influence in between different levels of recognized heritage. The idea is that different scale and different level of relations (that are univocally connected with the morphology) connect the influence caused by the average composition of a building, and as the research explains in the next chapters, its variation in time, with the influences on the surrounding urban complex.

Just to give an example: the influence of the shape of a single house in the viability of a neighborhood, has no apparently connection with the quality of the urban context. On the other hand the impact of a single house modification, for example with an addition of a floor on the roof that reduce the radiation of the sun on the street is high. Differently the hygiene of an entire neighborhood can condition relative monumentally recognized elements, for example modifying touristic flows.

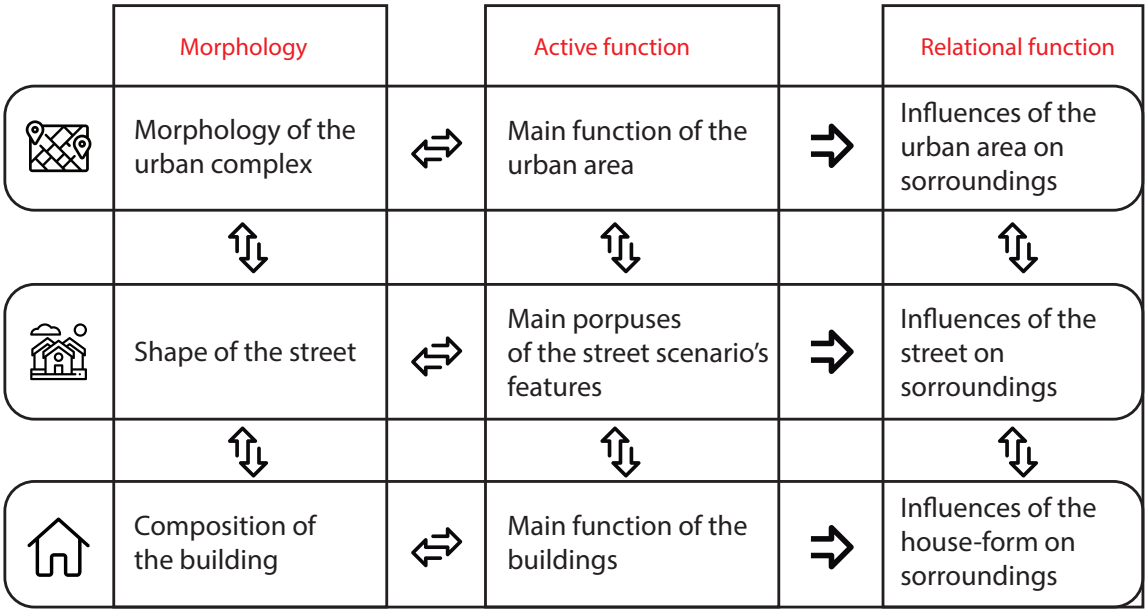


Figure 8: How the mutual influences in the matrix Morphology/ Active func./Relational func. connects different scale of morphological entities that are mutually conditioned.

At the end we can say that the influences are mutual between the following couples of entities:

House-forms / street scenario and neighborhood

Street scenario / Monumental recognized monuments

However, as viability has been taken as an example of the possible influence index, the research discuss about this methodological step in chapter 9. Creation of Indicators.

Now that the typology of relation has been described and the different sets of heritage entities level has been identified, the last relation is the one to focus on in order to find the possible answer to the question: is it possible to create a mutual conservation and valorization methodology in between house-forms and recognized heritage monument?

PART 4 – Methodology

11. Analysis model for identification of new and old elements in the heritage city centres of emerging countries

Many research activities have been conducted on the theme of analysing new and old in the heritage cities' elements in emerging countries. In one hand some of these, approach the problem mostly with a technologic support (Gopi, 2012), on the other some investigation worked it out by historic analysis (Bose, 2010).

As a matter of facts, the identification of symbolic boundaries between heritage and not-heritage elements (what to maintain and preserve and what not) inside an historic city, moreover if the case study is inside a quick developing environment and a heritage still not recognized[11] old centre, is an important discussion ongoing in the Indian subcontinent since long time. However, the aim of this study is not to dictate roles on the whole set of heritage elements, or examine the way to work on-site in the restoration field: the aim of the research is settled on a wider range, examining procedures of identification of heritage elements to preserve and encroachments to be fixed up. This has to be done throughout a methodology that leads sort elements into categories. It is possible to suppose the following: if the theory is applicable on the Indian cities' heritage, it would be possible to find a way to adopt and adapt it also on other similar contexts.

This chapter introduces the methodology to understand elements that are in conflict with the mutual preservation processes in between heritage recognized areas or entities, and the historic city centres. Therefore the indicators of relational functions, already introduced in chapter 9. Creation of indicators and developed in the followings, requires an attention to the characteristic that influences reciprocally the house-forms and the street scenario, together with the influences between the street scenario and the urban complex.

[11] "not already recognized" is to be intended as "not listed inside any government catalogue"

One of the main issue that is possible to face during the process of highlighting new and old elements in the historic centres of Indian cities is the definition of the organic shape of the initial settlement. The methodology hereafter presented takes under consideration that the identification of an addition in the shape of the heritage city does not necessary mean the presence of an encroachment. The variation of a colour in the façade, or the different style of nearby buildings could be due to an historical variation of the people living there as well as an advent of new conquerors. Stratification, most of times, is part of heritage of the place (Rapoport, 1969). Changes in society and the influences of new stiles are usually recognized and present in literature (Havell, 2008): this helps in the documentation of different shapes of the building by age of construction.

Nevertheless this research, thanks to many study cases documented, underlines the average mutation of the shape of the buildings in the last decades, with the advent of new needs: this simplifies the recognition of a tendency and then the recognition of parts of the heritage scenario that are alien inside the historic form. The methodology bases on experts diagnosis on the case studies and gives the possibility to define the main variations.

Nevertheless, the identification of an integrated tool that defines every little change in the morphology of a building seems unnecessary towards the examination of the main area variation. That’s the reason of taking in charge an average variation of the urban complex.

As already explained the documentation, as well as the acquiring method (supported by tools) has to be validate: the methodology adopted for the validation has been checked in many different ways and the decision was to adopt some reviewing technologies and tools (that have been in turn proved with high definition technologies) in examining the morphology of the buildings. Concerning the historic aspect the proof of the methodology was given by the comparison between the data extracted from old reports (Jain, 1989; Jain, Jain and Majmundar, 1989): this comparison gave a percentage value on how the documentation campaign is truthful. In this way the morphology of the new documentation and the historical aspects have both a percentage value of veracity.

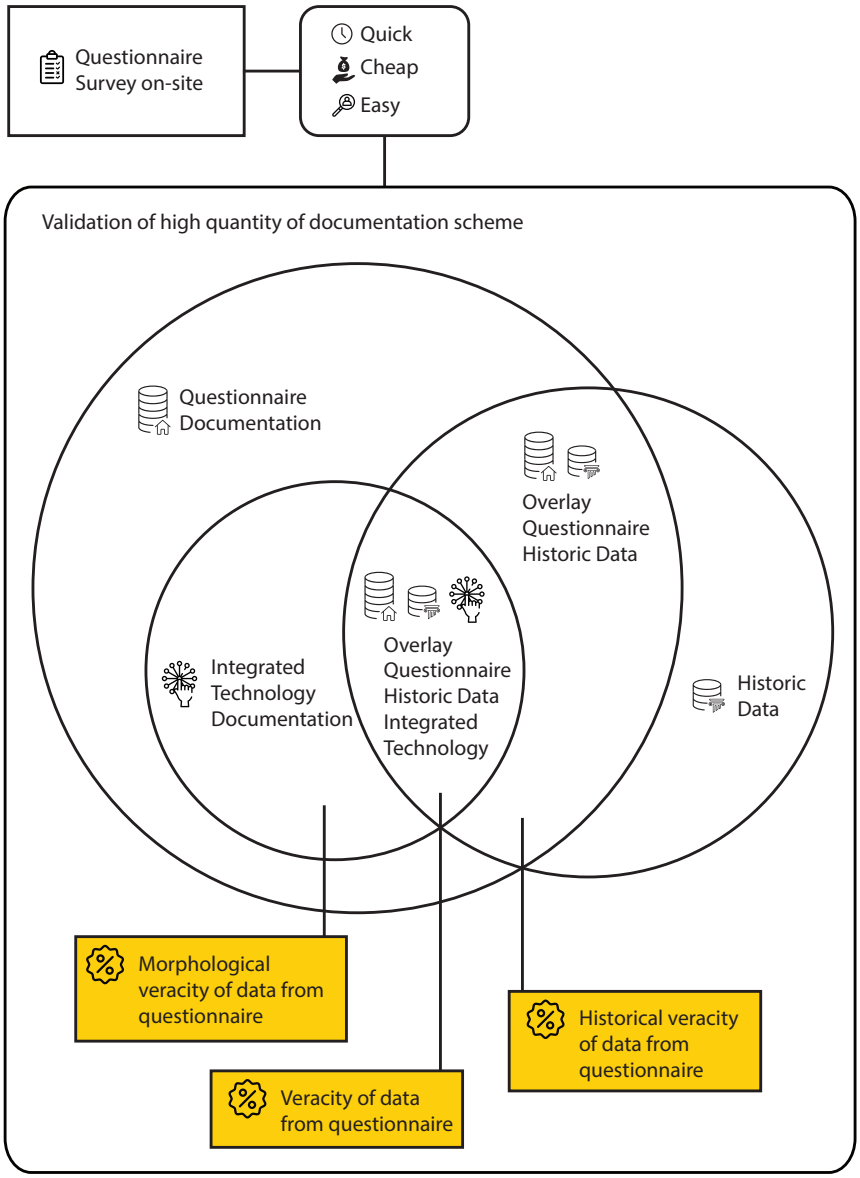


Figure 9. Diagram of validation of quantity data from low to high accuracy technology

At the end the research shows how a high value of veracity will be enough for the creation of an usable documentation. As a matter of facts the basic documentation will be undertaken thanks to an easy and cheap methodology. In fact a questionnaire has been created, starting from more than 30 indicators: for the aim of this research many of them has been detected as not efficient. In chapter 14. Morphological variation: the problem of time, cost and expertise for the survey the entire set of initial indicators is reported and is present a description of the adopted ones. However, because of the double-check done in order to understand the level of veracity of the documented data thanks to the questionnaires, the study proved on 219 case studies the methodology: thanks to these data was possible to prove (with a high veracity percentage level) the feasibility of the questionnaire for other areas of the city that have no literature researches on. The checked average variation analysis method allows the use of that data for the identification of mutation of morphologies that brought the creation of encroachments.

11. 1. Definition and reason of encroachments' problem

An encroachment in architecture, known also as a "structural encroachment" is a concept in American real property law, in which a piece of real property hangs from one property over the property line of another landowner's premises. The actual structure that encroaches might be a tree, bush, bay window, stairway, steps, stoop, garage, leaning fence, part of a building, or other fixture. Some attorneys classify it as a type of easement, related to an easement in gross, while some scholars classify such as one type of encroachment.

(Structural encroachment)

Alien structures emerging from preexistent as we saw in previous chapters are spread allover the Indian heritage centers and influence surrounding areas. This chapter analyses the adopted methodology in order to define predominant typologies of encroachments and the main reason these illegal structures born in the heritage centers.

The needs of people are changing quickly because of two main reasons: as previously said, on one hand there is the willingness of citizens that lives inside the city center to be part in the process that is involving mostly the newer part of the city: a push towards a westernization tendency. On the other, the necessity of better hygienic standards than the present ones. These two factors are present mostly in the young generations because of many reasons (as the possibility to make comparison all-over the world).

Nevertheless, the absence of funding and the need of quick incomes (see chapter *5.2. Exploitation of the historic city centre for economic investment: the touristic pressure*), together with the lack in the transfer of traditional know-how on constructive methodologies, we already analyzed the reasons in chapter 5 of this study, create fertile ground to "spontaneous" informal structures.

However, a consideration is needed in order to better understand the field of the analysis: encroachments this study examines have been created starting from the late '80s. The absolute majority of those cases are caused by the already explained reasons in the beginning of this research, as the willingness to have new incomes and to grow the family budget due to the increasing touristic economy.

The methodology adopted in this research takes in charge all this factors and the impossibility to have a literature on all the cases. The identification of the need that brought the creation of an easement was analyzed in a double way: a survey in between 219 case study thanks to a questionnaire and a check of the similarity in between the initial composition and the present one (see chapter 12. Comparative methodology to analyse variation of building in time).

This means the study analyses the encroachment problem in a precise delta of time taking in consideration the variable of not to have some previous survey. The investigation throughout a delta of time gives the possibility to understand not just the morphology and its influences on the local surroundings: it gives the possibility to explore the reasons some healthy, viability, accessibility and many other problems occurred in time.

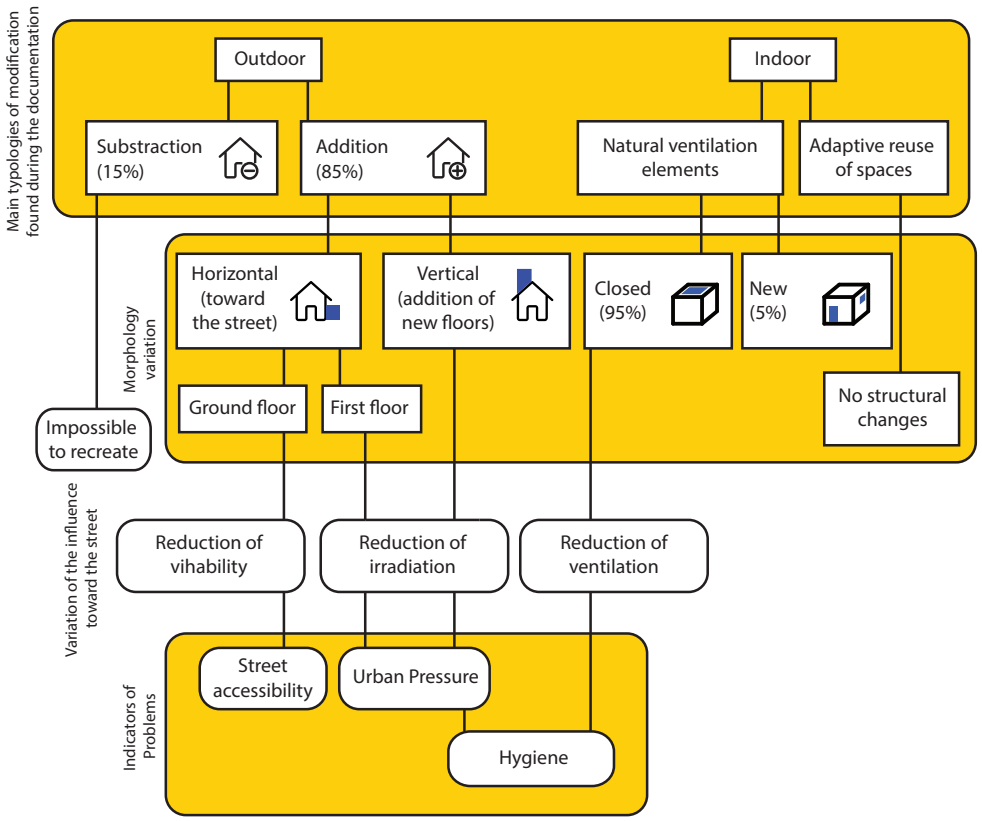


Figure 10. Typical Modification of the building structure and effects on the street scenario

An introduction of the main justification of the creation of easements is the need of more space inside residential buildings. Commonly happens in heritage centers without monitoring possibilities by municipality corporations, where the toilet is shifted outside, with the creation of a new room, sometime with structural problems and creating a reduction of the street size. However, the location of the new “room” of the house cannot be on the road, but most of times influences the proportion of

the streets. Most of times, the new room (as we said toilet, but can be any other, as a little kitchen and the previously existent kitchen space converted into a bedroom or a new living-room), is placed on the otta (or otla, the external semi-public relational space). This shifting of relational functions towards the street generates the need of the creation of a new space before the ordinary parking stripe for motorbikes. In few lines, it has been possible to describe one of the average procedures of reduction of the vehicular path and a consequent increase of viability problems. Nevertheless sometimes the function is shifted not in the direction of the street, but on the same building, creating new rooms on the traditional rooftops.

Apparently this solution can be the correct one. However, due to the survey done for this research, the evidence is that the effects of that kind of action, whenever it is done without a pre-planning phase (that could possibly solve that problems), are two. First is the reduction of solar irradiance in the street, which generates a reduction of hygienic and safety standards; second is the decrease of the free area on the roof top terrace, traditionally used as a sleeping area during summer times in that cities and force the house owner to close the internal courtyard (which is present in the majority of the traditional indian houses): this effect the reduction of natural ventilation elements and the setup of automated air circulation systems. Most of times the electrical supplies for the air conditioning are in between the windows, avoiding the possibilities during the daytime to have a circulation of air thanks to natural ventilation and increasing the temperature of the street in both night and day times. The increment of temperature decrease the level of hygiene and increase the level of pollution along the street. The final effect is the decrement of livability of the street and moreover, of whole area.

At the end, the debate on the “restoration” methodology, together with the definition of punctual intervention of conservation or the discussion on the architect/conservator behaviours (Balzani and Dalla Negra, 2017), is not a matter of this research: that one is a step forward and the identification of the right methodology can be one develop and has to be, fortunately, a case by case action. Nevertheless this study is located before that point: the identification and the introduction of an analysis methodology to identify problems in the urban complex that emerged in time, which brings to the examination of crucial character of the street scenario that the conservation has to focus on.

12. Comparative methodology to analyse variation of building in time

12. 1. Variables of change: the main features to document

This chapter's focus is on the methodology of analysis adopted to examine the differences in between old and new composition of the not recognized heritage entities in Indian old city centres, as residential houses, commercial plots, and entire street scenarios.

As previously described (see chapter *11. Analysis model for identification of new and old elements in the heritage city centres of emerging countries*), this will lead to the identification of new average changing tendencies of buildings that influence the street scenario and then the urban complex. The urban complex in turn have a mutual relation influence system with the monumental recognized areas, as Fort, important buildings, heritage listed areas.

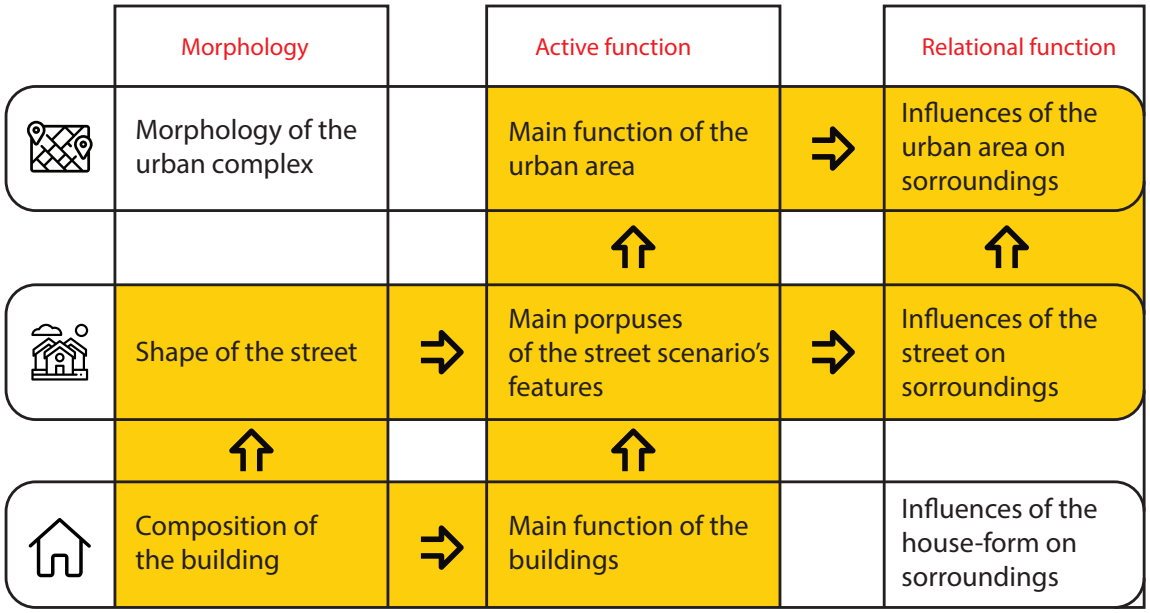


Figure 11. Matrix Morphology/Active Function/Relational Function and connection with building/street scenario/urban complex

In order to reach the aim of the research of having a wide range of replicable possibilities on other case studies, it seems important to define a proper scale of value and understand the possibility of making comparison analysis throughout different kind of data.

Actually, these data came from apparently different backgrounds: in the first part of this research many possible classification has been examined. One first categorization can be the state of “listed” of an heritage entity into a catalogue by different government entities (for example ASI, Archaeological Survey of India, or INTACH, Indian National Trust for Art and Cultural Heritage). Another categorization can be the different typology of structural encroachment that modified the composition of a building during the past decades of development of the country. The challenge of the study in the adoption of a survey methodology, in fact, has been to find the better one in order to create a comparison among the characteristic of the building between two different historic moments. Moreover, in the creation of a research that has to be valid for other kinds of environment also, the purpose was to embrace a wider possibility of data and cases. This is the main reason that led the research to test different possible set of instruments.

In this scenario, the chapter introduces one comparison methodology that allows the recognition of common variables in between different environments and how these variables are connected. As already treated in chapter 9. Creation of Indicators, the research analysed possible common factors that can describe the average changing tendencies of certain areas that creates a mutual influence between entities thanks to the introduction of indicators.

The comparative methodology of analysis has been conducted on data surveyed thanks to different methodology because of many factors as different availability of literature or possibility to survey in a certain way the object. Is it possible to find a detailed description, together with the one of the obtained results, in *PART 5 Identification of equipment and tools for survey and documentation.*

In order to analyse the new needs of the population and the average variation quantitatively, a questionnaire has been created based on different factors and that is hereafter described.

One part examines directly the differences among the actual situation and the 1989’s one thanks to the INTACH surveys (see chapter *6.1. Indian National Trust for Art*

and Cultural Heritage Reports). Another part defines procedures to adopt in case of absence of surveys: these methodologies uses modern survey technologies and ad-hoc questionnaires that and are validate by an evaluation with the previously mentioned direct comparison. This is possible because has been chosen to overlay some areas in between the two surveys. The total number of surveyed buildings is 219, and it has been conducted all over the city centres of two cities.

As a matter of facts, some periods of time (as the last 30 years in case of this research) could be considered as a short time for a structural variation of the main features of architecture in already developed countries, maybe also because of the deep conservation theory and practice recognized. On the other hand this period of time can contain many structural changes in a quick developing country. There are many factors involved in this tendencies of variation (see chapter *5. Issues in preserving heritage in an emerging countries: the Indian urban scenario*), as for example the reduction of the rural population and nomads that influence the growth of the cities, the need of more spaces and services. This leads also to the privacy need, which involves, obviously, the architectonic asset of the houses.

In 1970, the rural population of the less developed regions of the world was estimated at 1910 million – 75% of the total population. By the year 2000 it will probably have reason to 2906 million, despite wholesale migration from the country to urban areas. (UNICEF and WHO, 1975)

It is easy to understand that all these needs affect the house forms and the shape of the city: concerning the quickness of the city population increment we can understand why a 20 or 30 years change can be very important for a country in the same situation as India.

Thanks to some factors, as the presence of an initial interest of safeguarding the Heritage, the research settled the “initial moment” during the 80’s. In fact, the advent of industrialization, which came strongly in that period in India, started the big change that is still now ongoing (Chadha and Chadha, 2008).

12. 1. 1. Creation of the questionnaire

One of the most important study that this research analysed is the identification of the most appropriate documenting methodology to apply in the environment of emerging country: the literature analysis highlighted different architectural typologies and this was very important for the identification of the most appropriate method.

Thanks to the indirect survey, the research examined a big campaign of documentation that has been conducted during initial period of the huge Indian development that someone named “westernization”. In both the case study cities, Ahmedabad and Jodhpur, the challenge of documentation has been undertaken already during the 80’s (chapter *6. Catalogues of historic heritage in India*). Taking in mind the previous documentation as presented in chapter *6.1. Indian National Trust for Art and Cultural Heritage Reports*, a new set of indicators and factors have been introduced in the questionnaire. Therefore, indicators as inclusivity, accessibility, sustainability are, for example, used in westernised countries, apparently seem to be not very useful for the environment this research focuses on: but this is not completely true. Indicators as “inclusivity, accessibility, sustainability” can be adopted on a wider analysis range: the inclusivity of an individual house does not have relevant influence on the surrounding area. On the other hand, the inclusivity of an entire area have effects on the entire environments. For this reason the basic documentation of the individual building, toward this kind of documentation (where the study is focused on the average morphological variation of the house-forms and the street scenarios) are not useful because too wide and omni-comprehensive: nevertheless, these kind of indicators are useful to understand and define the whole area’s characters. As the study focuses in detail in chapter *14.1. Quantitative analysis: Questionnaire Survey*, the basic analysis that has been followed to define the methodology of approach to the urban structure of that city centres, has to be based on easy, quick and quantitative data.

These data have to be validated: so the methodology adopted to validate the data is explained in chapter *13. The relational functions and the analysis of variation of influences*: from the morphological modification of a building to the influence of the area toward the monument. The need of having a quick, easy and quantitative analysis is bivalent: first the tools that will be used for the analysis has to be approachable for the possibilities of local actors, that, in emerging countries, as the research already underline in chapter 5.2, are mostly on other economic target at the moment. On the other hand the tool created have to give a report on the average variation of the morphology, and then, on the relational factors of the historic centre towards the monumental recognized area.

12. 1. 2. Comparison between old and new survey

In order to catalogue and compare different typology of data as the one surveyed thanks to questionnaires, together with the metric ones and the photogrammetry one with a high level of detail, a hierarchy system of register for the survey adopted methodologies is the theme of this chapter.

As already introduced in the beginning of the Methodology the representative scheme to understand the set of variables in the analysis is the following: in fact, to embrace the highest number of case study and to test the feasibility on heritage Indian context (see chapter 14. Morphological variation: the problem of time, cost and expertise for the survey), many techniques have been tested.

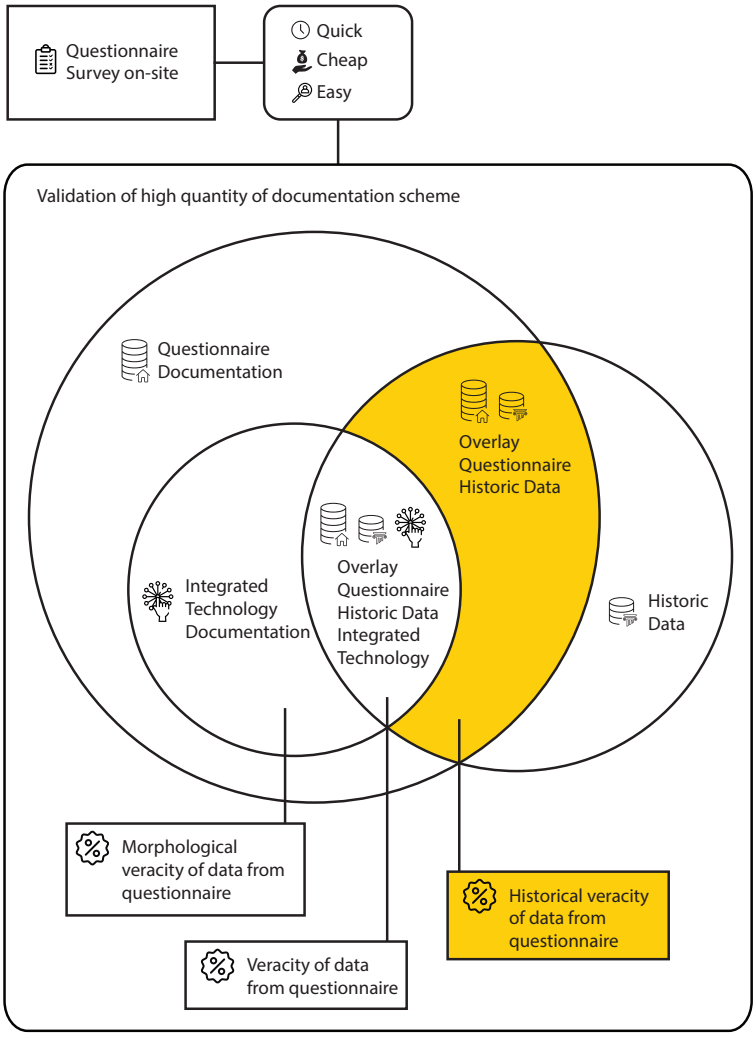


Figure 12: Portion of the dyagram analysed in this section. The overlapping of historic data.

In this scenario, the tools used and the different kind of detail present during the different documentation phases, need some clarifications: the importance to have a common basic knowledge of each area and to create an evidence of the basic factors that are important for the research allows some discretization.

Tools that evidently give very detailed report of the documented object, as the Laser scanner, are adopted in this study, just as checking technologies: as previously said the need to have a quick, easy and cheap documentation system is crucial. That is why the study introduced some compensation factors:

1. Time (time spent in the creation of the documentation, that will of course present a higher value for laser scanner survey, then the standard survey methodologies)

2. Level of detail (influence the number of documented study cases)

3. Quality of data (the error of the survey influence this indicator: of course the accuracy of the data will be higher following a direct survey methodology)

Another average categorization done due to the stakeholder real detail needs and possibilities is the one that concerns the size of the area to be surveyed.

The matrix of the three previously described compensation factors creates the following diagram that shows, thanks to the analysis of the case studies of this research, the most appropriate technology to apply in the survey of precise urban element in different scale.

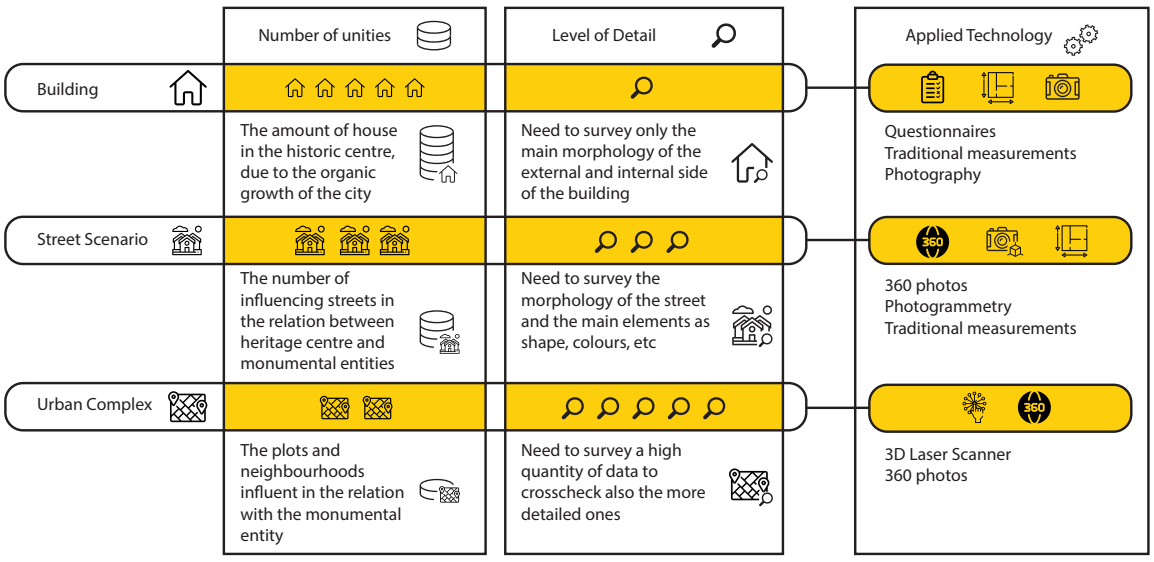


Figure 13. Qualitative and quantitative analysis (and related tools) of data for the aim of the research

On the other hand the comparison in between the surveys done in the late ‘80s by INTACH and Jain Associates and the new ones imposes the creation of other factors to balance level of detail and quantity of data. In fact the data extracted as variation of house-forms, public spaces, monumental areas due to this documentation, proves the validity of the methodology on other case studies that have not a similar old survey.

Therefore, in order to proceed with the comparison methodology of the surveys, is important to analyse some factors: the level of details, the quantity of data and the on-site survey time.

The early surveys collect a high number of case studies on neighbourhood where is possible to understand composition of street and volumes within a scale that starts from 1:1000 and gets to 1:200. On the other hand there are also detailed plans, sections and facades representations of many building taken as individual case study. From the first part that concerns the Urban Scale (see the composition of the reports in chapter *6.e. Indian National Trust for Art and Cultural Heritage Reports*) is it possible to understand the variation of individual building in different way: throughout a comparison with the newly surveyed data by *Questionnaires* or by T*raditional measurement system* and by *360° photos*. Level of detail is almost the same, considering the level of detail of metrical survey fixed at 1:200 scale and the colour and details data of the 360° photos. The old composition of the house-forms and the new photographic data shows the forward movement towards the street (recognizable in 1:200 scale).

However, the cross check in between the two survey systems is very important to validate the procedure: once the databases of variation has been created at different scale (the individual building one and the street scenario one) the comparison between the two is validating both of them. The two level of overlapping of data, historic / contemporary and individual building / street scenario, gives an average data of the modification in that area. Proceeding area by area and then pulling together the street scenario databases of average change it is possible to highlight some principles of the temporal variation of the urban complex case study.

The final stage is the overall checking of the surveyed data thanks to a high level of detail methodology on wider areas to prove the validity of the detail data surveyed on a little scale. The 3D laser scanner survey gives the possibility to check the data in a short time covering long distances and big areas. As a matter of facts this technology is very expensive and costly. That's the reason of the introduction of the Photogrammetry: the scale of investigation is not detailed to the point that makes useful the data.

At the end, there is the possibility to relate, in the changing process, different inputs, surveyed with the appropriate methodologies, thanks to a dedicate matrix of indicators cross checked at different level of details.

Tools adopted in this research and tested on field are following.

Basic technologies:

- Questionnaires
- Traditional measurement system
- Photography

Medium technologies:

- 360° photos
- Photogrammetry

Advanced technologies

- 3D laser scanner

Of course, these survey methods have pros and contras: the creation of compensation indicators allows the comparison in between the extracted data. Nevertheless, in order to create a methodology that is applicable in the emerging context, the study needs to consider other factors as the difficulty in affording expanses for high budget instruments or the lack of technology knowledge in 3D survey field. This is the main reason the research explores different analysis methodologies, basing on the different stakeholders' possibilities (economic and technical). The first group, Basic technologies, contains tools that are in the possibility of every kind of basically skilled technician. Questionnaire and photography are commonly used for cataloguing information also from municipal corporations.

On the same page the traditional measurement system is easily affordable but with important results: in fact the research compares in some of the case studies in the PART 6, the variation of level of detail in between different technologies and the actual scale needed for the conservation process. It will be evident that sometimes the 3D laser scanner detail is not needed for typology of building with different levels of problems.

On the other hand the research shows in PART 6 how important is in certain case the usage of high level technologies for pubic areas' preservation and enhancement processes.

13. The relational functions and the analysis of variation of influences: from the morphological modification of a building to the influence of the area toward the monument

This chapter analyses relational functions by two points of view. The first one is inside the heritage urban complex, as the research introduced rapidly in chapter *8. Development processes in Urban Scenario*, concerning the mutual linked transformation caused by the construction processes acted on an individual building scale to the whole urban complex. The second part analyses the effect of the different distribution of the heritage areas in relation with the heritage monument, taking in charge the distribution of the two and the spatial overlapping of regions.

Keeping in mind the considerations on the variation of the street scenario due to the variation of the composition of a building (brought, as shown in previous chapters, by a changing willingness of the economic situation of the stakeholders), it is possible to create a matrix of possible relation in between two different scales of value. The first one is the scale that regards the size of the examined area. As previously studied, the quality of a single building influence qualitatively the street scenario that creates, together with the other street scenarios, the average quality of the urban complex.

However, mixing this data with the second categorization of morphology and active / relational functions (see chapter *9. Creation of Indicators*) the diagram gives a wider but more detailed view of the problem: the active function of a single building influences the one of the street and then the urban complex's one too. Therefore, it is possible to relate the main function of the building, which is also related to its morphology, to the influence on the surrounding areas. This gives a matrix of three by three factors.

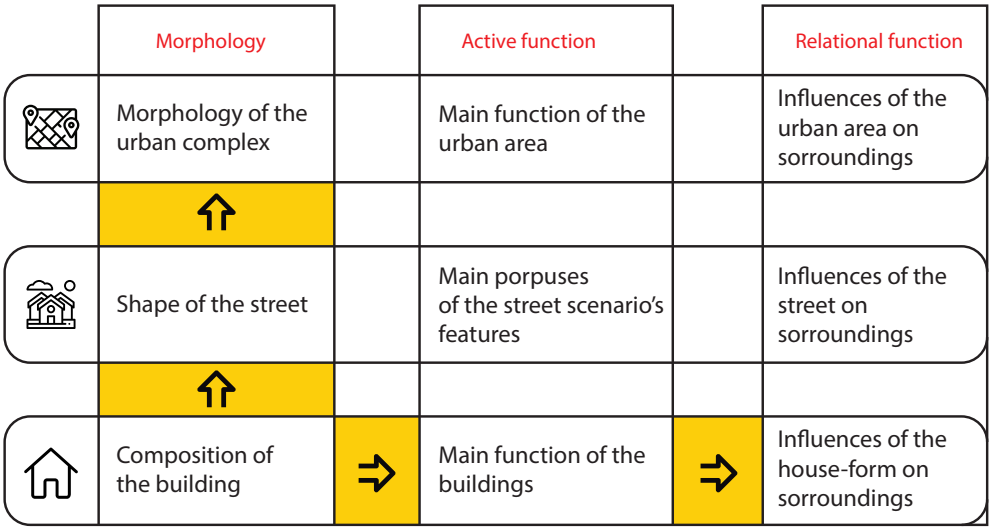


Figure 14: Matrix of relations between different scale (Individual building/Street scenario/Urban complex) and the connected aspects (Morphology/Active function/Relational function)

On one side are there the different scale of analysis: the individual building, the street scenario and the urban complex, categorized because of the size. The second categorization is the one of the morphology and functions of entities that are related as composition of the house that effect and is effected in a mutual way by the active function and that creates an influence on the surrounding areas, the relational function.

Going deeper in detail it is possible to read the matrix in two ways: taking under exam the “scale” direction it is possible to say that the size of a building, the number of inhabitants, as the presence of natural ventilation elements have a resonance on the presence of drainage systems and highness of the complete street scenario. In their turn, these factors are influent in the level of urban density level of the city area.

If we read the matrix in the “morphology/function” direction it is possible to say that the width of the carriageway (morphology) influence the viability (active function) that has effects on the accessibility towards other areas (relational function).

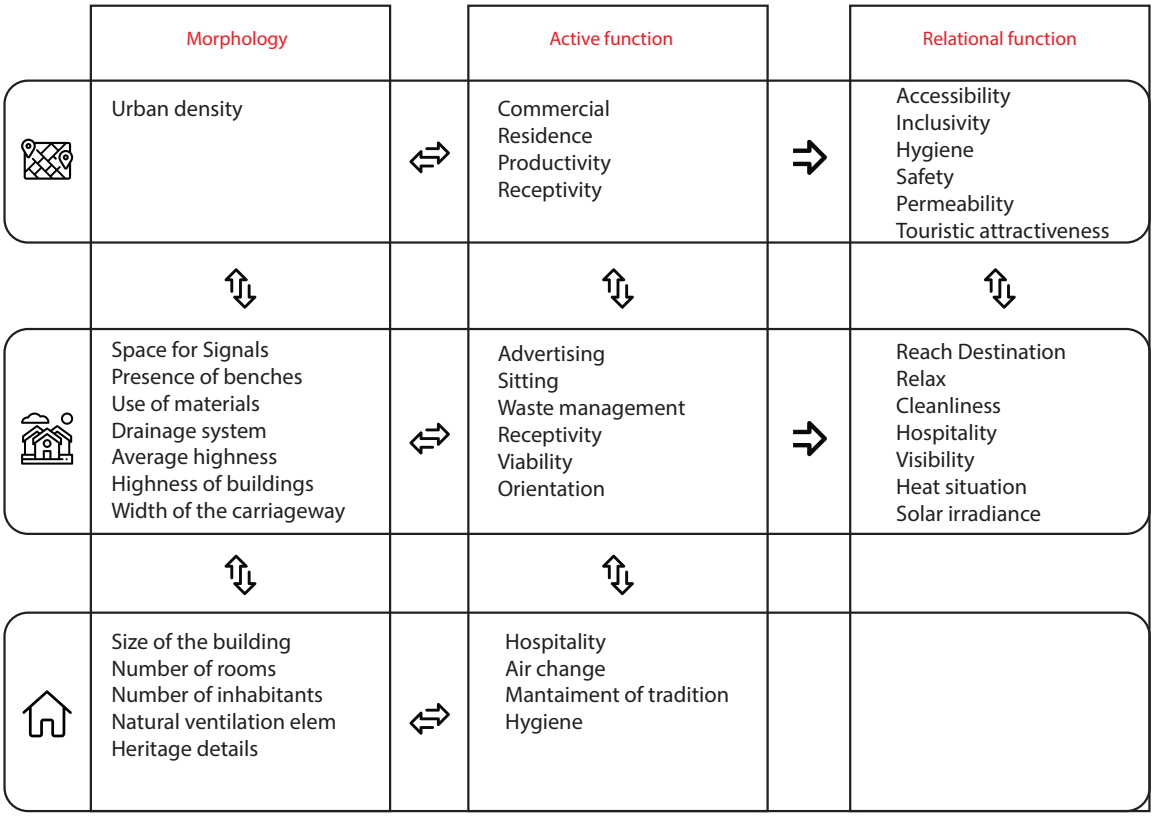


Figure 15: Surveyed indicators inside the Matrix. The relation of scale systems and morphology/functions that are connected in mutual ways.

Of course, this analysis methodology has to be implemented in the characters due to the intent of the research and the urban structure examined. This research analyses the possibility of create a mutual conservation and valorisation system in between the heritage listed and recognized entity and the urban heritage not listed or recognized. Together with this is the consideration that the study analyses that part of the historic urban context that have a high rate of new informal structures due to the lack of possibilities from municipality to monitor the whole process of development in the quick emerging environment.

Of course the iteration quantity to get from the morphology of an individual building towards the relational functions of the whole urban complex is the same in every direction (4): it is possible to get from one point to the other in the following ways:

in the Morphology/Function axe first:

1. Morphology - Number of rooms
2. Active function - Possibility of creating new restrooms (for the establishment of receptive function)
3. Relational function - Incomes for the nearby structures

then the Relational Function axe:

A. Individual building - Incomes for the nearby structures

B. Street scenario - Garbage renewed management system (Cleanliness)

C. Urban complex – Hygiene

However, as it is easy to understand, this path is very methodologically fragile: the passage in between the point 2 and 3 is not direct and measurable; the same happens for the step from A to B in the Relational functions in between individual building and street scenario: in fact the garbage renewed system factor can be provided both from the increasing of the incomes to the structures present on the street or from the creation from Municipality of a management of that field.

This is the reason the research take some of the factors inside the matrix as laterally influent: some of the functions and morphological characteristic have been judged as not significant for the aim of this research. As for example the relational functions of an individual building has been studied partially because of two reasons:

• few influencing possibilities on the relational level at an urban complex

• impossibility of creating a relational modification towards the other nearby buildings

This two reasons make the group not influent for the aim of the research. The same is for the Morphology of the urban complex, but in that case some factors as Urban density (that influences at the relational function level the Urban Pressure) are relevant.

Now that the first matrix has been examined the step forward is the insertion of another overall variable: the time. As a matter of facts, as already investigated in the previous chapters the research takes in charge a double documentation system: the 2017's one and the late 80's one, with a temporal gap of almost 30 years. The following diagrams shows the matrix of interaction in the same way but with the addition of the time variable.

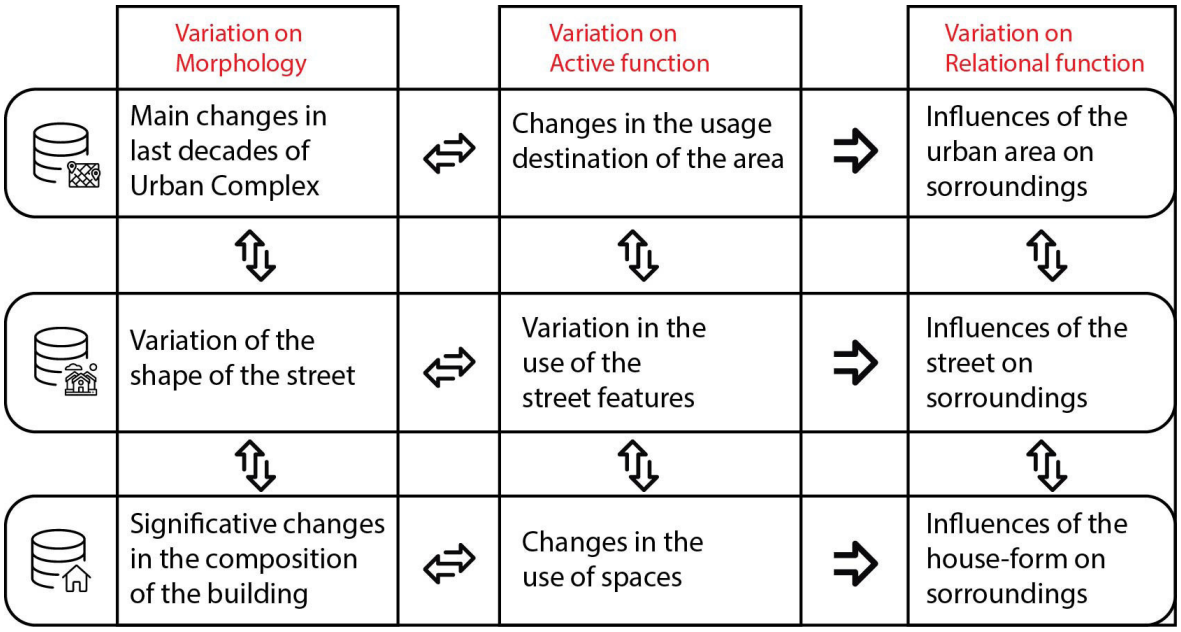


Figure 16: Matrix of interaction system with the addition of the time overall variable

It is possible, due to this interaction system, understand the relation in between the variation among surveys done in different moment of time, explained in chapter 12.1. Variables of change: the main features to document, and the influences that the structural changes in the average house-forms in one part of the city towards the monumental entities.

The average change in the morphology of building in a certain area have effects in the mutation of the influences of the urban complex towards the monumental entity: but how to recognize these indicators that are really influent?

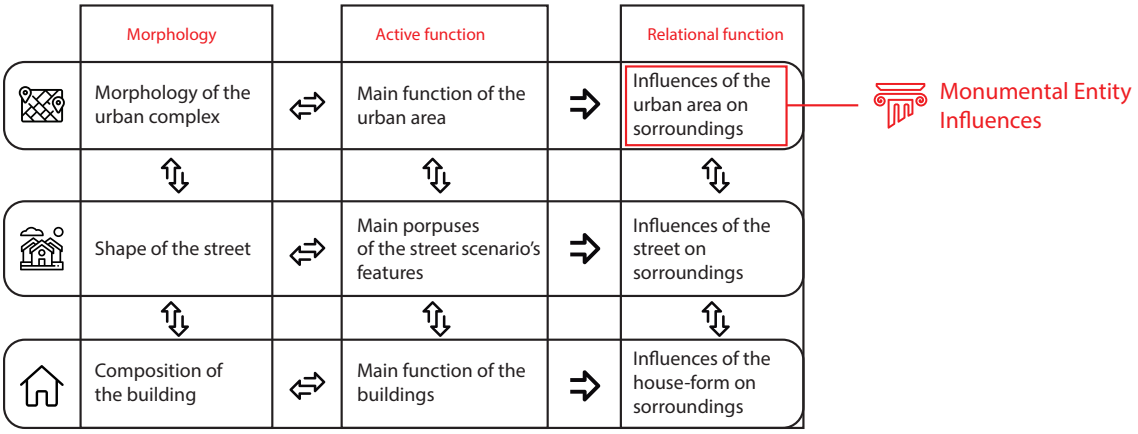
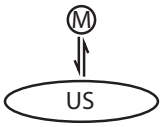
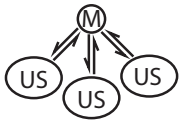
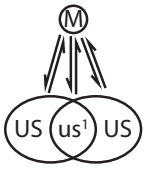
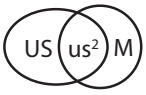


Figure 17: Complete diagram and the relation with the monumental entity

Relational models	Relevant relational indicators		
	M->US Touristic recepticity Touristic Attractiveness	US->M Permehability Riceptivity Accessibility	
Rel. Model between M = Monumental Entity US = Generic urban structure			
	M->US Touristic recepticity Touristic Attractiveness	US->M Permehability Riceptivity Accessibility	US->US Permehability Riceptivity Hygiene
Rel. Model between M = Monumental Entity US = More urban structures			
	M->US Touristic recepticity Touristic Attraction	US->M Permehability Riceptivity Accessibility	us1 Urban Pressure Permehability Accessibility Touristic Attractiveness Metabolysm Hygiene
Rel. Model between M = 1 Monumental Entity US = More urban structures us^1 = Interpenetration US-US			
	us2 Urban Pressure Permehability Accessibility Touristic Attractiveness Metabolysm Noise pollution		
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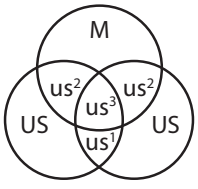
	us1 Urban Pressure Permehability Accessibility Touristic Attractiveness Metabolysm Hygiene	us2 Urban Pressure Permehability Accessibility Touristic Attractiveness Metabolysm Noise pollution	us3 Urban Pressure Permehability Accessibility Touristic Attractiveness Metabolysm Hygiene Safety
Rel. Model between M = 1 Monumental Entity US = More urban structures us^2 = Interpenetration M-US us^1= Interpenetration US-US us^3 = Interpenetration US-US-M			

Figure 18: Relational models between the heritage listed monuments and the old urban complex

Concerning the effect of the different distribution of the heritage areas and their average change in relation with the heritage monument, it is possible to define different combination of relational models.

The variables are the followings:

- Monumental entity (heritage listed and recognized) that interacts with one urban complex in different ways.
- The interaction can be along a unique line in between the two entities or with more directions that connect more than one urban complex and one monumental entity.
- Again, the urban complexes can have an overlapping area and the entity can be related also to that one. This means that influential characters surveyed thanks to previously mentioned indicators could be merged in that overlapping sector or cancelled because opposite. This could make them have no effects on the heritage monumental entity.

The diagram shows the described typology of relations and the consequent potential influence on the indicators at an urban complex level. In fact the typology of relation (regarding also the indicators of relational function) ongoing between the monumental entity and the urban nearby complex, as it is defined in the previous chapters, is determined basing on the morphological situation between the two.

13. 1. Creation of indicators for the analysis of old city/monument relative functions

Concerning the asset of behaviours of actors towards different kind of dimensions of heritage (listed and not listed ones), the research adapted to the field of conservation and valorisation of the heritage some already tested indicators. The analysis has been conducted throughout interviews and indirect surveys of two kinds: the first one created thanks to the use of CDIS indicators , regards the monumental heritage listed entities and their characteristics. The second one is created to highlight some relation system in between the different level of heritages, the listed and not listed ones, but that have mutual influences with the modalities already explored in chapter *13. The relational functions and the analysis of variation of influences: from the morphological modification of a building to the influence of the area toward the monument*.

The final list of adopted influences indicators is based on the comparison cross in between this documentation and the one from the analysis explored in chapter 12. The following investigation allows the surveyor to highlight the possible index to analyse at the level of relation in between an urban complex and the heritage listed area.

The first documentation methodology has been created on the base, as already said, on the UNESCO CDIS: Culture for Development IndicatorS.

In terms of research, the Indicators embody an innovative methodology that demonstrates culture's multidimensional role in national development processes through facts and figures, by unveiling challenges and by highlighting opportunities for the future. As an advocacy initiative, the CDIS implementation tools provide guidance for maximum policy impact through culture's integration into development strategies.

(Alonso and Medici, 2014)

The manual that shows the composition and the aim of the CDIS is composed by 7 parts:

1. Economy dimension
2. Education dimension
3. Governance dimension
4. Social participation dimension
5. Gender equality dimension
6. Communication dimension
7. Heritage dimension

This research takes in exam the 7th Dimension, the Heritage one, adapting the indicators to this study. In the chapter “Objective of the Dimension” it is possible to read:

The aim is to evaluate the efforts undertaken by public authorities and their outcomes, in relation to the establishment and implementation of standards, policies, concrete mechanisms and measures for the conservation, safeguarding, management, transmission and valorization of heritage in a given country. A better understanding of the challenges, potentials and shortcomings of these efforts is thereby gained. (Alonso and Medici, 2014b)

The undertaken optimization of this research on the UNESCO Indicators has been conducted in order to:

- Use the same index also on non-public institution, as the study takes in exam NGOs, Trusts and Foundations.
- Highlight policies that influences in a direct/indirect way the surrounding areas.
- Highlight the dependence/independence of the Heritage object by the surroundings.

Basically the initial check list inside the UNESCO CDIS is qualitative. The whole list of question has been divided into three groups, major components that have a different percent weight to create the final observation:

1 - Registration and inscription: this groups regard the amount of heritage entities (it can include intangible ones) already inserted inside a national and international list. In order to simplify the definition we can use the terminology "Census of Heritage Entities" – total weight of this level is 30%. The subdivision of this group is the following (with the weight): 33% International level registrations and inscriptions; 67% National level registrations and inscriptions.

2 - Protection, safeguarding and management: this second group relates to policies, measures, facilities, capacity building and community activities associated to the protection of the good. This group, with a value of 40% of the final, is divided into 3 subcomponents: 33% Conservation and Valorisation; 33% Knowledge and Capacity Building; 33% Community involvement.

3 - Transmission and Mobilization of support: the last indicator is related to two different aspects of awareness and it's divided as following: 60% of the value of this indicator focuses on the on going programmes with the intent of promoting educational potential of heritage; 40% is on the quality and quantity of agreements with civil society and the private sector concerning the protection and conservation of heritage.

However the research highlighted the integration difficulties in merging the information of this documentation methodology and the previously analyzed indicators because of the totally different nature. Therefore, in order to understand the best way to identity the usable data in the previously explained documentation, the indicators (listed in chapter 15. Actors' questionnaire) have been resumed and modified. This created a new list of indicators that allows the comparison. In fact some factors that came directly from the CDIS list were assembled and simplified to highlight the usable Relational Function's indicators on the documented case study.

Just to give one example (complete list is in chapter *15. Actors' questionnaire* too)

• Does an operational centre for capacity-building in heritage related areas exist?

• Is there any capacity-building and training programme you/your institution implemented in last 3 years?

• Is the community involved during the decision-making process of identifying tangible heritage elements and registering them?

• Existence of heritage site management committees with local community representation

Have been simplified with

• Social Impact

o Inner (actions of the actors that have resonance on the heritage listed monument thanks to a participation of the local community)

o Outwards (actions of the actor that have resonance on the urban areas nearby)

Another example is the following:

• Is there a dedicated annual budget for the identification, protection, safeguarding, conservation and management of cultural heritage?

• Are there specific policies and measures for conserving and promoting inventoried cultural heritage adopted in the last 5 years?

• Are there legislation/policies/measures regulating archaeological excavation adopted?

Have been simplified as follows:

• Velocity of changing in time

This indicates the possible results obtainable in reasonable timing

• Conservation state

In a scale of bed / medium / good these factors influence the nearby areas on the awareness aspect.

After the double documentation thanks to both questionnaires the study highlighted the more efficient usability of the second set of indicators.

PART 5 - Identification of equipment and tools for survey and documentation

The issue of new technologies feasibility in architectural conservation field, regarding developing countries, is a quite recent debate. Typology of output needed and usability of already existent instruments that have to be applied on subjects that have to be considered as slightly different from the ones the instrument has been created for. In fact, survey tools have been created with a precise aim and in order to give certain typologies of data: most of time, even though the growing adaptability, machine are created with the precise target of inspection of some specific objects typologies.

As a matter of facts, one of the most evident differences between Indian architectonic scale of detail and the quantity of the same, spread all over a temple, for example, is easily recognizable. In fact, looking at the majority of traditional Hindu temples (one of the most famous is the Kajuraho Group of Monuments, in Madhya Pradesh), it is evident how the standard survey methodologies applied for documenting heritage architectural monuments in western countries are not flexible on extremely detailed and big scale object unless considering a very long survey campaign.

This chapter introduces the methodologies the research adopted in order to apply some of the already existing tools in order to check the questionnaire documentation already explained in Part 4. Methodology.

One part of the described tools and methods comes from the field of architectural survey and gives the possibility, as previously analyzed, to compare new situation of urban complex and old one in a morphological way. This will be checked using some high technological tool that have been adapted to the triad “cheap, quick and easy”: as described in Part 3. Proposal of the Research, the intent is to analyze and prove the feasibility of the methodology on emerging nations, in quickly developing environments, where the targets of the Municipalities (many times) are towards a development, with many difficulties in heritage preservation.

Other instruments come from other fields as the touristic one or the world of digital visualization. Technologies, as explained in chapter 12.1. Variables of change: the main features to document, have been chosen for some main characteristic: the local

availability, the economic affordability, facility to use and, of course, the efficiency.

All the hereafter inspection methodologies satisfy those characteristics with an equilibrium between all the factors. The efficiency is the one that balances the others. For example with a reduction of level of detail, the economic affordability raises.

Moreover is important to clarify that the research has not the intent or aim to introduce an advancement of the already quickly evolving tools and instruments in the field of 3D Modeling or technological survey of heritage sites. Many research activities have been done to define tools and their usability for that target of survey and cataloguing, already introduced in chapter 12.

“Current BIM software, however, prove to be rather lacking in managing large amounts of data arising from the survey, especially if carried out with modern technologies such as laser scanner and photogrammetry” (Brusaporci and Maiezza, 2016).

The purpose is to find the more affordable and quick methodology to adopt in order to reach the aim. Introduction of new possibilities due to an advancement of technological tools could be a possible future study: many Indian Universities are already undertaking the challenge to improve new technologies and to convert them into feasible tools for the survey of local heritage.

The aim of this equipment’s part is to check a possible use (as the study already highlighted in a quick, easy and cheap way) of already existing tools towards the definition of a methodology on emerging countries (with the entire set of local multiple historical constructive layers, level of spread decorative detail and all the other peculiarities). To achieve this, the research focuses into the double check of two kind of data, that were examined as follows, on order to reduce the cost and to validate the feasibility of the methodology on that area/environment.

First part focus on the morphological documentation: defining the variation in time of the shape of the building and the modification of the use of spaces. That documentation is carried out using a standard methods of cataloging (with a specially formulated questionnaire) generalizing as much as possible, in order to make it replicable on other areas/case studies. In order to check the validity of the data throughout the standard onsite documenting methodology, the research achieved some case studies in overlapping areas with the old documentation. As it will be possible to check in next chapters the questionnaire is created in order to document the possible variation of a certain area in a period of time also without

a previous documentation. The choice to have some overlap with the old surveys comes from the need to validate at least one part of the data to check the whole documentation methodology. This will validate with a percentage of truthfulness the average historical morphological variation.

On the other side the research focuses on checking the contemporary shape of the building that previously has been surveyed by the “door to door” standard documentation, and then scanned with modern technological tools (360° photography, Photogrammetry and 3D Laser Scanner).

In this way, the research checked both the historical variation and the actual shape, which have been previously documented by a standard “questionnaire”. At the end, we will have a percentage value of truthfulness of the questionnaire’s data on many case study acquired by different double checking methodologies.

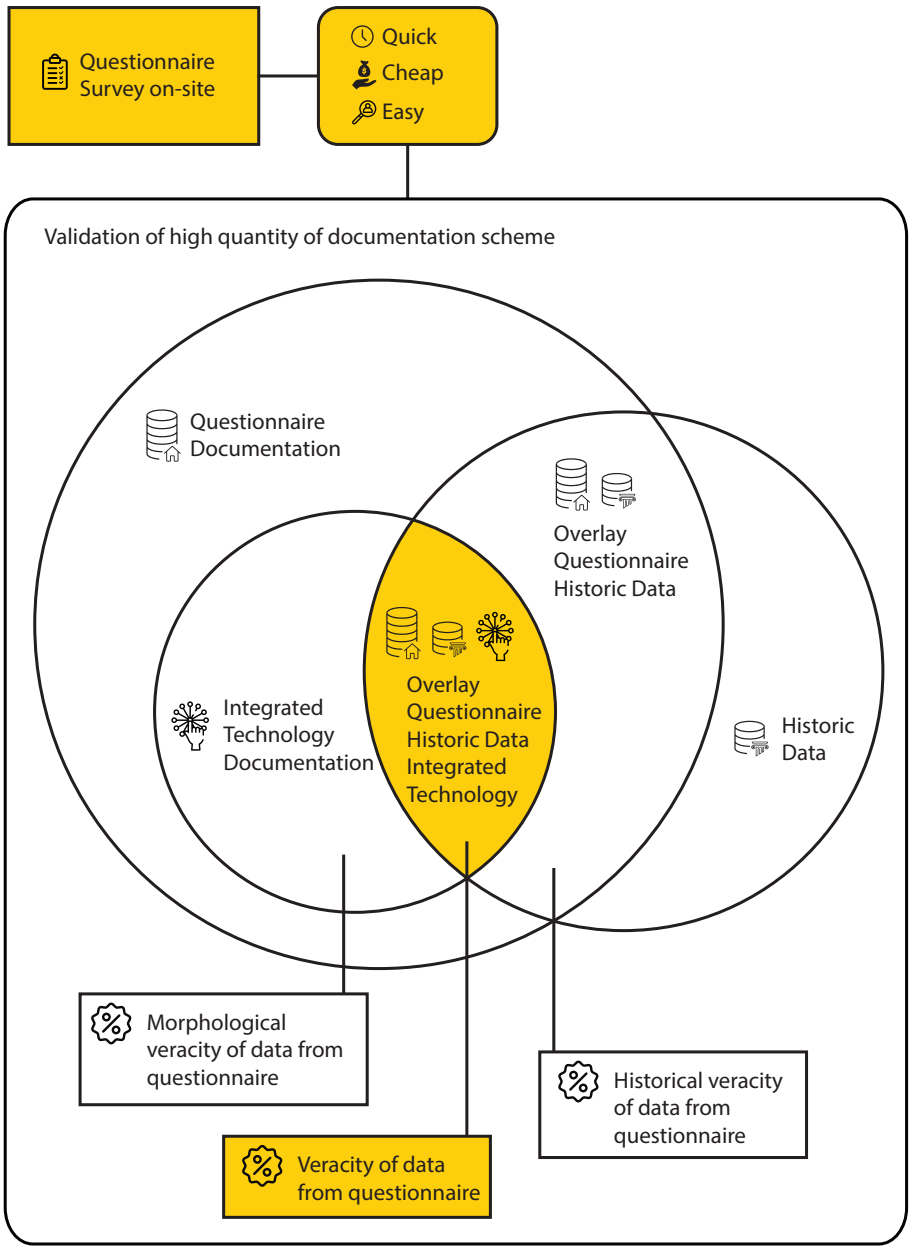


Figure 19: Representative diagram of the double check (historical and morphological) methodology and extraction of veracity of data

14. Morphological variation: the problem of time, cost and expertise for the survey

At the beginning of the third part of this study has been exposed the importance to maintain a high level of feasibility on the emerging country context. The characteristics of velocity, cheapness and easiness comes from the necessity to create a usable methodological tool, integrated with many technologies, starting as the research already explained, from a documentation by questionnaire, till the 3D laser scansions. This chapter discuss these three characteristics and their reasons.

First, as already examined in chapter *5.2. Exploitation of the historic city centre for economic investment*: the touristic pressure, the index of new construction works in emerging nations as India in increasing day by day also because of high investments by Governments. This creates need of development of new structures inside the historic centres and the quickness of this changing process is one of the first points this research took in charge.

India is in a major phase of urbanisation. No matter which figures you select, the urban population growth projections are incredible. In a 2006 report, India's Registrar General suggested a rise of 248 million people living in cities between 2001 and 2026. The 2010 McKinsey Global Institute Report on 'India's Urban Awakening' suggests a rise of 250 million citizens between 2008 and 2030. That means between 10 million and 11.4 million new people to be accommodated in Indian cities every year.

(Johnson (ed.) and Johnson, 2015)

The growing economy is leading the people towards the cities and this means the need of creating new spaces. Of course, the majority of the population that migrate towards the cities have the new city as main target. Nevertheless, some part of the population, because of different economic possibilities decide to set themselves inside the city centres.

In this environment of quick changes, the mutation of the heritage centres and the variation of needs generate a process of very quick transformation of the feature of

the street scenarios and buildings themselves. Meanwhile a complete documentation of the urban complexes, as already underlined during this research, has never been done and the risk to loose, because of the development, huge parts of the heritage areas inside the city is critically elevated and already on going. The creation of a catalogue that discerns the areas where it is possible to have a development, and its modality, is needed and within a very short time.

On the other hand, in spite of the raising level of alphabetization on the heritage and documentation themes inside educational structure and the growing awareness on this problem inside the municipalities' institutions, the systematization of a shared procedure that can be applied in order to document the developments inside the city centres with high skilled technicians, is still a far idea. Of course, the direction has to be towards the use of technological tools, with shared database, GIS and all the kind of data that would be necessary to create a complete and exhaustive census of the buildings.

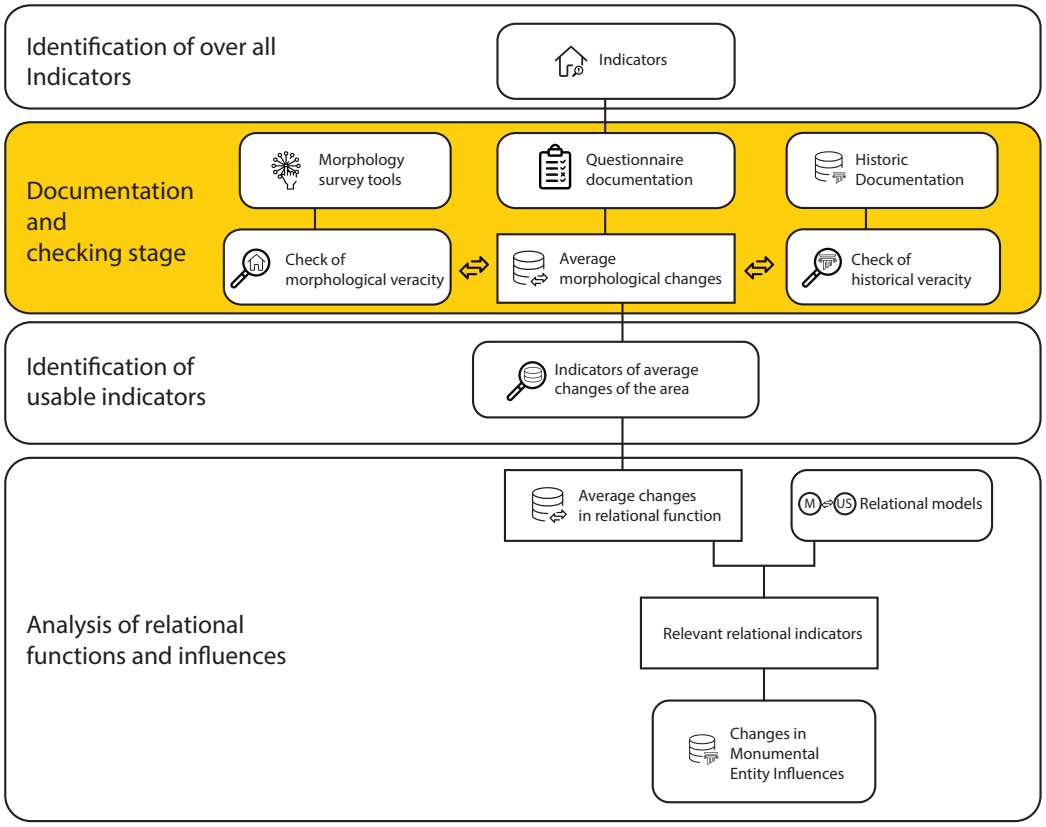


Figure 20: Complete methodology of documentation and analysis of mutual influence possibilities in between the historical variation of the urban complex and heritage recognized monumental entity

However, the idea of creating a feasible method to apply in order to realise surveys with high level of detail is not possible now, with the previously examined quickness necessities. The basic documentation hereafter described is based on a simple questionnaire that the technician or the surveyor can easily complete and fill without a deep and long training before. The basic extracted data are sufficient in order to understand the average modifications of the building structures and analyse that data to understand, with solid bases, the needed actions to prime the conservation process in the urban area.

The methodology, as already shown in chapter 12. Comparative methodology to analyse variation of building in time, introduces a double check procedure that validates the data with the base of 3D and integrated photographic supplies. These double check actions on the questionnaires' data could also be done in a second moment, in order to achieve the veracity of the documentation: however, as per the study cases of this research, the average veracity for the questionnaire survey is mostly high.

So the methodology is based on a cheap tool for the quantitative analysis. Then the study tries to define two checking methodologies that are economically affordable too: the photogrammetric 3D reconstruction and the 360° photos for the identification of variation in the morphology and quality of the building. At the end the procedure allows the documentation of the heritage centres in emerging nations thanks to a cheap, easy and quick process in order to answer to the tree needs of usability, lack of technical skills and velocity of morphological variation rocesses and is double-checked with tools that needs only a little higher level of knowledge.

14. 1. Quantitative analysis: Questionnaire Survey

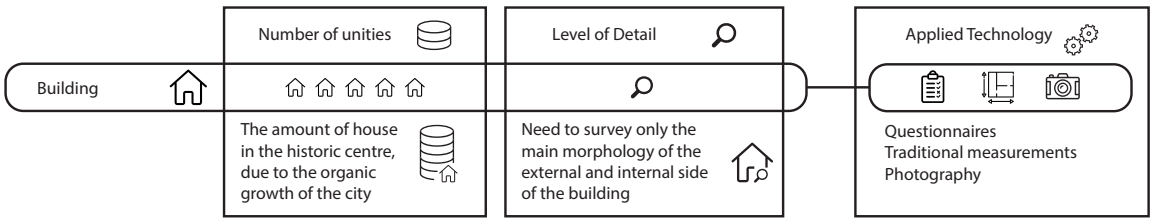


Figure 21: Quality and quantity of needed data from modern documentation campaign: the matrix with different levels of detail and quantity of surveyed unities is hereafter examined for the questionnaire survey part

This chapter examines the high number of data documented that gave the chance to create checking possibilities for the variation of the individual architecture, which allows monitoring the average variation of the urban complex too, with affordable non-metric tools.

The many different kinds of survey campaigns have been conducted from 2013 in Ahmedabad and Jodhpur, chosen as case studies because of many characteristic cited previously in this research. The already underlined features of the two cities make that couple of cities as a good starting point of analysis: in fact the two cities are very different one by the other mainly because of the size, but indeed have many similarities, as this study highlights, considering the development processes.

This has been highlighted thanks to the documentation conducted and thanks to a literature research that historically shows the first settlements, finding analogies with many cities in north India (Khawas and Kulshreshtha, 2017) (Kumbhat, 1996).

The documented case studies within the two cities in order to understand the validity of the proposed methodology concerns data surveyed in different moments and different methodologies (see chapter 12 and 13): the total number of case studies is 219 surveyed case studies with this methodology (60 in Ahmedabad and 159 in Jodhpur).

Taking in mind the consideration and the methodology explained in chapter *12.1.1. Creation of the questionnaire*, the surveyed factors are hereafter described:

- Human Presence
    - inhabitants in 2017 (quantity)
    - inhabitants in the 1980's (quantity)

This first part shows, as previously said the variation of the number of people living in the building.

- Residential Area Presence
    - Yes/No
- Commercial Area Presence
    - Yes/No

The majority of houses were composed by both commercial and residential space: this data is thanks to the '80s survey. This indicator shows the modification in the use of the ground floor and first floor rooms and it is important to understand, together with the variation of inhabitants, the changes in the usage of space and in the quantity of square meters for inhabitant of the living space.

- Architectonic volume Indicators
    - Total Area Occupied by the house
    - Addition Horizontal
    - Addition Vertical

This data, together with the previous ones, shows the average modification of the house and the typology composed by the vertical and horizontal addition/ modification. With the irst surveyed data, the *Total area occupied by the house*, allows to understand the geometric mean of modification of volumes in a certain area.

- Architectonic composition Indicators
    - Addition / Substraction of internal walls for creation of new rooms
    - Variation of natural ventilation elements (e.g. internal courtyards)
    - Total Variation of the house from initial composition

This part groups the modification inside the house with a percentage that is based on the total size of the building. The third indicator, *Total variation of the house from initial composition*, groups the previous two.

- Historical Decorative Elements
    - Elimination of elements
    - Conservation of elements
    - Adaptive reuse

The last part of the questionnaire is on the variation of the decorative elements and collects the data on the actions that have been done in the conservation, modification or conversion of elements.

All the morphology data have been checked and proved with a photographic survey and compared with the old data of INTACH surveys in case of overlaying areas (see chapter *11. Analysis model for identification of new and old elements in the heritage city centres of emerging countries*).

In order to better understand the meaning of this part of the survey some examples are shown below on the influence of the morphology variation.

In the group of indicators named as “compositional architectonic indicators”, is created by three main factors:

1. Variation of internal walls in order to create new ambient;
2. Variation of natural ventilation vernacular elements;
3. All-over variation of original architectonic composition.

These three factors together let understand, on the same study case, different things mutually influenced: as per other research already done in the past, one of the main factor that makes the houses to be abandoned by the inhabitant, is the increase of internal temperature due to the internal courtyard covering (Aryani et al., 2018). As a matter of fact, the natural ventilation in this environments is one of the most

important factors of the liveability of the houses (Choi and Lee, 2014). Many studies on the situation of the houses after the colonial period wrote in last 10 years shows how, after the advent of the British in India, lot of houses were left uninhabited due to the willingness of the having more space inside the house that generated the needs of closing the internal courtyard.

However, the decision to close that internal, but outside, area corrupted the ancient system of natural ventilation creating no more liveable, because too hot, ambient all-over the house, in grazing sometimes more than 4°C. (Aryani et al., 2018)

The indicator number two, *Variation of natural ventilation vernacular elements*, shows in a percentage scale changes of many kind with a focus on natural ventilation system, with addiction or reduction. Therefore, for example, if one family closed completely the courtyard, the indicator will show us the result of minus hundred percent. On the other hand if the family has increased the size of the courtyard by the half of the initial measure, the result about these indicate the +50%. Another example can be the one of the *Velocity of changing in time* factor that has 2 faces: if the change of the Heritage Monument is controlled by the actor and quick in time, this doesn't mean that the variation given by the influence is controlled too. One of the risk is the creation of new encroachments in the area, or the inefficiency of the drainage system of the surrounds, that creates problems on the Heritage Monument too. On the other side the quickness of the change, for example towards a conservation of the artefact, can be well planned taking in consideration the surrounding areas also. There will be a benefit from both sides. This effects more than one factors: the quality of air, the cleanliness of streets and the respect of the parking areas.

Application of tool:

In order to better understand the typology and results of this part of the research hereafter is shown one of the documented area with this methodology

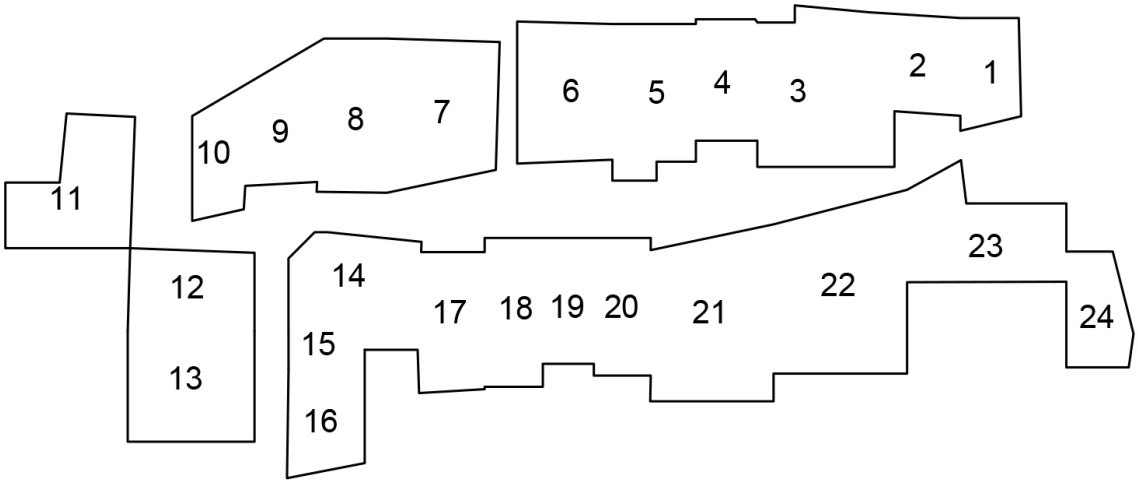


Figure 22: One of the documented areas (redrawn) of 1989 INTACH made by Minakshi Associates: Brahmapuri area, Johdpur

The entire neighbourhood have been outlined just to identify and catalogue the number of houses. This process has to be managed in order to take in consideration the possible comlpetely-new buildings.

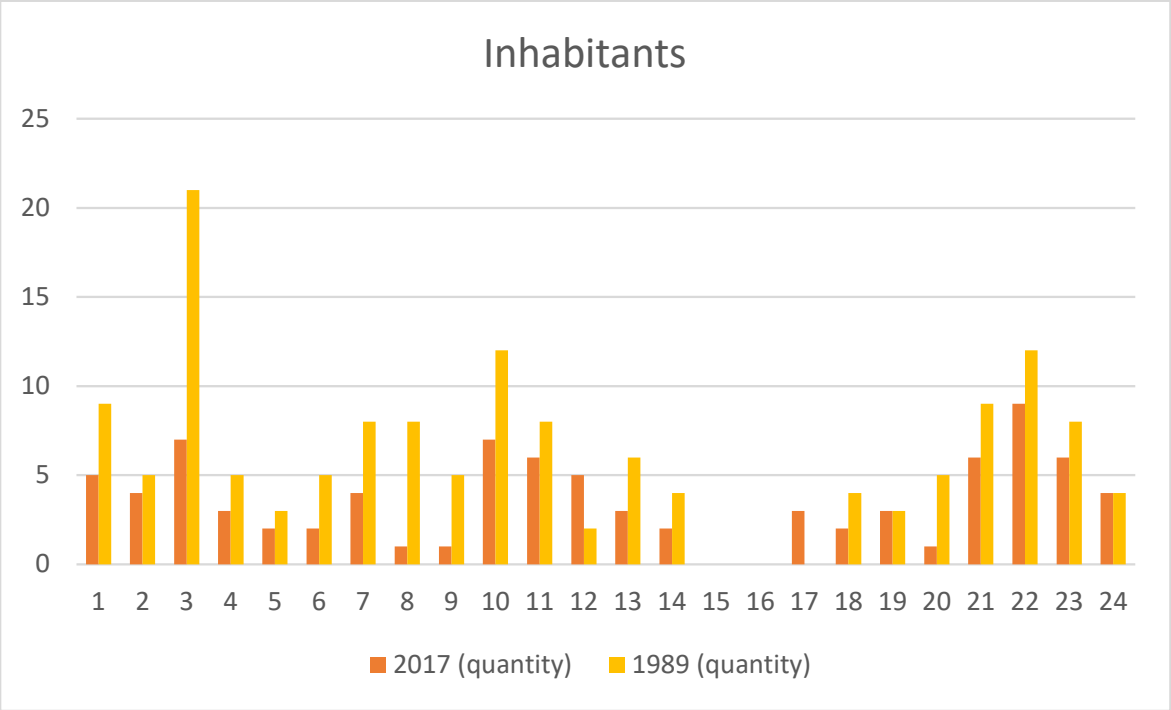
With a door to door operation and with the help of an interpreter we surveyed the entire neighbourhood on the points of the questionnaire.

BRAHMAPURI STREET		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Inhabitants	2017 (quantity)	5	4	7	3	2	2	4	1	1	7	6	5	3	2	0	0	3	2	3	1	6	9	6	4	
	1989 (quantity)	9	5	21	5	3	5	8	8	5	12	8	2	6	4	0	0	0	4	3	5	9	12	8	4	
Residential Area Presence	yes / no	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	
Commercial Area Presence	yes / no	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	
Architectonic composition Indicators	Total Area Occupied by the house - sqm	18	27	55	22	36	40	46	30	27	17	38	30	41	36	11	23	27	25	20	25	60	60	65	41	820,00
	Addition Orizontal (encroachments) - %	0	0	0	0	0	0	0,1	0	0,1	0	0	0,2	0,2	0	0	0	0	0	0	0	0	0	0	0	0,03
	Addition Orizontal (encroachments) - sqm	0	0	0	0	0	0	4,6	0	2,7	0	0	6	8,2	0	0	0	0	0	0	0	0	0	0	0	21,50
	Addition Vertical (new floors) - %	0	0,5	0,5	0	1	1	2	0	1	2	1	1	1	0	1	0,5	1	1	1	1	0	0,5	0,5	0	0,68
	Addition Vertical (new floors) quantity sqm	0	13,5	27,5	0	36	40	92	0	27	34	38	30	41	0	11	11,5	27	25	20	25	0	30	32,5	0	561,00
Architectonic composition Indicators	Addition of new internal walls %	0,2	0,8	0	0,4	0,2	0,2	0,6	0	0,2	0,6	0,1	0,4	0,2	0	0	0	0,4	0,2	0,4	0	0,4	0,2	0,2	0	0,24
	Reduction natural ventilation elements %	0	0,8	0,4	0,2	0,4	0,2	0,6	0	0,4	0,6	0	0,2	0,6	0,2	0	0	0,8	0	0,2	0	0,4	0	0	0,4	0,27
	Total Variation of the initial composition %	0,2	0,8	0,2	0,4	0	0,2	0,6	0	0,4	0,6	0,1	0,4	0,4	0,2	0	0	0,6	0,2	0,4	0	0,4	0,2	0,2	0,4	0,29
Historical Decorative Elements	Elimination of elements %	0	0,2	0,4	0,2	0,6	0,2	0,8	0	0,4	0,8	0	0,4	0,2	0	0	0	0	0	0,2	0	0,4	0	0	0,4	0,22
	Conservation of elements %	0	0,2	0,4	0,2	0,4	0,6	0	1	0,4	0	0,8	0,2	0,4	0,8	0	0	0,2	0,4	0,2	1	0,6	0,8	0,8	0,4	0,41
	Adaptive reuse %	1	0,6	0,2	0,6	0	0,2	0,2	0	0,2	0,2	0,2	0,4	0,4	0,2	0	0	0,8	0,6	0,6	0	0	0,2	0,2	0,2	0,29

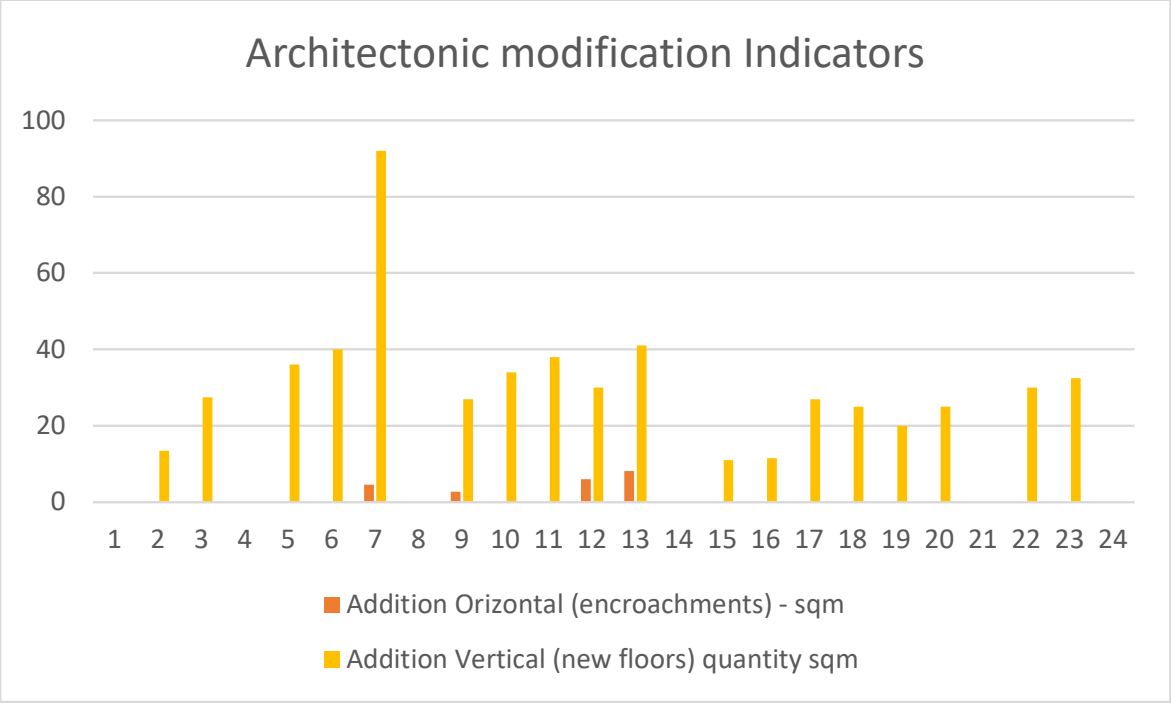
It is possible to understand that the variation of the shape and other characteristic thanks to the documentation by questionnaire.

The accuracy of this kind of documentation has to be checked into two factors that are the main ones surveyed: the historical and the morphologic one.

Now we take in exam only the inhabitants' presence:

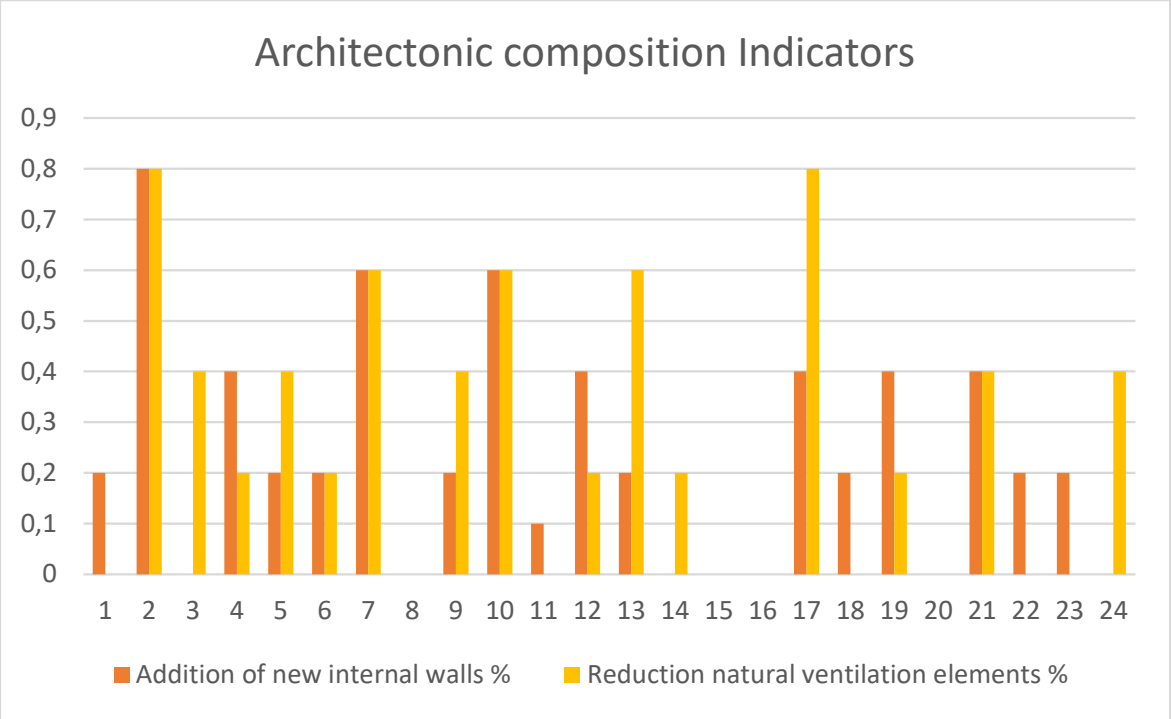


As it is usual in many surveyed areas the quantity of inhabitants decreased because of the reasons this research already cited previously: the willingness of a new house and the land availability outside the heritage centre with many facilities and infrastructures made inhabitants to shift in the last decades from old to new towns. In order to achieve an usable data the research decided to take in exam the mean of this decrease data: remaining inhabitants are the 66% of the 1989's presences, so with a reduction of 34%.



This diagram represent the quantity and the quality (horizontal or vertical) of volumetrical addition in the area divided by house. It is possible to identify a tendency of the complex in vertical addition. This is partially because of a lack of space in the area and the already congested vihability. However the average data in this study case that comes from this diagrams are the following:

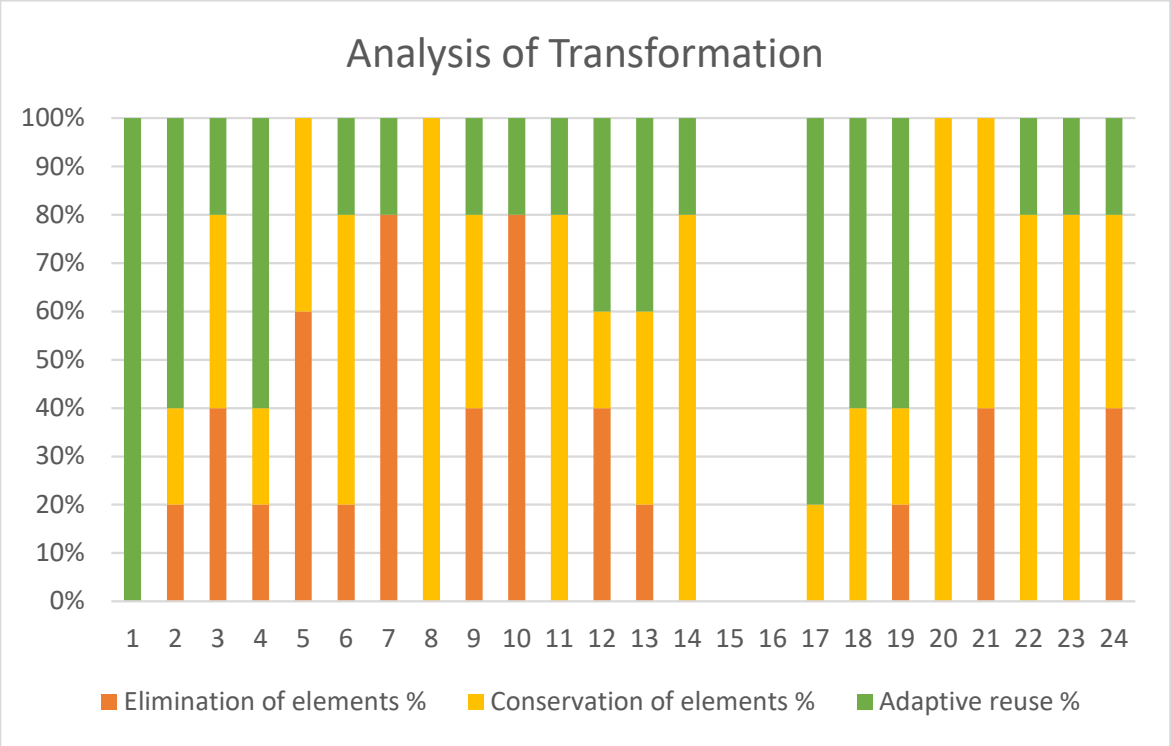
- 3 % average growth of buildings towards the street
- 68 % average vertical growth



The diagram compares two elements of variation of inside features: internal walls that have influence, most of times, with the reduction of natural ventilation elements. In fact, this diagram highlights how the average data are the followings:

- 24 % average addition of new walls
- 27 % average volumetric reduction on the total size of the house of natural ventilation elements
- 29 % average variation from initial composition on internal features

The average value of modification is related and very similar inside the different buildings also: it is evident how in case 2, 6, 7, 10, 21 the variation of internal walls has a direct relation with the modification of natural ventilation elements.



- 22 % average elimination of traditional elements inside the structure
- 41 % average quantity use and morphology preserved spaces
- 29 % average quantity of adapting reused spaces

As it is evident from this diagram the primary tendency of the inhabitants in the process of evolution of the last decades taht involved the area is to preserve the use of spaces. The reasons of this are various: the ageing of the inhabitants in that area, the impossibility of creating new infrastructures due to the lack of spaces, which brings the need to mantain the old features.

In general therms, if we compare this data with the ones of other areas, it will be evident how the variation that involved this area is not that high. This depends on the religious system also, regarding this case: the brahmins area is historically recognised as the first one born in Jodhpur after the Fort and the people respect the old habits and the environmental spaces.

14. 2. Qualitative analysis

14. 2. 1. The urban scenario: 360 comparative photographic survey

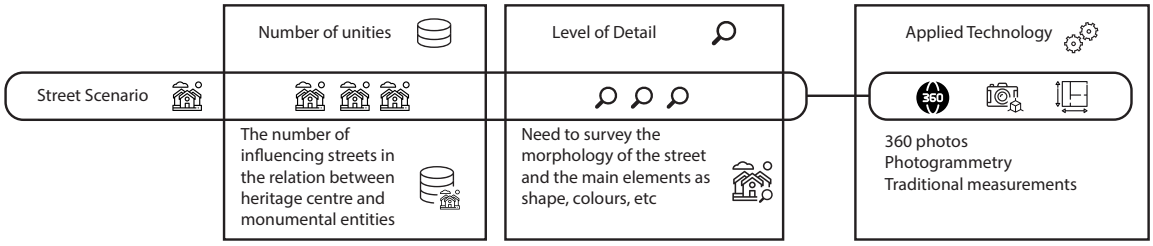


Figure 23: Quality and quantity of needed data from modern documentation campaign: the matrix with different levels of detail and quantity of surveyed unities is hereafter examined for the Street scenario documentation partcampaign: the matrix with different levels of detail and quantity of surveyed unities is hereafter examined for the Street scenario documentation part

This chapter examines the possibility to use the photography to create models of comparison for the house-forms composition, materials, colors and many others. In fact the use of the photography proves the validity of the documentation already collected with the questionnaire but without an old survey to compare: thanks to the campaigns conducted for this research, the photographic integrated tool shows differences in between a delta of few years.

The refreshing time of some advanced visualization system as Google Street View has a turnover of 6 months for big cities and 1-2 years for little villages in western countries. Thereafter the changes recorded thanks to these systems, when adopted in already developed countries, are not as evident as the one in cities where the main evolution in the urban complex is happening recently due to the economic growth and the increasing of new needs.

The creation of a comparison system in between a photographic survey done in a developing country with the same typology of attributes as the previously mentioned systems has never been undertaken: this research collected this kind of data within a period of 6 years in the old center of Ahmedabad. The challenge was to understand variation in the morphology thanks to the comparison of 360° photos shot by the same point, checking the variation surveyed thanks to the questionnaire.

The choice of using this kind of instrument is due to multiple reasons. In fact, it would be easier to check the data with other tools as for example drone photography:

nevertheless it is important to remember that the drone technology is quite new and because of that, in order to have a usable data in terms of quality, it is very expensive and need lot of training of the operator. Because of this the research tries to understand if an easy applicable and relatively cheap tool could be enough as a first approach. Of course with an implementation of this study it would be possible to discover some new technologies that will become of public domain.

Before taking in exam the studied photos, it is important to explain in detail what a 360° photo is. 360° photos are spherical or cylindrical photos.

The possible techniques to create these photos are mainly two: this research adopted both of them and hereafter describes the pros and contras.

The spherical ones have a ratio of 2 by 1. This means that proportionally the horizontal dimension is the double of the height and every part of the two half consist in a squared image (1 horizontal by 1 vertical). In the last years many cameras have been developed with the function of shooting, with a unique click and thanks to special lens, the entire spherical photo.

The cylindrical photos have different ratio, depending on the number and the quality of every single photo that will compose the final one. Cylindrical photos are possible with a more cheap equipment but do not contain the whole visible sphere: thanks

Figure 24: Example of spheric photo shot along the Heritage Walk of Ahmedabad in July 2017.

to the help of professional tripods, the idea is to shoot an average number of 32 photos from the same point. Before taking every one of them a turn of 30 degrees of the camera is needed for each photo on the horizontal line and then, with the same position of the previous ones, shifting vertically of 30 degrees more towards the upside direction and then down. In this way, taking overlapping areas in between nearby photos it is possible, thanks to dedicated software the reconstruction of the cylindrical image.

The first campaign has been conducted over 71 stations in the old city of Ahmedabad, along the Heritage Walk in 2012. The handy camera used was a normal-resolution

Figure 25: Example of cylindrical photo shot in the same point of the previous one, in Heritage Walk of Ahmedabad in 2012

one (12 Megapixels). Nowadays, just after few years, the development of the technology allows to take this kind of images with smartphones with internal informatics gyroscope and compass. Of course, due to the choice of not raise the economic investment the photos have not the support of measurable point clouds: this aspect brought a limitation of the possibility of extraction of data gave from the technology. On the other hand, it gives the possibility to focus on different factors. The prerequisites that allows a comparison in between the photos are inevitably the calibration of the camera's color reference system (with the set-up of the point of total-white) and the choice of the same light conditions.

However, the data that is possible to extract from this kind of survey, taking the case of shooting one individual photo are followings:

- Main composition of a space
- Colors of the objects

The possibility of recording the GPS position allowed the multiple shot by the same point. In different moments. As introduced before the comparison in between 360°photos with the prerequisite over cited allows the comparison in between two photos from the same grip point with different dating. If this is done within a considerable gap of time, it is possible to create a comparison in between the differences of the main composition of a space and the colors of the objects, which are the two extractable kind of data.

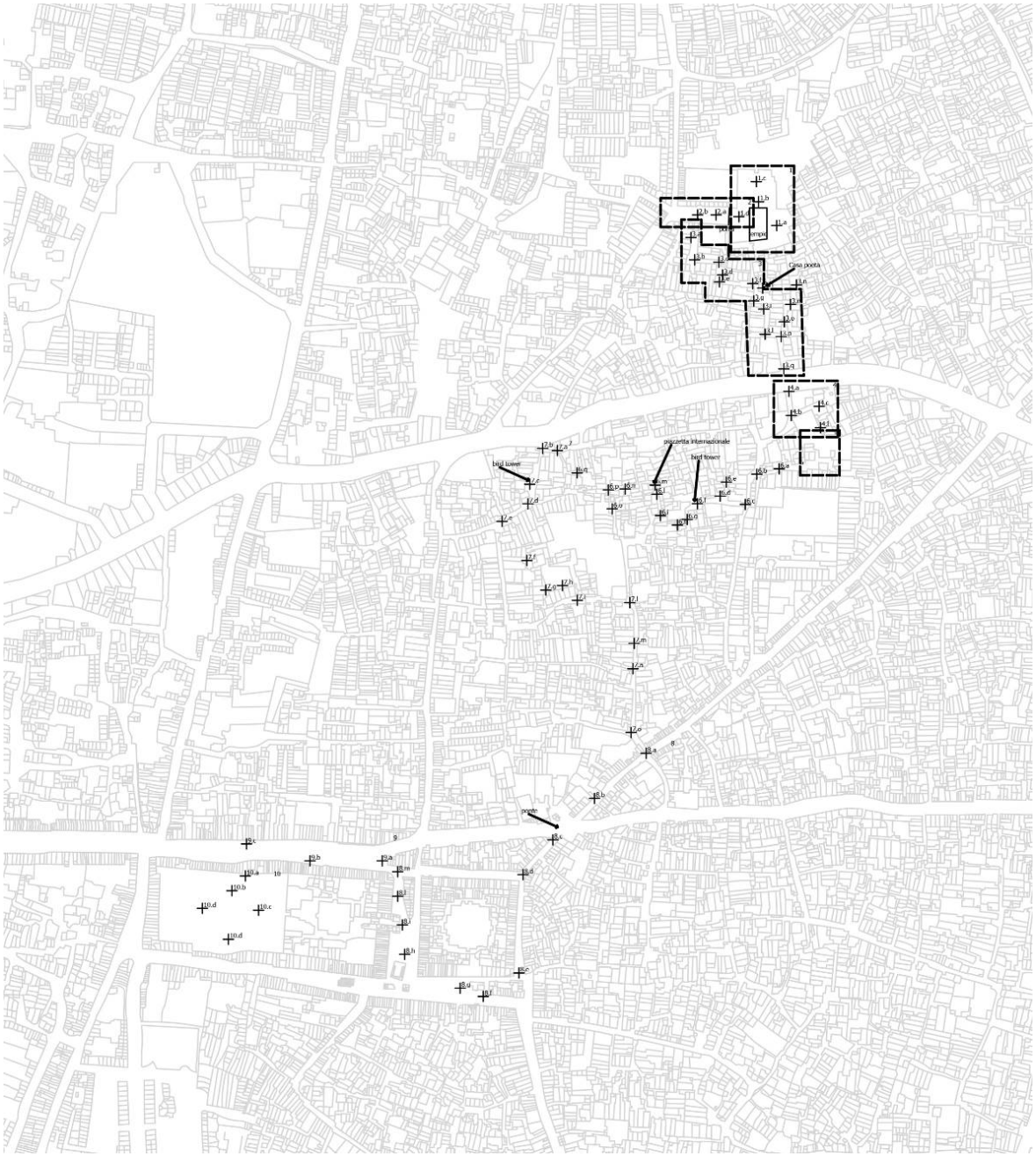


Figure 26: The map shows the exact position of the 71 stations surveyed Along the Heritage Walk of Ahmedabad in 2012 and 2017

Hereafter an example is reported that shows the changes in between 2012 and 2017 occurred on a well known square over the Heritage Walk of Ahmedabad: it is called the Poet Square because of the white house owned by Kavi Dalpatram, a very famous poet of Ahmedabad. The area is named Iambeshwar ni Pol.

Figure 27: Example of the differences between the same station in 2012 and 2017 with two exemplificative case study

As it is possible to see in this case, there are two major changes and, in order to explain the double check done in this area in between the first cylindrical photo (2012) and the second one spherical (2017), we take in charge the changes in between these two cases.

Case 1:

- Complete morphological variation.
- No assimilation of the traditional wooden structure and decorative details

Figure 28: Detail of Case 1 from another shooting point (the previous one)

In addition the structure (it is possible to see in the second photo) has almost no windows on the ground floor and this will bring in the next years the set up of electric supplies in order to decrease the temperature inside the structure.

Apparently, the reconstruction has been done structurally in a stabile way: however, the compositional elements will bring needs of external supplies for shadowing the sun irradiation and to cool the inside environment. This will bring the street nearby to a increase of temperature and pollution with the consequence of a reduction of well-being in the area.

Case 2:

- Addition of 1 floor
- Reduction of natural ventilation system
- Conversion of the façade to a new (untraditional) system

Figure 29: Detail of the two facades and main changes. The building has a sharing wall system: this means that on the other three sides it can not grow.

The addition of a new floor (Detail 1) together with the setback of the openings (Detail 2) makes a reduction of the natural ventilation system: moreover on the ground floor the semi-public space of the Otla (otta) has been converted into a complete private space with an architectural style that does not respect the previous composition.

These two study cases exemplifies how the check in between the questionnaire and the real situation has been done in this study.

14. 2. 2. Laser scanner technology and Photogrammetry

As previously discussed in chapter *12.1. Variables of change: the main features to document*, the aim of using high technological tools consist in the validation and the merge of sub-documentation that have been carried out thanks to affordable technologies in term of cost and knowledge of available technicians.

Actually, 3D Laser scanner technology is a well-known technology employed mostly in industrial and manufactural sectors, where investment possibilities are high and already many researches have been discussed and are nowadays a matter of study on the application of point clouds on heritage buildings and sites (Parrinello and Picchio, 2013) (Brusaporci et al., 2012).

On the other hand, as analyzed in *12.a Analysis of Actors' behaviors*, there are corps in India with possibilities and interests in conserving heritage of old city centers, but sometimes what is missing is the idea of using determinate tools.

However, the 3D laser scanner is just an instrument: the decision on what and how to survey is crucial. For the aim of this research, as the main documentation is done thanks to other tools the 3D Laser scansion is useful in the checking phase. In fact, the methodology consider this tool just with a quick and high range usage purpose, in order to reduce the hiring cost and rent the object just in the final phase of the on-site survey.

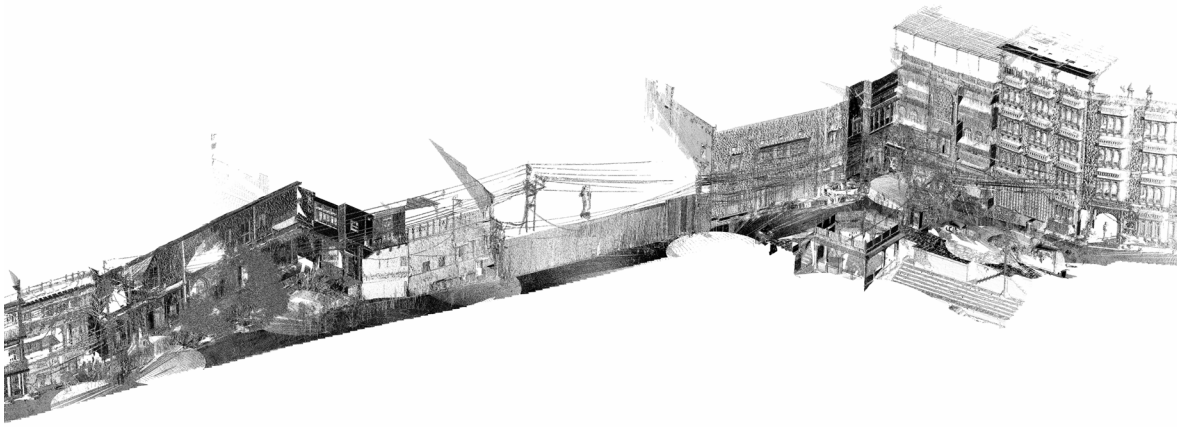


Figure 30: Point cloud of the Toorji Ka Jhalra stepwell square in Jodhpur surveyed in 2014 with a 3D Laser Scanner @DIAPREM Center, University of Ferrara

Nevertheless the actors with possibilities demonstrated the willingness to use them (Balzani et al., 2015): however, sometimes the results are not directly usable because initial operation on a wider study, actors are more impressed by costs then the results, also because of the need of have results to work on in short time. The quick changes of the urban context is evident and sometimes if the results are not as fast as the mutation process, tools results useless.

On the other hand is easy to survey a high quantity of data but with a low resolution and check the previous documentation processes. Thanks to the use of a low quality grid on the survey sphere, depending on the size of the surveyed area: the quality of information because of the use as a check of the main morphological aspects of the building that is necessary to the aim of this research is not very high because of the object of survey. The strategy is to check the main shape of the street scenario interested: understanding the shape of the building and overlaying with the other surveys.

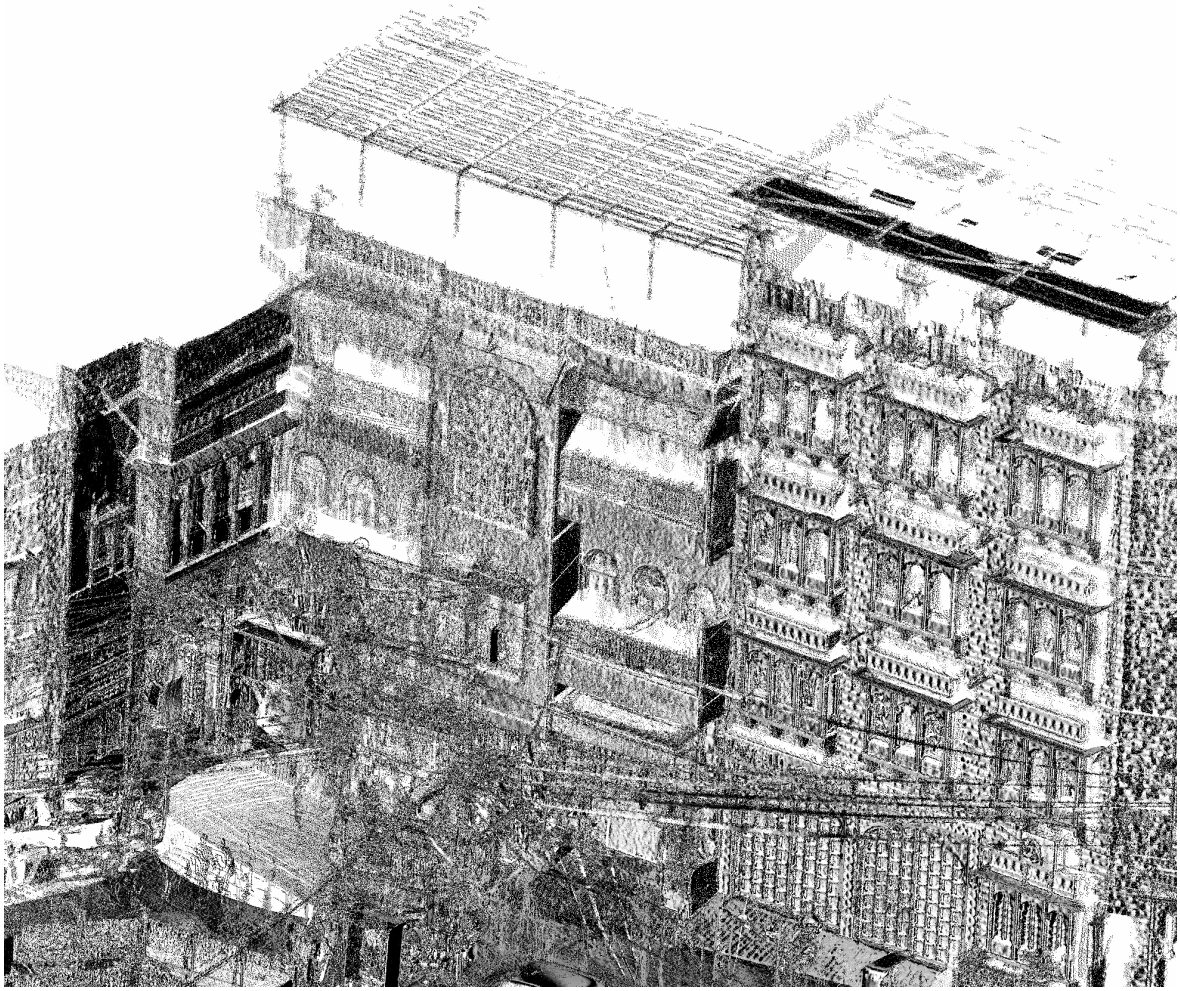


Figure 31: Same point cloud as before but with a higher detail to understand the level of detail that is not needed for the aim of this study

Actually, this is very useful in certain specific cases: for example to check the distance (then to judge as pressure or proximity) of an urban complex in some not reachable areas or high elevations. Concerning the representation, the point cloud in this study represent the most reliable tool to use and to achieve in order to check the main feature of the street scenario composed of the entire amount of building that are present.

However, as important other prerogative of the tools to use the research highlighted the importance of economic investment. As the study already highlighted, one of the factors that can make the methodology be adopted and use is the cheapness of the used instrument. Therefore has been considered as necessary to identify possible other cheaper technology that can keep the detail of the documentation on the same level of the one that is necessary and that is previously examined. Taking in mind that the quality is not the focusing element for this kind of environment is possible to define other technology that can give us the possibility to have an overview and a check of the encroachments on the urban environment.

Encroachments that are important for the study and that have a quantitatively influence on the relational function of the area are elements that are easy to check with a well-done operation of photogrammetry and reconstruction.

Image 32: Point Cloud created with 16 photos reconstruction thanks to photogrammetry processes of the old centre of Jodhpur, inside one of the case study areas

This is a reconstruction of the Sumer Market, the former grain market of Jodhpur. The reconstruction has been carried out thaking 125 photos with a traditional smartphone (camera 12MP) and creating a point cloud of 681.000 points. Thanks to this scansion it is possible to definea raw map of the area and identify volumes: as we already said it is clear that this scansion has a permissible error, because this part of the analysis focuses just on volumes and not on deeper level of detail.

Figure 33: Point clouds of the Grain Market (Sumer Market) of Jodhpur. These point cloud have been created with a photogrammetry operation and reconstruction.

15. Actors' questionnaires

Basing on the CDIS of the Heritage Dimension the research has converted some of those indicators in order to obtain a profile of the institution that could be useful for understanding influences in all the three segments of UNESCO indicators. The gauge extracted from the Data Table and converted into questions, gave the possibility to relate different typologies of actors. The following list groups shows the composition of the questionnaire (divided by the three subcomponent recorded above):

Registration and inscription:

- Actor typology
- Typology of listed structure
- Public / Private
- Does exist a registry or list of natural and cultural heritage that contains all the buildings belonging to the actor?
- Has this list been updated in last 5 years?

Protection, safeguarding and management

- Is there a dedicated annual budget for the identification, protection, safeguarding, conservation and management of cultural heritage?
- Are there specific policies and measures for conserving and promoting inventoried cultural heritage adopted in the last 5 years?
- Are there legislation/policies/measures regulating archaeological excavation adopted?
- Is there a museum holding permanent collections of heritage?
- Do you have management plan(s) elaborated or updated in the last 3 years?
- Is there a documentation centre?
    - If yes, for which kind(s) of heritage?
- Is there an interest or some already undertaken join venture with the national

level for an integrated development of cultural heritage?

• Do you have to follow any kind of national regulation in acting on the cultural heritage?

o If yes, which are they?

• Does an operational centre for capacity-building in heritage related areas exist?

• Is there any capacity-building and training programme you/your institution implemented in last 3 years?

o If yes regards some of this aspect?

• Is the community involved during the decision-making process of identifying tangible heritage elements and registering them?

• Existence of heritage site management committees with local community representation

Transmission and mobilization of support

• Are there the heritage sites clearly identified for visitors to recognise their status as heritage sites?

• Is there a visitor interpretation centre?

• Is there any kind of help to your mission from [Municipality]

• Is there any kind of help to your mission from [Privates]

• Is there any kind of help to your mission from [Population]

• Is there any kind of help to your mission from [Trusts]

• Is there a community centres and associations created and managed by communities themselves that collaborate with you/your institution? If yes, what is the name of this body?

• Is there any capacity-building and training activity intended to increase heritage expertise amongst teachers? If yes, in which field?

• Is there any programmes you support to raise awareness and promote all forms of cultural heritage?

One part of the question has been not examined because of the irrelevant value they have in the research.

The second survey campaign among the Actors focuses on the definition of some indicators that are mostly connected to the mutual influence of the undertaken policies in between Heritage listed “Monuments” and the heritage related areas (see chapter 13. The relational functions and the analysis of variation of influences: from the morphological modification of a building to the influence of the area toward the monument).

The indicator surveyed in this part are hereafter listed:

- Private / Public

Identification of the heritage ownership

- Visual Perception
    - Morphology
    - Chromatic

Here are analysed factors that gives the scale of relational influence in between the two different categories of heritage entities.

- Environmental Impact

Influences of the surrounding areas on the monumental listed entity

- Environmental Influence

Influence from the monument to the surrounding areas.

- Social Impact
    - Inner
    - Outwards

The resonance of the action undertaken by the actors.

- Urban Pressure

This indicator shows the level of pressure influence from the outer areas on the monumental one in exam.

- Touristic Impact
    - Inner
    - Outwards

Presence of tourist arriving to see the monument (the first case) and that goes after

in the surrounding areas and vice versa.

• Religious influence

Importance of the heritage listed element in the religious field for the inhabitant of the surrounding areas.

• Velocity of changing in time

This indicates the possible results obtainable in reasonable timing

• Conservation state

• Accessibility

• Inclusivity

In a scale of bed / medium / good these factors influence the nearby areas on the awareness aspect.

The research highlighted the irrelevant nature of some of the indicators listed: as the religious aspects. As a matter of facts the entire list of question and consequent indicators have been created and analyzed in order to embrace the biggest number possible of case studies.

Part 6 – Case studies and outputs

This chapter introduces some of the case studies the research focused on.

The methodology has been applied on a multitude of case studies (219 single buildings, 20 areas in the city centers, allover 2 cities). Hereafter the research explains the results on some of those case studies and the double check actions undertaken to verify the same.

The decision of taking under examination one case study in the city of Jodhpur and another in the city of Ahmedabad has been taken in order to better show the used technological tools in order to check the research results.

16. Jodhpur old city and the growing urban pressure on Mehrangarh Fort

One of the overlapping areas in between the INTACH documentation and the 2017's one is located near by the Mehrangarh Fort of Jodhpur, North West direction. The research examined that area, named Mathuron ki Pol, as a test for the methodology. This means that first the documentation has been conducted just using the questionnaire, checking the results on some spot points in order to understand the veracity of the survey thanks to photogrammetric reconstruction of certain neighborhoods. Second, the final data are compared with the historic ones from the INTACH Lok Kshetra Report on Jodhpur.

The photogrammetric reconstruction of some spot parts was done to verify the morphological data of the area.

The choice to analyze this area is due to the interpenetration in between the two different entities.

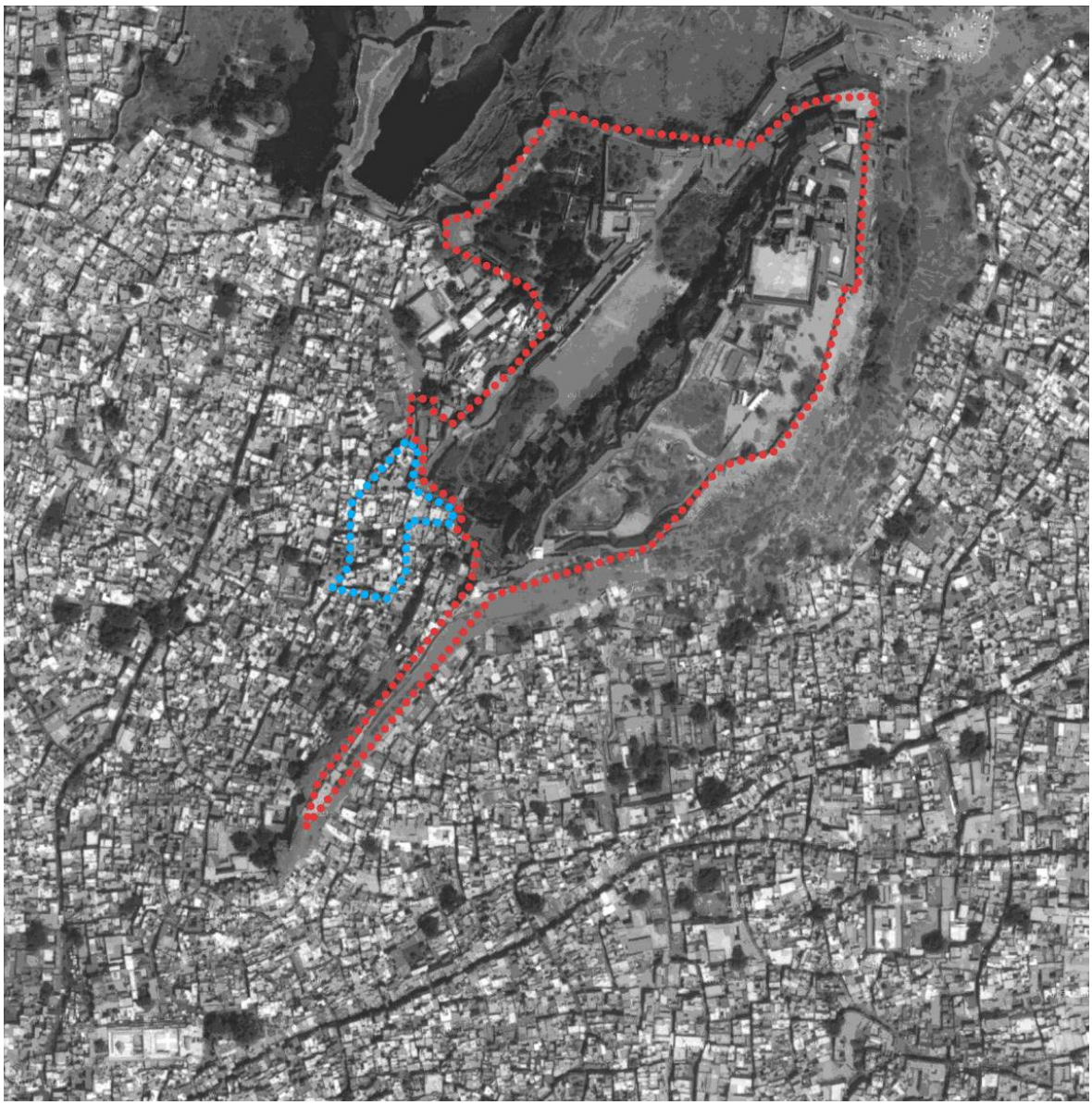


Figure 34: This image represent the area under exam. The red dots are defining the fringes of the Mehrangarh Fort's area and the blue ones represent the area under examination, Mathuron Ki Pol.

The area of Mathuron Ki Pol and the questionnaire documentation

The following image represent the area under exam. The main image has been taken from the previous documentation and checked onsite for the main additive changes. One of the highlights is the fact that there are not in the area completely new constructions. This peculiarity, that have no influence on the documentation, is because of the morphology of the ground: it is on the slopes that grows towards the Fort. Another reason could be the narrowness of the spaces in between the houses.

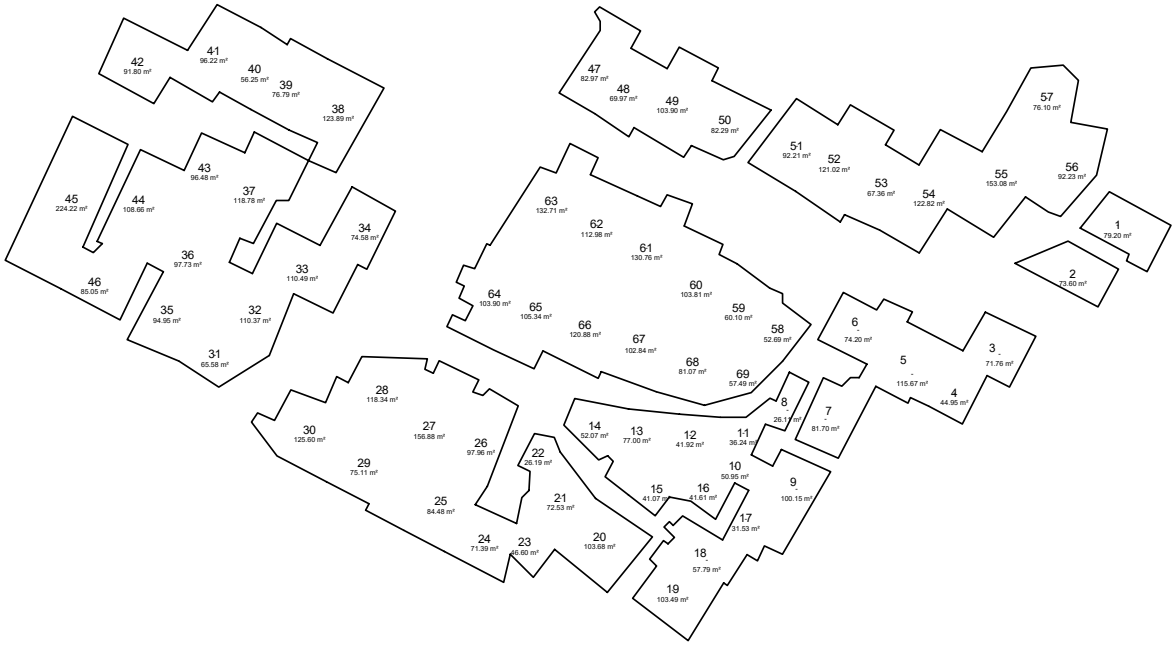


Figure 35: Draft plan of the Mathuron Ki Pol area, with the main outlines of building as reported in the INTACH Report

The surveyed data are the followings for each building inside the map:

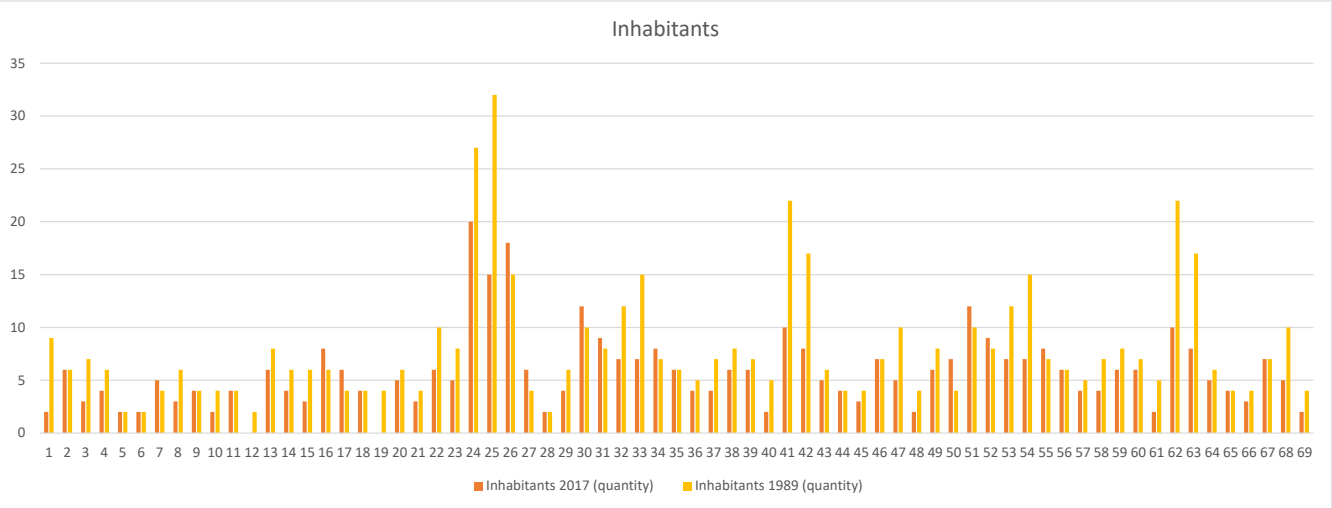
MATHURON KI POL		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Inhabitants	2017 (quantity)	2	6	3	4	2	2	5	3	4	2	4	0	6	4	3	8
	1989 (quantity)	9	6	7	6	2	2	4	6	4	4	4	2	8	6	6	6
Residential Area Presence	yes / no	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Commercial Area Presence	yes / no	Y	Y	Y	N	N	Y	N	Y	N	Y	N	N	N	Y	N	Y
Architectonic composition Indicators	Total Area Occupied by the house sqm	80	70	70	45	100	75	80	25	100	50	30	40	80	50	40	40
	Addition Orizontal (encroachments) %	0,2	0,0	0,2	0,0	0,2	0,0	0,1	0,0	0,1	0,2	0,0	0,0	0,0	0,4	0,0	0,0
	Addition Orizontal (encroachments) sqm	16	0	14	0	20	0	8	0	10	10	0	0	0	20	0	0
	Addition Vertical (new floors) quantity %	1,0	1,0	0,5	1,0	0,5	1,0	2,0	1,0	0,2	1,0	2,0	1,0	0,5	0,0	1,0	0,5
	Addition Vertical (new floors) sqm	80	70	35	45	50	75	160	25	20	50	60	40	40	0	40	20
Architectonic modification Indicators	Addition of new internal walls	0,2	0,5	0,4	0,3	0,1	0,2	0,2	0,4	0,0	0,0	0,0	0,1	0,0	0,6	0,6	0,4
	Reduction natural ventilation elements %	0,4	0,6	0,4	0,2	0,2	0,4	0,6	0,2	0,0	0,4	0,6	0,2	0,0	0,0	0,4	0,2
	Total Variation of the initial composition	0,3	0,6	0,4	0,3	0,2	0,3	0,4	0,3	0,0	0,2	0,3	0,2	0,0	0,3	0,5	0,3
Historical Decorative Elements	Elimination of elements %	0,2	0,2	0,2	0,4	0,2	0,4	0,8	0,6	0,4	0,2	0,8	0,6	0,4	0,4	0,2	0,2
	Conservation of elements %	0,4	0,6	0,6	0	0,6	0	0	0	0	0,6	0,2	0,4	0	0,4	0,4	0,4
	Adaptive reuse %	0,4	0,2	0,2	0,6	0,2	0,6	0,2	0,4	0,6	0,2	0	0	0,6	0,2	0,4	0,4

MATHURON KI POL		17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Inhabitants	2017 (quantity)	6	4	0	5	3	6	5	20	15	18	6	2	4	12	9	7
	1989 (quantity)	4	4	4	6	4	10	8	27	32	15	4	2	6	10	8	12
Residential Area Presence	yes / no	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N
Commercial Area Presence	yes / no	N	N	N	N	Y	Y	N	Y	N	N	N	Y	Y	Y	Y	Y
Architectonic composition Indicators	Total Area Occupied by the house sqm	30	55	105	105	75	25	45	70	85	97	155	120	75	125	65	110
	Addition Orizontal (encroachments) %	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,2	0,0	0,2	0,0	0,0	0,2	0,0	0,0	0,2
	Addition Orizontal (encroachments) sqm	0	0	0	0	0	0	0	14	0	19,4	0	0	15	0	0	22
	Addition Vertical (new floors) quantity %	1,0	1,0	1,0	1,0	0,0	0,5	0,5	1,0	0,0	0,5	0,1	0,0	0,5	0,3	0,5	0,2
	Addition Vertical (new floors) sqm	30	55	105	105	0	12,5	22,5	70	0	48,5	15,5	0	37,5	37,5	32,5	22
Architectonic modification Indicators	Addition of new internal walls	0,2	0,0	0,0	0,2	0,0	0,2	0,0	0,4	0,2	0,2	0,1	0,6	0,4	0,2	0,2	0,4
	Reduction natural ventilation elements %	0,2	0,0	0,0	0,0	0,0	0,4	0,4	0,6	0,0	0,4	0,4	0,4	0,2	0,4	0,4	0,2
	Total Variation of the initial composition	0,2	0,0	0,0	0,1	0,0	0,3	0,2	0,5	0,1	0,3	0,3	0,5	0,3	0,3	0,3	0,3
Historical Decorative Elements	Elimination of elements %	0,2	0,2	0,6	0,2	0,4	0,6	0,4	0,2	0,6	0	0,4	0,4	0,2	0,4	0,4	0,2
	Conservation of elements %	0,4	0,2	0,4	0,2	0,4	0,4	0,4	0,4	0	0,4	0,2	0,4	0,4	0,4	0,2	0,6
	Adaptive reuse %	0,4	0,6	0	0,6	0,2	0	0,2	0,4	0,4	0,6	0,4	0,2	0,4	0,2	0,4	0,2

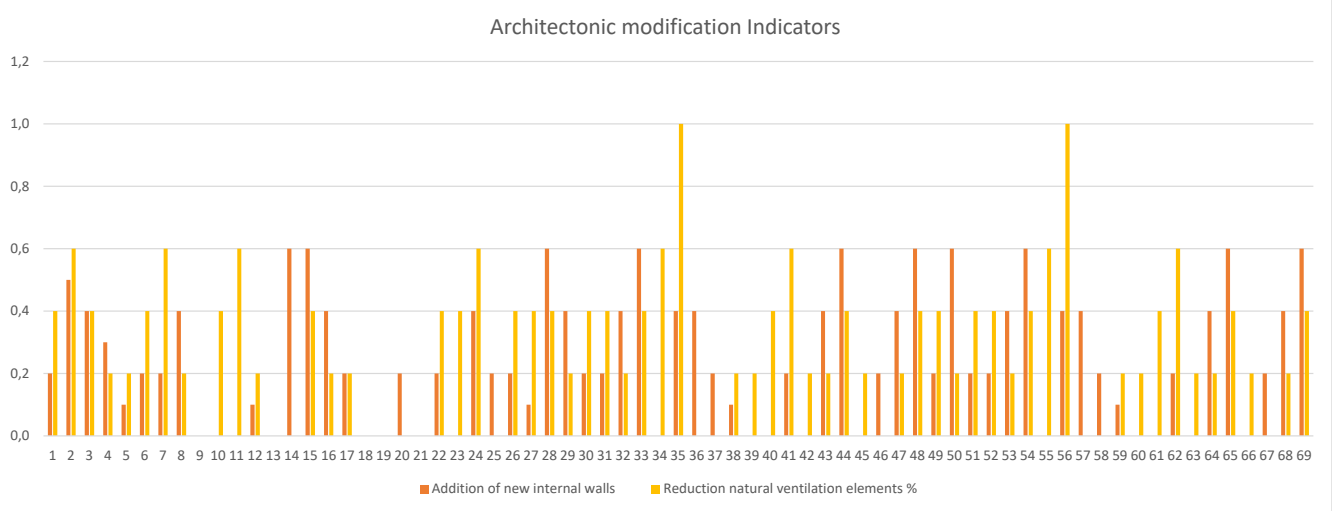
MATHURON KI POL		33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
Inhabitants	2017 (quantity)	7	8	6	4	4	6	6	2	10	8	5	4	3	7	5	2
	1989 (quantity)	15	7	6	5	7	8	7	5	22	17	6	4	4	7	10	4
Residential Area Presence	yes / no	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Commercial Area Presence	yes / no	Y	Y	Y	N	N	N	N	N	N	Y	Y	Y	N	N	N	Y
Architectonic composition Indicators	Total Area Occupied by the house sqm	110	75	95	95	120	120	75	55	95	90	95	110	225	85	80	70
	Addition Orizontal (encroachments) %	0,4	0,2	0,2	0,2	0,0	0,0	0,0	0,0	0,0	0,0	0,2	0,0	0,1	0,2	0,2	0,0
	Addition Orizontal (encroachments) sqm	44	15	19	19	0	0	0	0	0	0	19	0	22,5	17	16	0
	Addition Vertical (new floors) quantity %	0,2	0,2	0,2	0,8	1,0	0,5	0,2	1,0	0,0	0,6	0,4	1,0	2,0	0,2	0,5	1,0
	Addition Vertical (new floors) sqm	22	15	19	76	120	60	15	55	0	54	38	110	450	17	40	70
Architectonic modification Indicators	Addition of new internal walls	0,6	0,0	0,4	0,4	0,2	0,1	0,0	0,0	0,2	0,0	0,4	0,6	0,0	0,2	0,4	0,6
	Reduction natural ventilation elements %	0,4	0,6	1,0	0,0	0,0	0,2	0,2	0,4	0,6	0,2	0,2	0,4	0,2	0,0	0,2	0,4
	Total Variation of the initial composition	0,5	0,3	0,7	0,2	0,1	0,2	0,1	0,2	0,4	0,1	0,3	0,5	0,1	0,1	0,3	0,5
Historical Decorative Elements	Elimination of elements %	0,4	0,2	0,6	0,4	0,4	0,2	0,2	0,2	0,4	0,2	0,2	0,4	0,4	0,2	0,4	0,4
	Conservation of elements %	0,4	0,8	0,2	0,6	0,2	0	0	0,4	0,6	0,2	0,6	0,4	0	0,2	0,2	0,6
	Adaptive reuse %	0,2	0	0,2	0	0,4	0,8	0,8	0,4	0	0,6	0,2	0,2	0,6	0,6	0,4	0

The data have been documented in a 7 days period during the month of June 2017 by one inspector.

From the previous data, it is possible to extract the following average quantities:

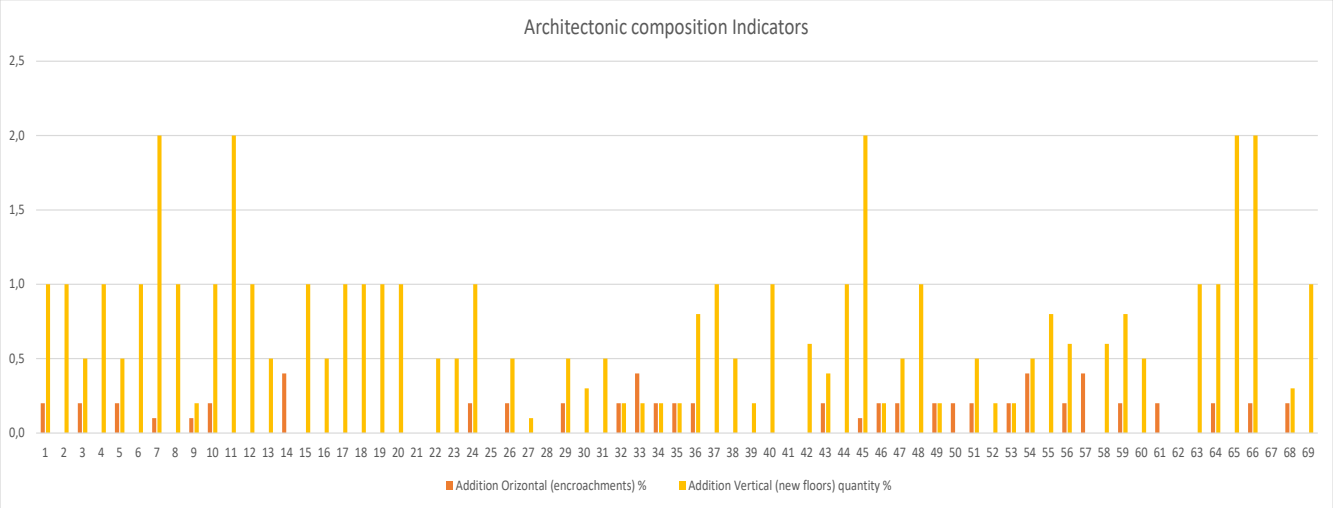


Inhabitants in the area are in 2017, 30% less than in the late 80s'.



- 25 % average addition of new walls
- 30 % average volumetric reduction on the total size of the house of natural ventilation elements

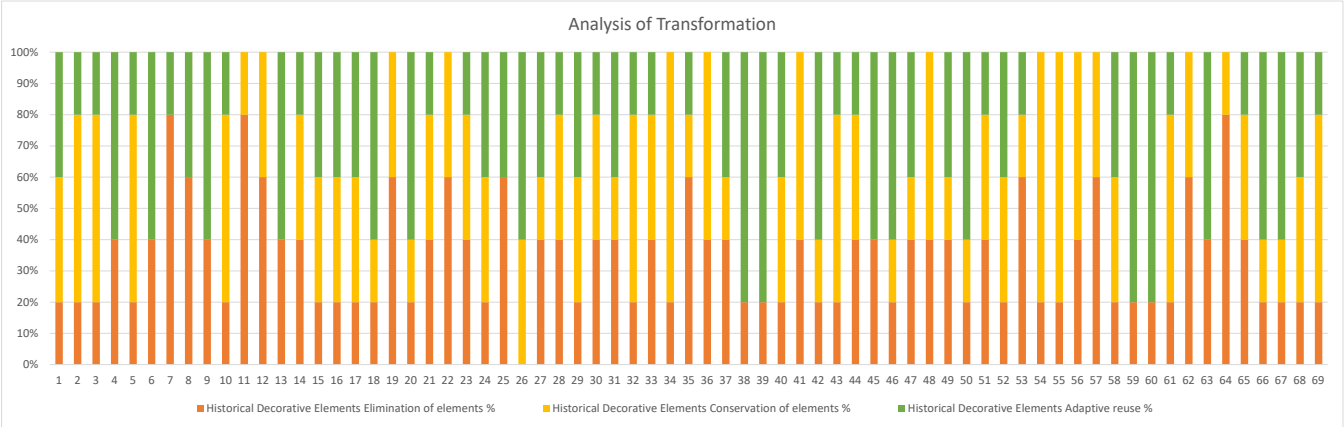
Comparing the two data with other ones from different areas Mathuron Ki Pol one is converting less the internal walls initial situation and has a standard of closing the traditional openings of 30%.



- 10 % average horizontal growth of the buildings toward the street
- 64 % average vertical growth

Figure 41: the tree images shows typical cases of over-volumes present in the areas. It is possible to distinguish (middle photo) the Fort walls and how the new building growth on it

As previously said the situation of growth of the size of the building is moving towards the vertical direction due to the lack of space along the streets. However, the growth has a very high factor with an average of 64%. This creates high-density areas.



- 34 % average elimination of elements
- 33 % average quantity use and morphology preserved spaces
- 32 % average quantity of adapting reused spaces

At this moment it seems the study have enough data to extract the average changes, as already written before: however, the next step is the checking of the veracity of the extracted data. This check has to be done on some sample areas (to be chosen where the highlights are present in the average's various diagrams). In order to understand better the way morphological and historical double check is done, the research reports 6 cases in the next pages: the first check, regarding building 24 and 26 is completely explained in all the passages. The followings (51/52 and 14/22) have the final data and the check visible: it was not useful to explain every time the applied methodology, which is the same for all of the check reported areas.

In a second moment the research analyses the Relational Models in between the Heritage recognize and monumental entity, in this case the Mehrangarh Fort, and the heritage area under inspection, Mathuron Ki Pol area. This additional investigation, as per the following scheme, will highlight the relational factors that are damaged by a mutation of the building average asset. Consequently, there will be the identification of the average changing character of the area to be conserved in order to prime the revaluation and enhancement mutual process Monument - Heritage area.

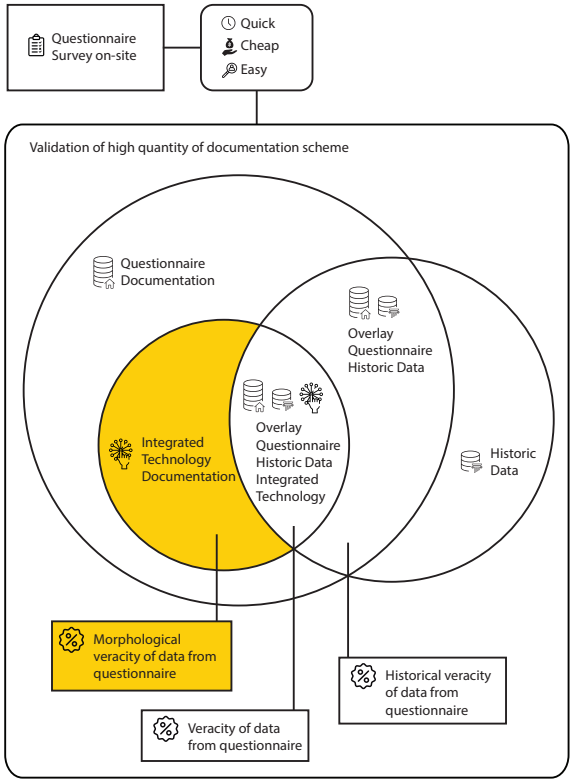


Figure 42: Detail in the main dyagram of veracity of the check thanks to integrated documentation methods

In order to define the checking cluster the study analyses now some examples different in from the morphological point of view:

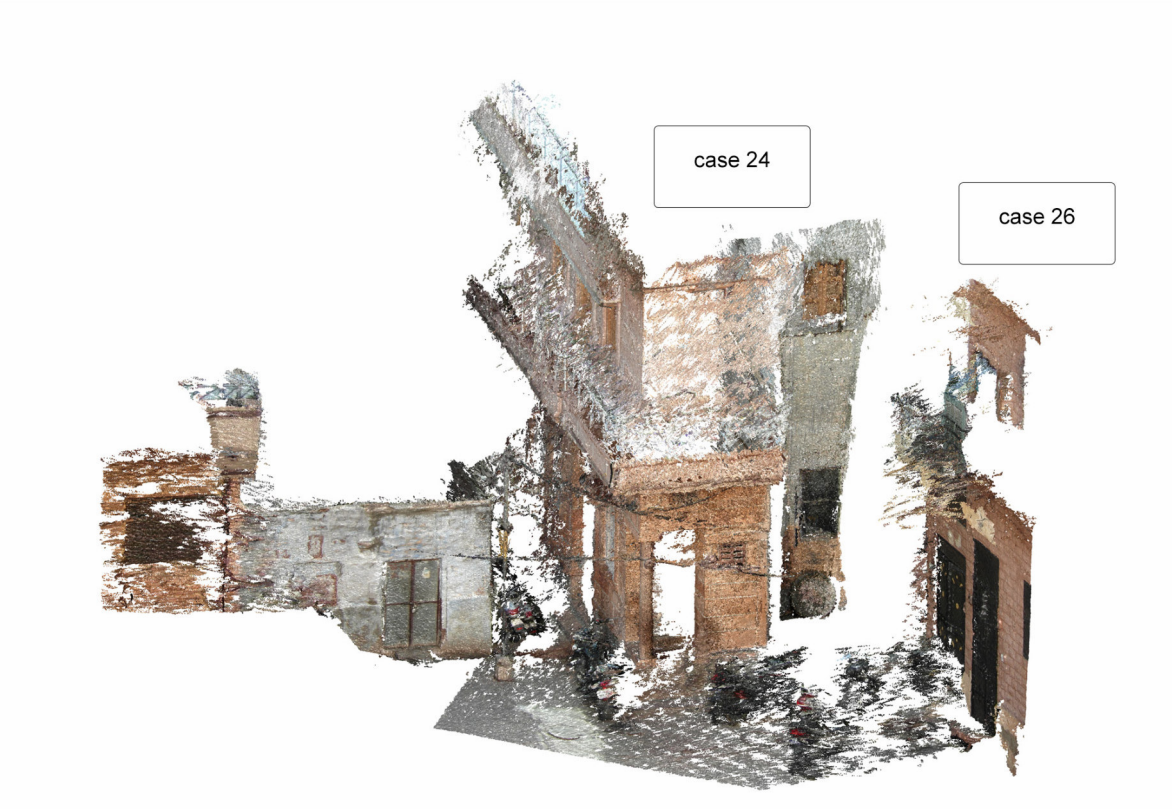
- the first couple of building (cases 24 and 26) are chosen because representative of the corner solution.
- the second sample (51 and 52) is the representative for the sharing wall system
- the third group (14 and 22) is chosen between the separate group.

These kind of checking morphologically different clusters have, of course, differences in between the entire belonging set: however, the factor of “standard deviation” from the representative sample will decrease in case of higher exemplificative case studied.

For a higher veracity level’s precision of the documentation it will be needed a future research on the minimum necessary number of double checked cases, thanks to a deeper statistic study.

Double-check detailed operation on cases 24 and 26

In this case the photogrammetric reconstruction has been done on the building 24 and 26.



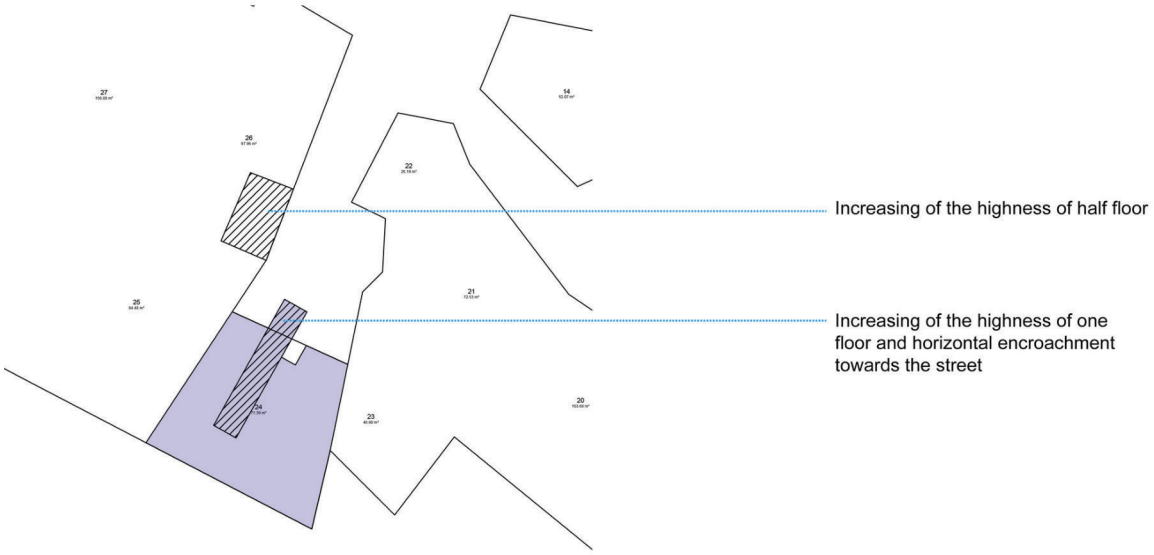
As it is possible to see from the reconstruction the questionnaire, from a morphological point of view was completely true regarding this area: building number 24 has an historical initial shape on the ground floor but an over structure has been created in order to make the whole building higher of one floor. The other building 26 has an over structure of a half floor. The addition on the ground (towards the street) is of the 20% of the basic area of the house. The problem created in this area is evidently a reduction of the carriageway. Thanks to a replacement of the new plans (from photogrammetric survey) and the old ones of the area is possible to highlight a difference in the building plan.

The prominent area is evident in this plan and the consequent reduction of the carriageway.

A rough comparison in between the old surveys and the new ones highlight the differences in between the morphology of the area.

Thanks to a comparison in between the plans and the horizontal section is possible to define some areas with differences inside the checking case study of the building 24/26.

In fact, with a comparison in between the 80's survey and the photogrammetric one is possible to distinguish the following differences:



Let us make a comparison for understanding in this part the veracity of the questionnaire survey.

MATHURON KI POL		24	25	26
Inhabitants	2017 (quantity)	20	15	18
	1989 (quantity)	27	32	15
Residential Area Presence	yes / no	Y	Y	Y
Commercial Area Presence	yes / no	Y	N	N
Architectonic composition Indicators	Total Area Occupied by the house sqm	70	85	97
	Addition Orizontal (encroachments) %	0,2	0,0	0,2
	Addition Orizontal (encroachments) sqm	14	0	19,4
	Addition Vertical (new floors) quantity %	1,0	0,0	0,5
	Addition Vertical (new floors) sqm	70	0	48,5
Architectonic modification Indicators	Addition of new internal walls	0,4	0,2	0,2
	Reduction natural ventilation elements %	0,6	0,0	0,4
	Total Variation of the initial composition	0,5	0,1	0,3
Historical Decorative Elements	Elimination of elements %	0,2	0,6	0
	Conservation of elements %	0,4	0	0,4
	Adaptive reuse %	0,4	0,4	0,6

Addition of 20% of the total volume horizontally:
- veracity 100% for case number 24
- veracity 50% for case number 26

Addition of 100% of the total volume vertically for case 24 and 50% volume case 26:
- veracity 100% for case number 24
- veracity 100% for case number 26

Ventilation:
- veracity 75% case 24
- veracity 100% case 26

At the end of this analysis is possible to understand that from the point of view of the morphological aspect the veracity of the indicators is quite exhaustive: the main error was on case 26 for the horizontal addition. In fact, as it is possible to see from the photogrammetric survey, there is no horizontal addition towards the street of the

case study 26. As a matter of facts, because of the composition and the constructive technologies, the ground floor of the building is older than the period taken in exam and there was no advancement towards the street. Nevertheless, the veracity is 50% on this indicator and not 0% because the advancement on the street of the first floor covered completely the former terrace/balcony that used to face the street from the first floor.

Concerning the vertical addition the veracity of the questionnaire had a value of 100% on both the study cases because building 24 grow one complete floorand the building 26 growth of just the half of the volume of an existing floor.

Thanks to the previous validation of the case 24 and 26 of the veracity for the exemplificative case studies of the 87.5% on the architectonic composition indicators.

From the point of view of the reduction of natural ventilation system, the process of

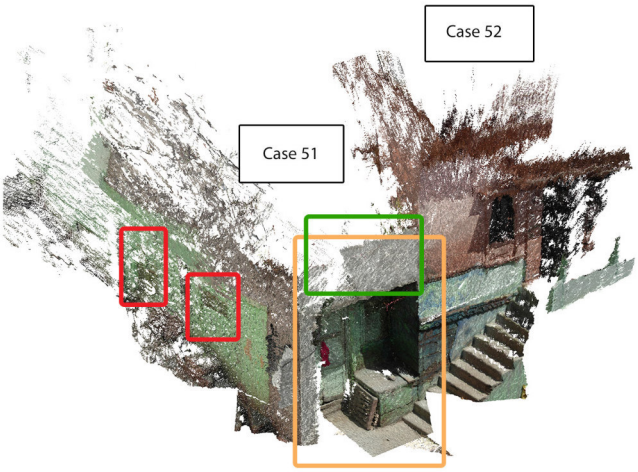
validation is the same: the creation of an extra floor (with few openings) reduces the natural stack effect and decreases the quality of air inside the house.

Some of the former windows have been closed permanently on both the case studies: basing on the volume of the house we can define the percentage of influence on the inside environment situation. The value of 60 and 40 percent was documented on the total quantity of windows in the ancient composition and the closing operations done. In addition, in this case the veracity is 75% for the building 24 and 100% for the 26. The average veracity for the entire documentation of the checking case studies is, at the end 87.5%.

Hereafter the study reports some of the case studies taken in the same area that shows the double checking operation.

Double-check operation on case 51 and 52

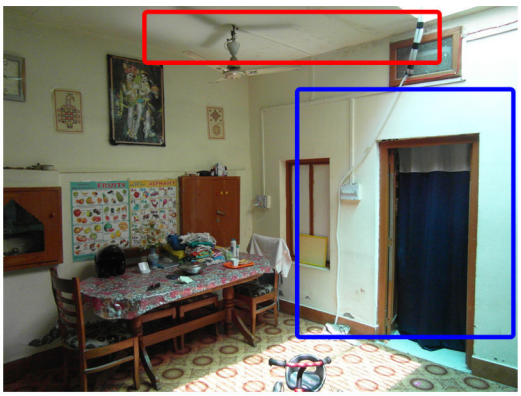
MATHURON KI POL		51	52
Inhabitants	2017 (quantity)	12	9
	1989 (quantity)	10	8
Residential Area Presence	yes / no	Y	Y
Commercial Area Presence	yes / no	Y	Y
Architectonic composition Indicators	Total Area Occupied by the house sqm	80	120
	Addition Orizontal (encroachments) %	0,2	0,0
	Addition Orizontal (encroachments) sqm	16	0
	Addition Vertical (new floors) quantity %	0,5	0,2
	Addition Vertical (new floors) sqm	40	24
Architectonic modification Indicators	Addition of new internal walls	0,2	0,2
	Reduction natural ventilation elements %	0,4	0,4
	Total Variation of the initial composition	0,3	0,3
Historical Decorative Elements	Elimination of elements %	0,4	0,2
	Conservation of elements %	0,4	0,4
	Adaptive reuse %	0,2	0,4



Veracity:

- *Architectonic composition: 75% (20% of horizontal addition is too high, maybe 5% = 8 square meters, 50% of addition vertical is checked)*
- *Architectonic modification: 100% (closing for 51 case of the 40% of the external openings; for case 52 there is a reduction of the internal courtyard due to the addition of a level on rooftop)*

MATHURON KI POL		51	52
Inhabitants	2017 (quantity)	12	9
	1989 (quantity)	10	8
Residential Area Presence	yes / no	Y	Y
Commercial Area Presence	yes / no	Y	Y
Architectonic composition Indicators	Total Area Occupied by the house sqm	80	120
	Addition Orizontal (encroachments) %	0,2	0,0
	Addition Orizontal (encroachments) sqm	16	0
	Addition Vertical (new floors) quantity %	0,5	0,2
	Addition Vertical (new floors) sqm	40	24
Architectonic modification Indicators	Addition of new internal walls	0,2	0,2
	Reduction natural ventilation elements %	0,4	0,4
	Total Variation of the initial composition	0,3	0,3
Historical Decorative Elements	Elimination of elements %	0,4	0,2
	Conservation of elements %	0,4	0,4
	Adaptive reuse %	0,2	0,4



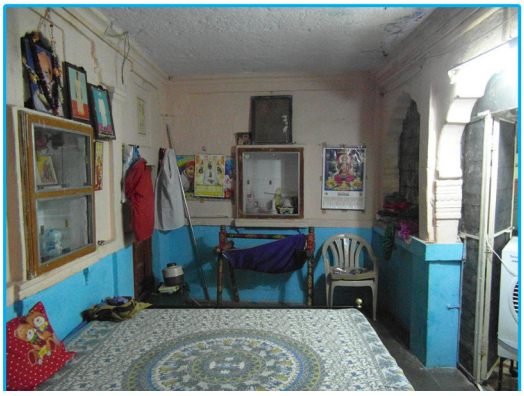


Figure 45: extract from 360 degree photo inside the case study number 51 to double check the data documented by questionnaire (ground floor, living room)

The possibility of taking photo inside the house gave the possibility to check the internal state of the building.

In this case (number 51) the reduction of natural ventilation element has been done around 40% and the check has been done internally thanks to a 360 degree photo.

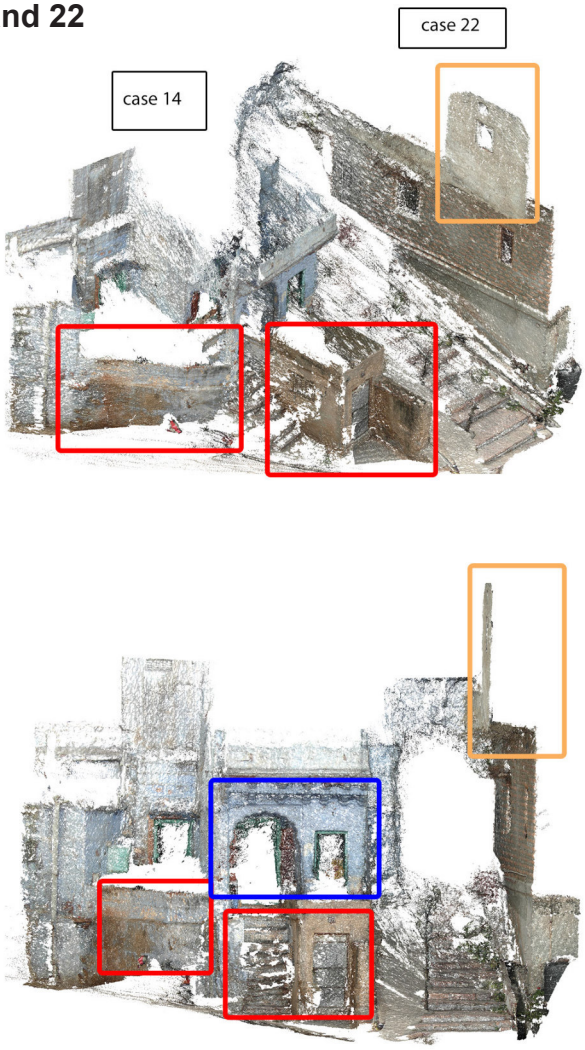
In the third image is possible to see a conversion of an entire internal space from a storage room (previous use) to a bedroom (actual use). However, the creation of a light wall that can be easily disassembled can be considered as revertible intervention that creates an adaptation in the usage of space.

Veracity:

- *Historical decorative elements: 100% (checked the adaptation of spaces and the maintenance of some traditional structures inside the house)*

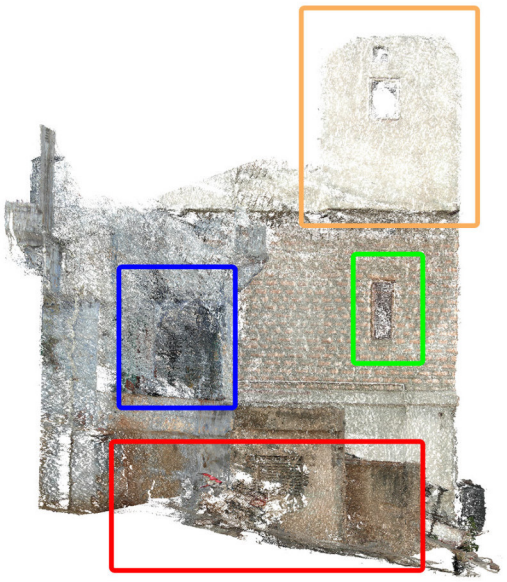
Double check operation on case 14 and 22

MATHURON KI POL		14	22
Inhabitants	2017 (quantity)	4	6
	1989 (quantity)	6	10
Residential Area Presence	yes / no	Y	Y
Commercial Area Presence	yes / no	Y	Y
Architectonic composition Indicators	Total Area Occupied by the house sqm	50	25
	Addition Orizontal (encroachments) %	0,4	0,0
	Addition Orizontal (encroachments) sqm	20	0
	Addition Vertical (new floors) quantity %	0,0	0,5
	Addition Vertical (new floors) sqm	0	12,5
Architectonic modification Indicators	Addition of new internal walls	0,6	0,2
	Reduction natural ventilation elements %	0,0	0,4
	Total Variation of the initial composition	0,3	0,3
Historical Decorative Elements	Elimination of elements %	0,4	0,6
	Conservation of elements %	0,4	0,4
	Adaptive reuse %	0,2	0



Veracity:

- *Architectonic composition: 100% (40% of the volume horizontally added seems to be right and half of the ground volume added on building 22 is present)*
- *Architectonic modification: 75% (examining the reduction of natural ventilation element and the present point cloud, the quantity of closed windows in building 22 is less then 40% of total. However the presence of an additional floor reduces the possibility of having a traditional functional natural ventilation system)*



Average veracity of the documentation on Mathuron Ki Pol area

As per the previous pages, the documentation, done thanks to questionnaire in a period of 7 days, have some feedback on the photogrammetric and the historic documentation.

Counting the whole set of veracity percentage factors it is possible to define an average value: in the previous study case, the veracity of the questionnaire have a total of 89.3%.

This means that the results of the questionnaires are true for an average of 89.3% cases. Because of this, the calculation of the indicators has to be considered with a possible average error of 10.7%.

Of course this embrace a wider set of possibilities: in some cases the error will be higher than 10% and in some cases less, it is important to remember that this sample is taken from a geographic cluster, as previously described in chapter 16. Jodhpur old city and the growing urban pressure on Mehrangarh Fort.

However, thanks to these data is possible to assume as a percentage of veracity for the entire area the value of 10.7% of error. Nevertheless, it is possible to assume also that this value represent the error on of 10.7% of the average mutation of the natural ventilation system or an average variation of the number of collapsed or newly built internal walls inside the building. From this wider point of view the variation of 10% is acceptable because laterally influent all over the whole set of data documented. However one possible development of this study could be the definition of clusters and veracity level details for the documentation. In fact, this research analyses just one total veracity of the entire area documentation, instead of a differenced veracity for all the set of data surveyed.

Average changes in relational models and definition of relational functions

After the previously described documentation, together with the definition of veracity levels, it is needed to highlight the relational factors the monumental entity recognized as Heritage site: in this case the Mehrangarh Fort.

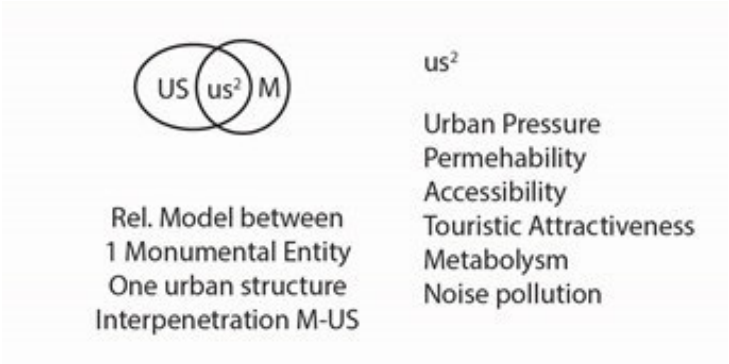
The following data, documented due to the questionnaire for main actors (see chapter 15. Actors' questionnaire), represent the results of 17 interviews done to different people inside the organization of the Mehrangarh Museum Trust at different level: people have been chosen at different levels of the organization (from the directional office to touristic guides) in order to analyze samples in the whole set of participants to the enhancement process of the fort.

Mehrangarh Fort				
INDICATOR			Impact of Indicator %	Specification
Ownership			100 Private	Owned by Maharaja Gaj Singh II
Visual Perception	Morphology		80	Own: Iconic
	Chromatic		20	Contrast: with the city of Jodhpur
Environmental Impact			20	Low emissions Garbage management Continuous cleaning
Environmenatal Influence			40	Natural: high level of pollution from desert Artificial: regulated pollution level
Social Impact	Inner		55	International relationship and MOUs
	Outwords		45	High interest and actions in conservation and enhancement of the heritage centre of Jodhpur
Urban Pressure			10	Outwords: no regulation on the development of the city near by but presence of wall system
Touristic Impact	Inner		90	National: own of the Fort
	Outwords		10	International: from the City of Jodhpur
Religious Influence			5	No influence: presence of temples
State of Conservation			95	Conservation controlled and continuous
Velocity of changing in Time			20	New extentions and structural changes but very slow process
Accessibility			90	Signals for paths and routes
Inclusivity			95	Facilitation for all the areas

Mathuron Ki Pol Area				
INDICATOR			Jodhpur City Centre (%)	Detail
Ownership			20 Priv 80 Publ	Partially owned by ONG: acquirement, conservation and sell/self use
Visual Perception	Morphology		25	Own: Organic composition
	Chromatic		75	Own: Iconic (blue colour)
Environmental Impact			90	High pollution level Lack of garbage management
Environmenatal Influence			60	Natural: high level of pollution from desert Artificial: high pollution level
Social Impact	Inner		90	Depending on casts system
	Outwords		10	Fort is seen as an alien body, but with symbolic value
Urban Pressure			90	Own: High urban density
Touristic Impact	Inner		75	International: of the city Jodhpur
	Outwords		25	National: of the Fort
Religious Influence			80	Neighbourhoods from cast system
State of Conservation			20	Building actions continuous but not monitored
Velocity of changing in Time			95	quick addictions end extentions but not monitored
Accessibility			0	No devices
Inclusivity			0	No devices

From the previous diagrams is possible to extract some data that are influent in the definition of the indicators that represent the area to work on.

Comparing the documented data with the relational model that represent better the location of the area and the geographic affinity to the monumental entity, it is possible to define the following model as representative:



The proximity between the area (us2) and the Mehrangarh Fort, because of the interpenetration of some areas, makes the scheme to be defined as the one hereafter.

As a result of this model the Relational Function indicators that defines the set of the most influent ones are the followings:

- Urban pressure
- Permeability
- Accessibility
- Touristic Attractiveness
- Metabolism
- Pollution

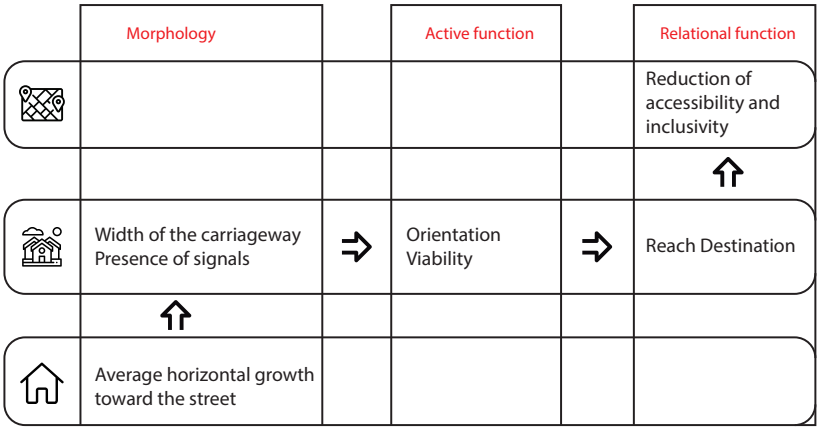
Now the comparison in between the Relational Model and the Actors' questionnaire will give the actual set of indicators that represent the factors that influences in change the effect from the old city area and the Mehrangarh Fort.

Indicators of subordination in between the two entities have two directions: it is possible that some indicators depend from decision or policy of the actor. Other depends from some difficulties of the city center's area under examination: in this moment is important to check the influence and not the direction of the same.

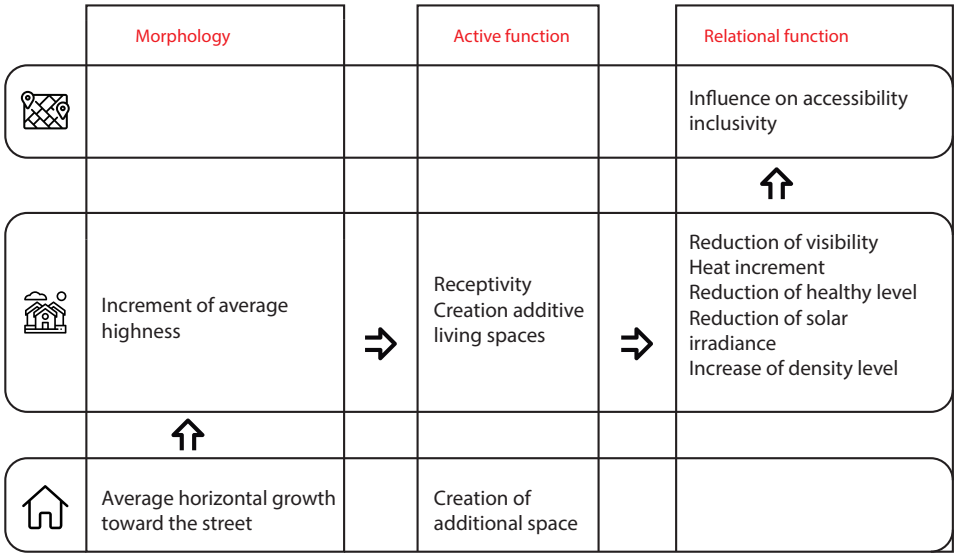
Here there are again the percentage indicators of average modification of the area.

- 25% average addition of new walls
- 30% average volumetric reduction on the total size of the house of natural ventilation elements
- 10% average horizontal growth of the buildings toward the street
- 64% average vertical growth
- 34% average elimination of elements
- 33% average quantity use and morphology preserved spaces
- 32% average quantity of adapting reused spaces

Following the path of the matrix Morhpology/Active Function/Relational Function and Various scale of entities under exam (Individual building/Street scenario/Urban complex) it is possible to highlight the dependence processes:



From the matrix is possible to understand that the average variation of 10% of the building shape all-over the areas toward the street creates a reduction of the width of the carriageway that reduce the space for the signals. This decrease the space for signals and for street supplies that reduces the possibility of orientation inside the organic urban structure. Than on a relational level this influence the circumstances that allows to reach the destination and it is related with a reduction of accessibility of the whole area.



On the other hand the vertical grow of the average dimension of the building in the area increase the highness of the entire area: this is due to the willingness, as previously said, to create new living spaces and area to convert to receptive activities. However this causes a reduction of visibility, increasing the heat of the area and, because of this, generating a reduction of solar irradiance and so, of the level of hygiene/health. That is one of the characters that create increment in the urban pressure.

17. Ahmedabad and urban metabolism of the Heritage Walk

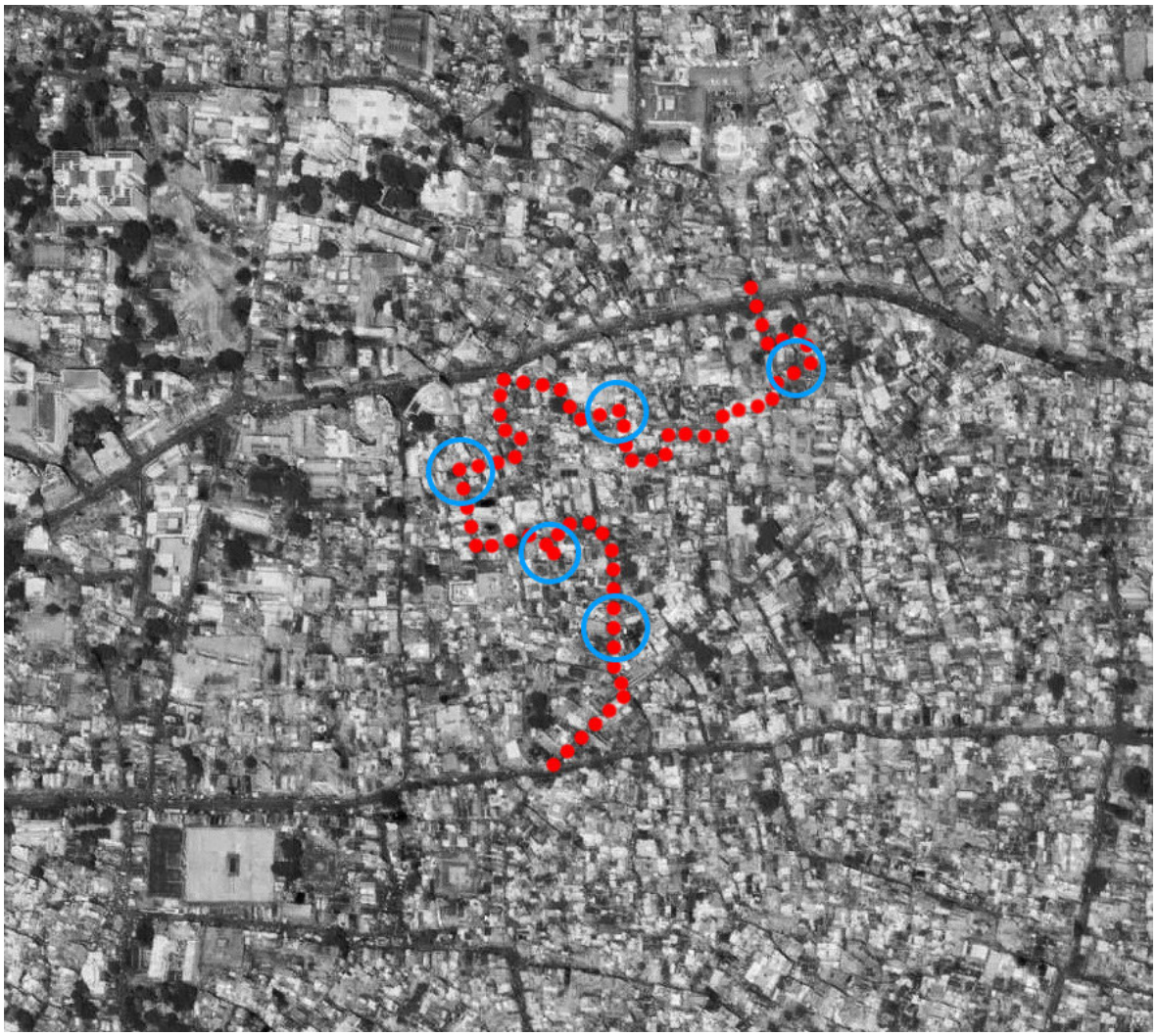


Figure 48: This image represent the area under exam. The red dots are defining the central part of the Heritage Walk of Ahmedabad and the blue ones represent the areas under examination.

The choice to analyse this area is due to presence of the Heritage Walk of Ahmedabad. This monumental path, created inside the city centre in order to show the main features of the old city, touches some important landmarks as old buildings and typical structures of the city: mainly it was created for touristic impact, and it takes from the Temple of Shree Swaminarayan Mandir towards the Jama Masjid.

The study analyses this part of the path to investigate on the most visited part of the city: because of this, the Heritage Walk is one of the best preserved portion of the Heritage Ahmedabad, and every variation or change in the houses' structure should be recorded by the municipality.

Inside the area, because of the vastness and the quantity of the houses the research documented some cluster set of houses disposed geographically along the touristic path: the total number of surveyed houses are 61 and are divided into 5 clusters as per the following scheme.

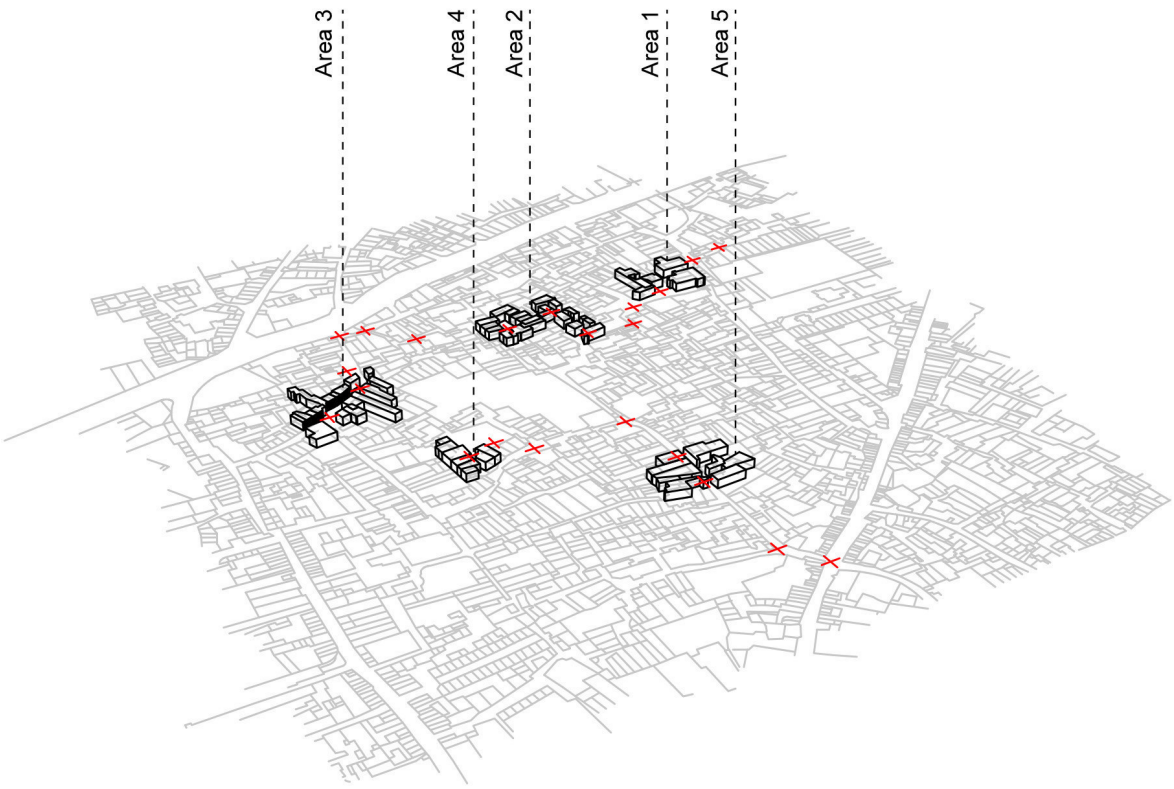


Figure 49: Geographic clusters to simplify the exemplification. The red crosses are the 360 degree photographic stations.

The analysed area starts from the Relief road and ends in Thankshal road.

Hereafter the detail of every cluster area. The crosses represent the position of the 360 degree photographic stations took in 2012 and 2017:

Area 1 and 2:

Questionnaire documentation for areas 1 and 2

Herirage Walk Area		1	2	3	4	5	6	7	8	9	10	11	12	13
Inhabitants	2017 (quantity)	15	16	6	20	8	4	6	3	3	4	4	3	2
	1989 (quantity)	23	20	10	22	14	8	12	6	4	5	7	8	4
Residential Area Presence	yes / no	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Commercial Area Presence	yes / no	Y	Y	Y	N	N	Y	N	Y	N	Y	N	N	N
Architectonic composition Indicators	Total Area Occupied by the house sqm	230	180	70	140	40	20	40	15	75	50	30	35	30
	Addition Horizontal (encroachments) %	0,1	0,0	0,2	0,2	0,0	0,0	0,1	0,0	0,2	0,0	2,0	0,0	0,0
	Addition Horizontal (encroachments) sqm	23	0	14	28	0	0	4	0	15	0	60	0	0
	Addition Vertical (new floors) quantity %	0,2	0,2	0,0	0,3	0,2	1,0	2,0	1,0	0,5	0,2	2,0	0,0	0,0
	Addition Vertical (new floors) sqm	46	36	0	42	8	20	80	15	37,5	10	60	0	0
Architectonic modification Indicators	Addition of new internal walls	0,6	0,2	0,4	0,3	0,1	0,2	0,2	0,8	0,0	0,0	0,0	0,1	0,0
	Reduction natural ventilation elements %	0,4	0,2	0,4	0,2	0,2	0,4	0,6	0,8	0,0	0,4	0,6	0,2	0,0
	Total Variation of the initial composition	0,5	0,2	0,4	0,3	0,2	0,3	0,4	0,8	0,0	0,2	0,3	0,2	0,0
Transformation of Elements	Elimination of elements %	0,4	0,2	0,6	0,4	0,2	0,4	0,8	1	0,4	0,2	0,8	0,6	0,4
	Conservation of elements %	0,2	0,2	0,2	0	0,6	0	0	0	0	0,6	0,2	0,4	0
	Adaptive reuse %	0,4	0,6	0,2	0,6	0,2	0,6	0,2	0	0,6	0,2	0	0	0,6

Herirage Walk Area		14	15	16	17	18	19	20	21	22	23	24	25	26
Inhabitants	2017 (quantity)	3	6	3	2	2	3	2	4	6	5	10	6	10
	1989 (quantity)	4	10	8	4	3	6	3	6	10	8	13	15	14
Residential Area Presence	yes / no	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
Commercial Area Presence	yes / no	Y	N	Y	N	N	N	N	Y	Y	N	Y	N	N
Architectonic composition Indicators	Total Area Occupied by the house sqm	30	65	45	45	35	45	30	75	60	45	40	45	80
	Addition Horizontal (encroachments) %	0,0	0,2	0,2	0,5	0,3	0,2	0,0	0,0	0,0	0,0	0,0	0,0	0,0
	Addition Horizontal (encroachments) sqm	0	13	9	22,5	10,5	9	0	0	0	0	0	0	0
	Addition Vertical (new floors) quantity %	0,5	0,5	0,0	0,0	0,0	0,0	3,0	2,0	0,0	0,0	0,5	0,5	0,5
	Addition Vertical (new floors) sqm	15	32,5	0	0	0	0	90	150	0	0	20	22,5	40
Architectonic modification Indicators	Addition of new internal walls	0,6	0,6	0,4	0,2	0,4	0,4	0,2	1,0	0,2	0,0	0,4	0,2	0,2
	Reduction natural ventilation elements %	0,0	0,4	0,2	0,2	0,4	0,4	0,0	0,6	0,4	0,4	0,6	0,0	0,4
	Total Variation of the initial composition	0,3	0,5	0,3	0,2	0,4	0,4	0,1	0,8	0,3	0,2	0,5	0,1	0,3
Transformation of Elements	Elimination of elements %	0,4	0,2	0,2	0,2	0,2	0,2	0,2	1	0,6	0,4	0,2	0,6	0
	Conservation of elements %	0,4	0,4	0,4	0,4	0,2	0,2	0,2	0	0,4	0,4	0,4	0	0,4
	Adaptive reuse %	0,2	0,4	0,4	0,4	0,6	0,6	0,6	0	0	0,2	0,4	0,4	0,6

Area 3 and 4: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Questionnaire documentation for area 3 and 4

Herirage Walk Area		27	28	29	30	31	32	33	34	35	36	37	38	39
Inhabitants	2017 (quantity)	2	6	7	6	8	15	2	7	2	6	3	2	10
	1989 (quantity)	4	8	16	10	8	19	3	16	4	7	4	4	13
Residential Area Presence	yes / no	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
Commercial Area Presence	yes / no	N	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N
Architectonic composition Indicators	Total Area Occupied by the house sqm	25	60	110	40	45	145	17	60	17	65	35	30	100
	Addition Horizontal (encroachments) %	0,4	0,0	0,2	0,2	0,2	0,2	0,4	0,2	0,2	0,2	0,0	0,4	0,0
	Addition Horizontal (encroachments) sqm	10	0	22	8	9	29	6,8	12	3,4	13	0	12	0
	Addition Vertical (new floors) quantity %	0,5	0,2	0,2	0,5	1,0	0,5	1,0	0,5	0,5	0,2	1,0	1,0	0,2
	Addition Vertical (new floors) sqm	12,5	12	22	20	45	72,5	17	30	8,5	13	35	30	20
Architectonic modification Indicators	Addition of new internal walls	0,1	0,6	0,4	0,2	0,2	0,4	0,6	0,4	0,4	0,4	0,2	0,1	0,0
	Reduction natural ventilation elements %	0,4	0,4	0,2	0,4	0,4	0,8	0,4	0,8	1,0	0,0	0,0	0,2	0,2
	Total Variation of the initial composition	0,3	0,5	0,3	0,3	0,3	0,6	0,5	0,6	0,7	0,2	0,1	0,2	0,1
Transformation of Elements	Elimination of elements %	0,4	0,4	0,2	0,4	0,4	0,8	0,4	0,8	0,6	0,4	0,4	0,2	0,2
	Conservation of elements %	0,2	0,4	0,4	0,4	0,2	0	0,4	0	0,2	0,6	0,2	0	0
	Adaptive reuse %	0,4	0,2	0,4	0,2	0,4	0,2	0,2	0,2	0,2	0	0,4	0,8	0,8

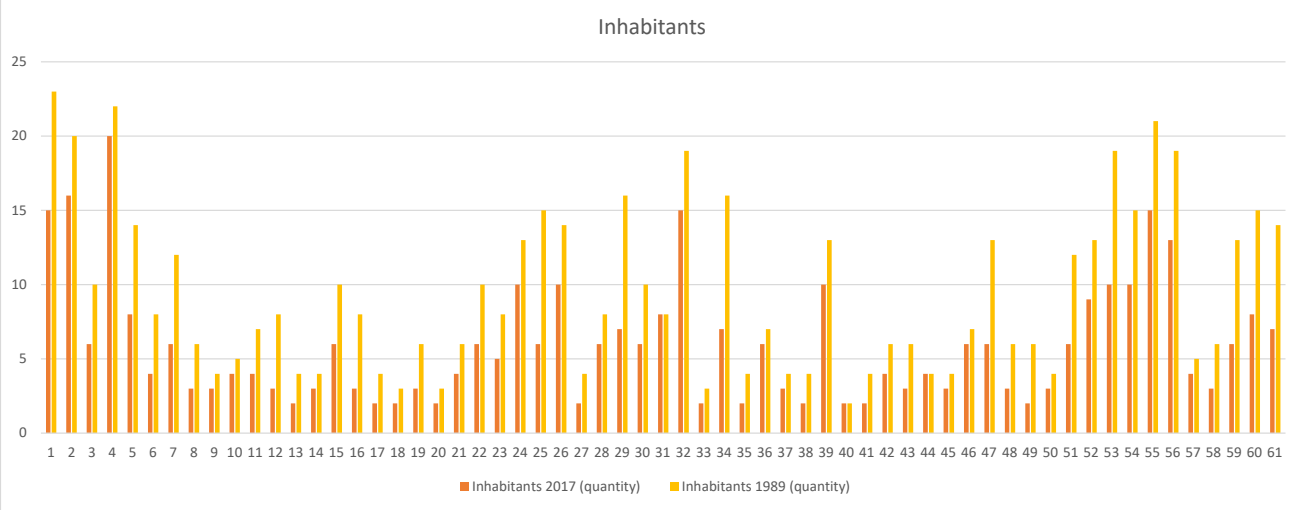
Herirage Walk Area		40	41	42	43	44	45	46	47	48	49	50	51	52
Inhabitants	2017 (quantity)	2	2	4	3	4	3	6	6	3	2	3	6	9
	1989 (quantity)	2	4	6	6	4	4	7	13	6	6	4	12	13
Residential Area Presence	yes / no	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Commercial Area Presence	yes / no	N	N	Y	Y	Y	N	N	N	Y	Y	Y	Y	Y
Architectonic composition Indicators	Total Area Occupied by the house sqm	15	32	40	37	25	28	65	105	55	47	35	55	65
	Addition Horizontal (encroachments) %	0,0	0,2	0,0	0,0	0,2	0,2	0,2	0,0	0,6	0,0	0,0	0,1	0,0
	Addition Horizontal (encroachments) sqm	0	6,4	0	0	5	5,6	13	0	33	0	0	5,5	0
	Addition Vertical (new floors) quantity %	1,0	1,0	0,6	0,5	1,0	1,0	0,5	0,0	1,5	0,2	0,6	0,2	0,5
	Addition Vertical (new floors) sqm	15	32	24	18,5	25	28	32,5	0	82,5	9,4	21	11	32,5
Architectonic modification Indicators	Addition of new internal walls	0,0	0,2	0,0	0,4	0,6	0,0	0,2	0,4	0,6	0,2	0,6	0,2	0,2
	Reduction natural ventilation elements %	0,4	0,6	0,2	0,2	0,4	0,2	0,0	0,2	0,8	0,4	0,2	0,4	0,4
	Total Variation of the initial composition	0,2	0,4	0,1	0,3	0,5	0,1	0,1	0,3	0,7	0,3	0,4	0,3	0,3
Transformation of Elements	Elimination of elements %	0,2	0,4	0,2	0,2	0,4	0,4	0,2	0,4	0,6	0,4	0,2	0,4	0,2
	Conservation of elements %	0,4	0,6	0,2	0,6	0,4	0	0,2	0,2	0,2	0,2	0,2	0,4	0,4
	Adaptive reuse %	0,4	0	0,6	0,2	0,2	0,6	0,6	0,4	0,2	0,4	0,6	0,2	0,4

Area 5:

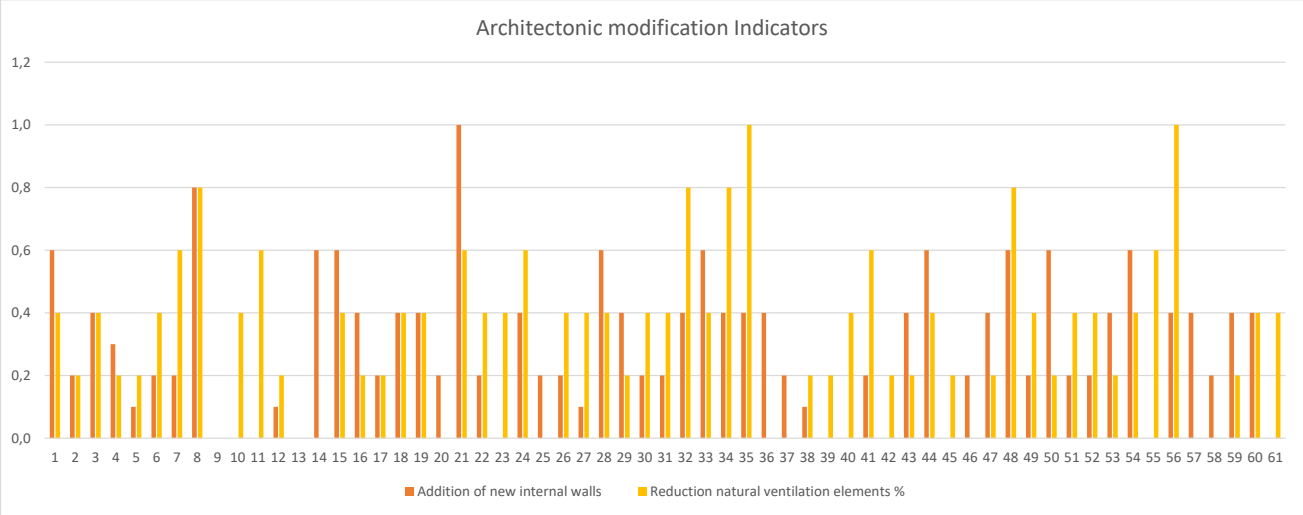
Questionnaire documentation for Area 5

Herirage Walk Area		53	54	55	56	57	58	59	60	61
Inhabitants	2017 (quantity)	10	10	15	13	4	3	6	8	7
	1989 (quantity)	19	15	21	19	5	6	13	15	14
Residential Area Presence	yes / no	N	Y	Y	Y	Y	Y	Y	Y	Y
Commercial Area Presence	yes / no	Y	Y	Y	Y	N	N	N	N	N
Architectonic composition Indicators	Total Area Occupied by the house sqm	100	125	175	145	50	45	100	120	105
	Addition Horizontal (encroachments) %	0,0	0,0	0,0	0,0	0,0	0,0	0,4	0,0	0,0
	Addition Horizontal (encroachments) sqm	0	0	0	0	0	0	40	0	0
	Addition Vertical (new floors) quantity %	1,0	0,4	0,0	0,2	0,0	0,2	0,6	1,0	0,0
	Addition Vertical (new floors) sqm	100	50	0	29	0	9	60	120	0
Architectonic modification Indicators	Addition of new internal walls	0,4	0,6	0,0	0,4	0,4	0,2	0,4	0,4	0,0
	Reduction natural ventilation elements %	0,2	0,4	0,6	1,0	0,0	0,0	0,2	0,4	0,4
	Total Variation of the initial composition	0,3	0,5	0,3	0,7	0,2	0,1	0,3	0,4	0,2
Transformation of Elements	Elimination of elements %	0,6	0,2	0,2	0,4	0,6	0,2	0,8	0,2	0,2
	Conservation of elements %	0,2	0,8	0,8	0,6	0,4	0,4	0,2	0,4	0,6
	Adaptive reuse %	0,2	0	0	0	0	0,4	0	0,4	0,2

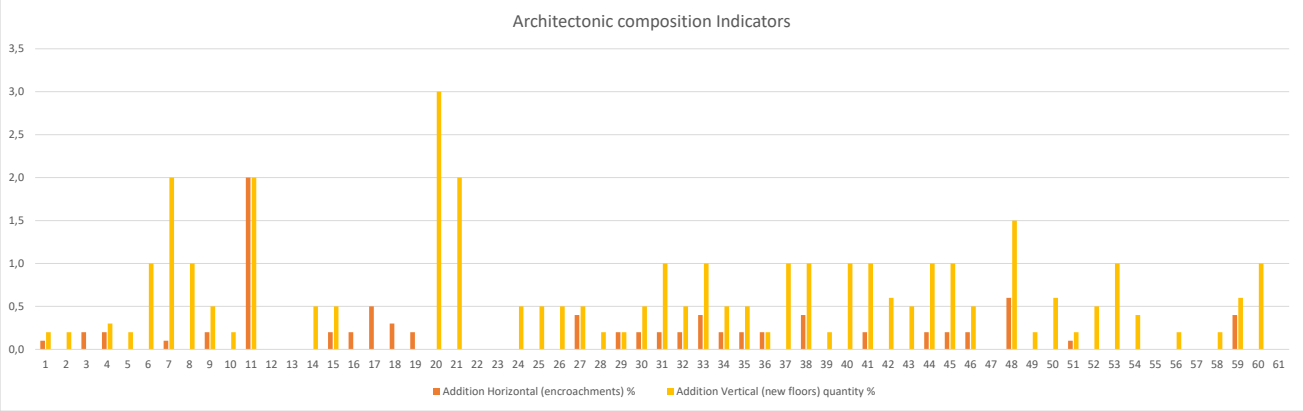
From the previous data, it is possible to extract the following average quantities:



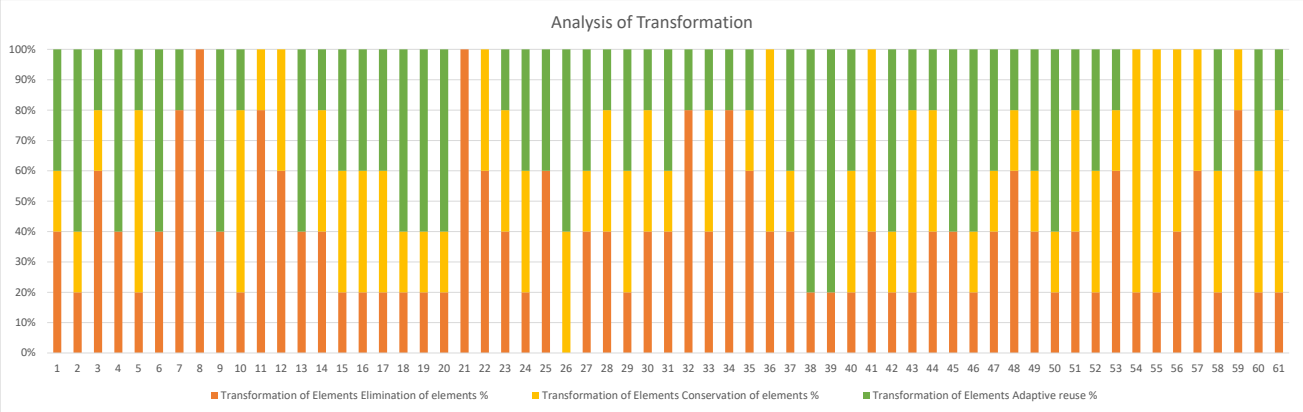
Number of inhabitants indicator had a decrement till the 60% of the initial number



- 30% average addition of new walls
- 35% average volumetric reduction on the total size of the house of natural ventilation elements



- 11% average horizontal growth of the buildings toward the street
- 45% average vertical growth



- 39% average elimination of elements
- 29% average quantity use and morphology preserved spaces
- 32% average quantity of adapting reused spaces

Due to these factors, comparing with other tendencies of areas on the same indicators, the inhabitants are creating more over-structures on the preexistences; another visible character of the variation is the elimination of heritage elements in the documented areas instead of conservation-adaptive reuse modality of intervention.

The research will hereafter show the double check on some of the cases. In this case the checking operation will be done analyzing the variation between the situation of 2012 and 2017.

Double check of Area 1: Cases 1, 3 and 4

Herirage Walk Area		1	3	4
Inhabitants	2017 (quantity)	15	6	20
	1989 (quantity)	23	10	22
Residential Area Presence	yes / no	Y	Y	Y
Commercial Area Presence	yes / no	Y	Y	N
Architectonic composition Indicators	Total Area Occupied by the house sqm	230	70	140
	Addition Horizontal (encroachments) %	0,1	0,2	0,2
	Addition Horizontal (encroachments) sqm	23	14	28
	Addition Vertical (new floors) quantity %	0,2	0,0	0,3
	Addition Vertical (new floors) sqm	46	0	42
Architectonic modification Indicators	Addition of new internal walls	0,6	0,4	0,3
	Reduction natural ventilation elements %	0,4	0,4	0,2
	Total Variation of the initial composition	0,5	0,4	0,3
Transformation of Elements	Elimination of elements %	0,4	0,6	0,4
	Conservation of elements %	0,2	0,2	0
	Adaptive reuse %	0,4	0,2	0,6

Veracity:

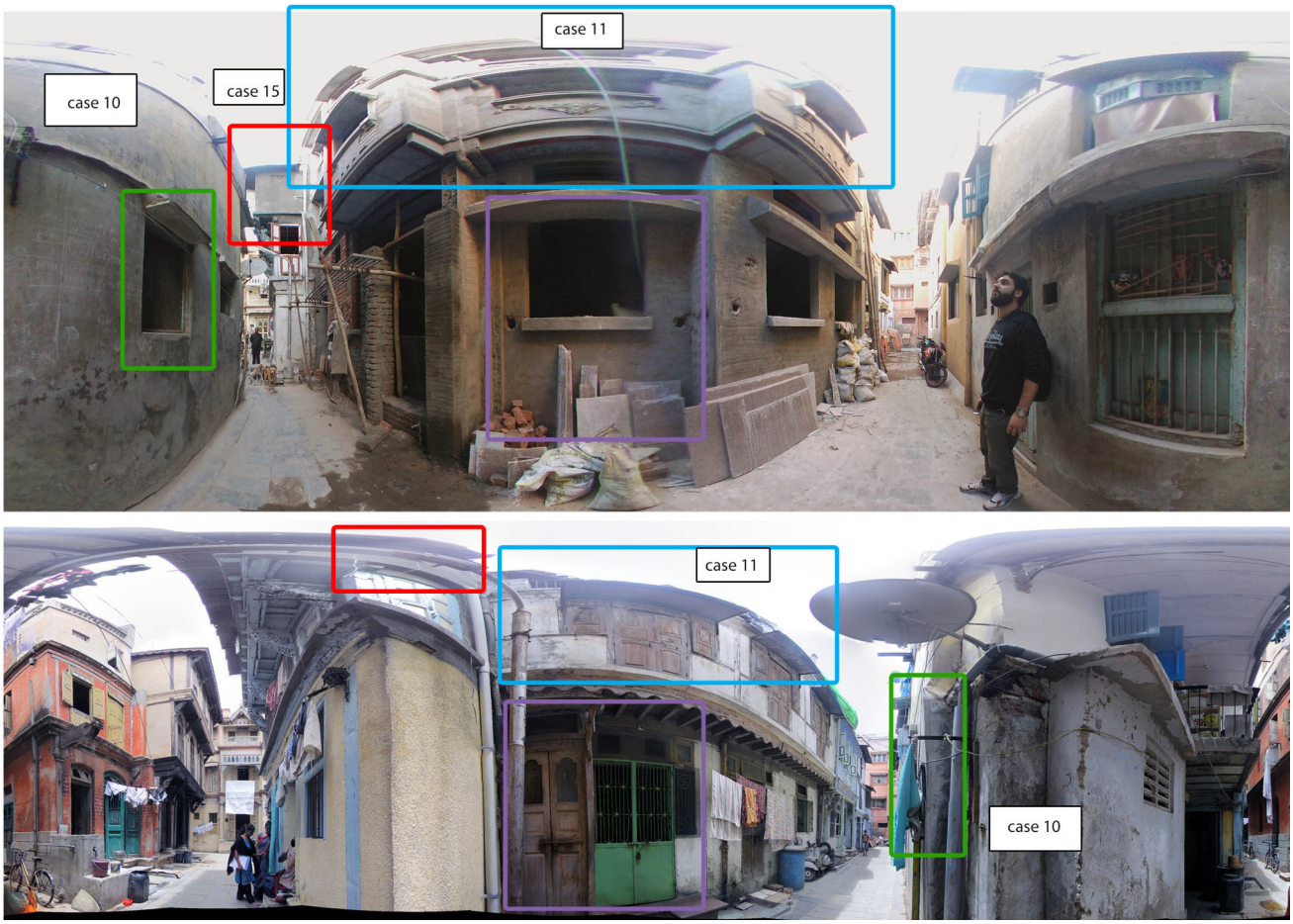
- *Architectonic composition: 75% (addition of the horizontal encroachment was before 2012 for case 4; 20% of vertical addition is too much should be 10% so 50% of addition vertical is checked)*
- *Architectonic modification: 100% (closing of 20% of windows for case 1; addition of encroachment of 20% of house area on the first floor)*
- *Historical decorative elements: 75% (The variation between 2012 and 17 is not visible, but comparing the urban form from the previous surveys seems that the case 3 was not the same size before in past years)*

Double check of Area 2: Cases 7, 9, 10, 11 and 15

Herirage Walk Area		7	9	10	11	15
Inhabitants	2017 (quantity)	6	3	4	4	6
	1989 (quantity)	12	4	5	7	10
Residential Area Presence	yes / no	Y	Y	Y	Y	Y
Commercial Area Presence	yes / no	N	N	Y	N	N
Architectonic composition Indicators	Total Area Occupied by the house sqm	40	75	50	30	65
	Addition Horizontal (encroachments) %	0,1	0,2	0,0	2,0	0,2
	Addition Horizontal (encroachments) sqm	4	15	0	60	13
	Addition Vertical (new floors) quantity %	2,0	0,5	0,2	2,0	0,5
	Addition Vertical (new floors) sqm	80	37,5	10	60	32,5
Architectonic modification Indicators	Addition of new internal walls	0,2	0,0	0,0	0,0	0,6
	Reduction natural ventilation elements %	0,6	0,0	0,4	0,6	0,4
	Total Variation of the initial composition	0,4	0,0	0,2	0,3	0,5
Transformation of Elements	Elimination of elements %	0,8	0,4	0,2	0,8	0,2
	Conservation of elements %	0	0	0,6	0,2	0,4
	Adaptive reuse %	0,2	0,6	0,2	0	0,4

Veracity:

- *Architectonic composition: 75% (case 7 no addition, reduction of veracity; case 9 addition of 10% checked; case 10 no addition checked; case 11 addition of 200% checked; case 15 no addition, reduction of veracity)*
- *Architectonic modification: 100%*
- *Transformation of elements: 100% (case 10 conservation of all the façade elements checked; case 11 80% of the natural ventilation elements were eliminated, checked)*

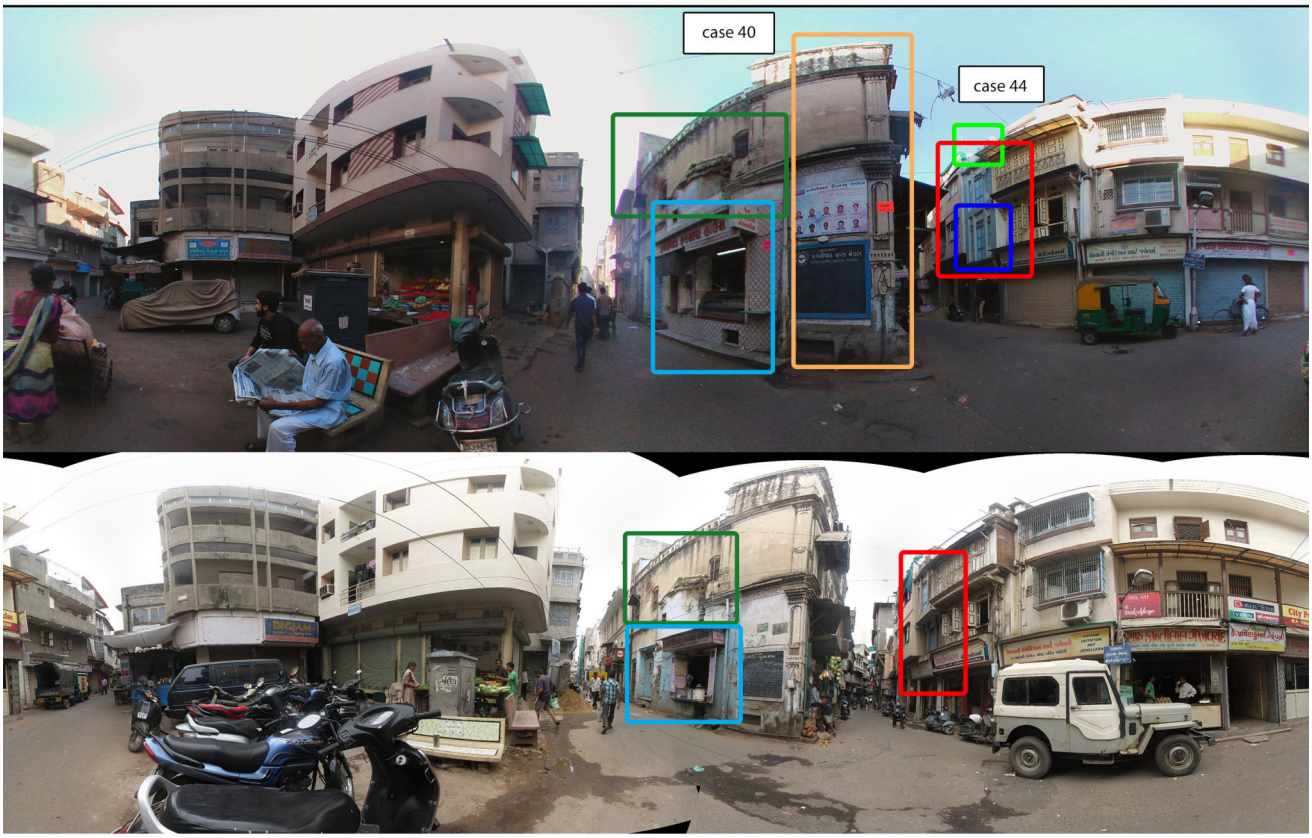


Double check of Area 3: Cases 40 and 44

Herirage Walk Area		40	44
Inhabitants	2017 (quantity)	2	4
	1989 (quantity)	2	4
Residential Area Presence	yes / no	Y	Y
Commercial Area Presence	yes / no	N	Y
Architectonic composition Indicators	Total Area Occupied by the house sqm	15	25
	Addition Horizontal (encroachments) %	0,0	0,2
	Addition Horizontal (encroachments) sqm	0	5
	Addition Vertical (new floors) quantity %	1,0	1,0
	Addition Vertical (new floors) sqm	15	25
Architectonic modification Indicators	Addition of new internal walls	0,0	0,6
	Reduction natural ventilation elements %	0,4	0,4
	Total Variation of the initial composition	0,2	0,5
Transformation of Elements	Elimination of elements %	0,2	0,4
	Conservation of elements %	0,4	0,4
	Adaptive reuse %	0,4	0,2

Veracity:

- *Architectonic composition: 100% (checked)*
- *Architectonic modification: 75% (there are no closing windows on the case 40; reduction of veracity; case 44 modification of the façade and addition of volume on the street at the first floor)*
- *Historical decorative elements: 100% (case 40 variation of façade, checked; case 44 variation of the entire traditional system of the façade, checked)*

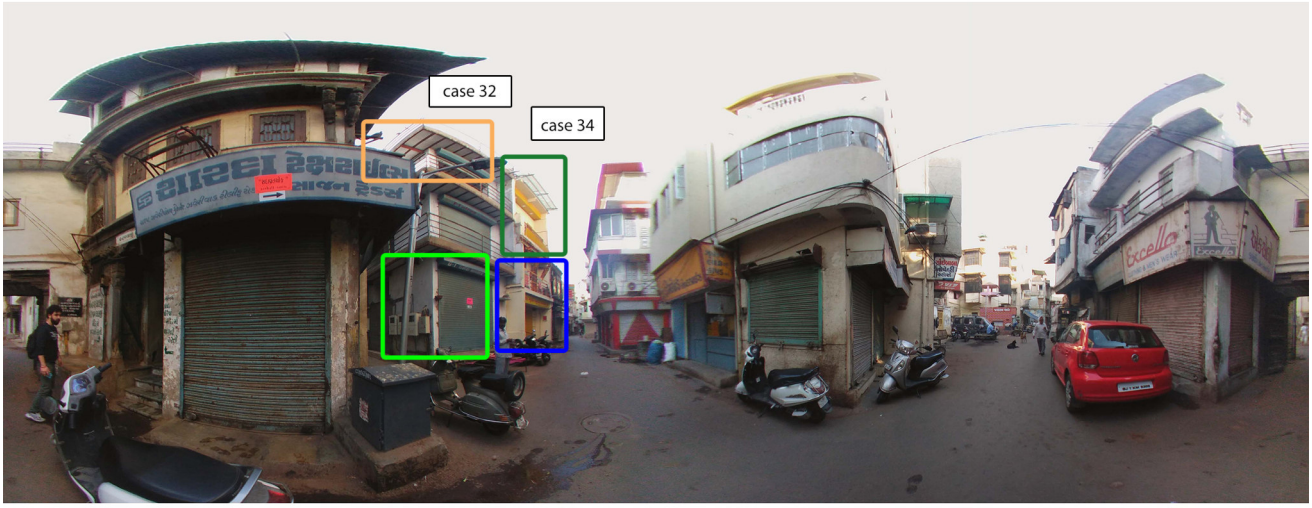


Double check of Area 3: Cases 32 and 34

Herirage Walk Area		32	34
Inhabitants	2017 (quantity)	15	7
	1989 (quantity)	19	16
Residential Area Presence	yes / no	N	Y
Commercial Area Presence	yes / no	Y	Y
Architectonic composition Indicators	Total Area Occupied by the house sqm	145	60
	Addition Horizontal (encroachments) %	0,2	0,2
	Addition Horizontal (encroachments) sqm	29	12
	Addition Vertical (new floors) quantity %	0,5	0,5
	Addition Vertical (new floors) sqm	72,5	30
Architectonic modification Indicators	Addition of new internal walls	0,4	0,4
	Reduction natural ventilation elements %	0,8	0,8
	Total Variation of the initial composition	0,6	0,6
Transformation of Elements	Elimination of elements %	0,8	0,8
	Conservation of elements %	0	0
	Adaptive reuse %	0,2	0,2

Veracity:

- *Architectonic composition: 100% (checked)*
- *Architectonic modification: 100% (due to the conversion of the system of façade the entire system of natural ventilation has been reduced and modified, 80% of the openings have been closed, checked)*
- *Historical decorative elements: 100% (the two entire façade and structural elements have been modified, some of the internal spaces have been converted, checked)*



Average veracity of the documentation

The veracity of the previous checked documentation has a total number of 91.6%. As for the same procedure of the Jodhpur study case, is possible to say that the error (of 8.4%) is not influent for the level of detail of our research.

Average changes in relational models and definition of relational functions

In the same way the documentation done thanks to the use of Actor's questionnaire gave following data: the data have been inspected on 26 members of the municipalities, NGOs and volunteers that works on the heritage city preservation.

Ahmedabad
Old City Areas

INDICATOR			Impact of Indicator	Specification
Ownership			100 Private	Inhabitants
Visual Perception	Morphology		80	OWN: Traditional Architecture with mix of geometric and organic structure
	Chromatic		20	OWN: Light recurring of colours
Environmental Impact			90	High levels of pollution
Environmenatal Influence			60	Natural: low pollution Artificial: high level of pollution
Social Impact	Inner		40	High, depends moderately on the Pols' system (Neighbourhoods)
	Outwords		60	Very high, interest in conservation of the old city
Urban Pressure			90	OWN: Very high density and population increasing
Touristic Impact	Inner		10	Touristic interest in fringe monuments
	Outwords		90	OUTWARD: importance for the presence of the Heritage Walk
Religious Influence			90	Important division in between different areas and different religions
State of Conservation			40	Continuous works of reconstruction nearby the boundaries with the new city
Velocity of changing in Time			60	Quick addition not monitored on boundaries of the city and near by the important monuments
Accessibility			0	No device
Inclusivity			0	No device

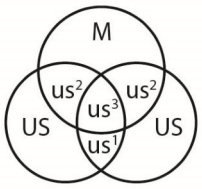
These are data on the heritage city environment in that precise point of the walk. In addition, followings are data documented from the same set of actors on the heritage walk itself.

Ahmedabad
Heritage Walk

INDICATOR			Impact of Indicator %	Specification
Ownership			100 Private	Public path
Visual Perception	Morphology		30	OUTWARD: Touches important monuments of the old city but the path is variable
	Chromatic		40	OWN: Recurring of traditional colours
Environmental Impact			50	High levels of pollution
Environmenatal Influence			60	Natural: low pollution Artificial: high level of pollution
Social Impact	Inner		90	OWN: Iconic, it's one of the icon of the old city
	Outwords		10	Conservation towards economic investments
Urban Pressure			70	OWN: high density but moderate because of iconic importance
Touristic Impact	Inner		70	National and international
	Outwords		30	Presence of old buildings in the historic centre
Religious Influence			70	Very high and changing in between the different points of the path
State of Conservation			50	Conservation moderately controlled but not continuous
Velocity of changing in Time			70	Quick addition mostly not monitored
Accessibility			0	No device
Inclusivity			0	No device

From the previous diagrams is possible to extract some data that are influent in the definition of the indicators that represent the area to work on.

Comparing the documented data with the relational model that represent better the location of the area and the geographic affinity to the monumental entity, it is possible to define the following model as representative:

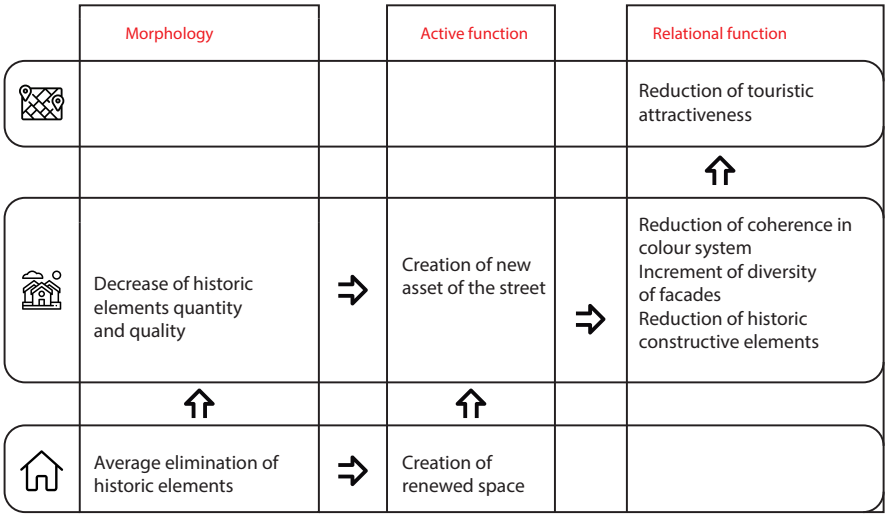


Rel. Model between
1 Monumental Entity
More urban structures
Interpenetration M-US
Interpenetration US-US

us^1	us^2	us^3
Urban Pressure	Urban Pressure	Urban Pressure
Permehability	Permehability	Permehability
Accessibility	Accessibility	Accessibility
Touristic Attractiveness	Touristic Attractiveness	Touristic Attractiveness
Metabolysm	Metabolysm	Metabolysm
Hygiene	Noise pollution	Hygiene
		Safety

Here there are again the percentage indicators of average modification of the area.

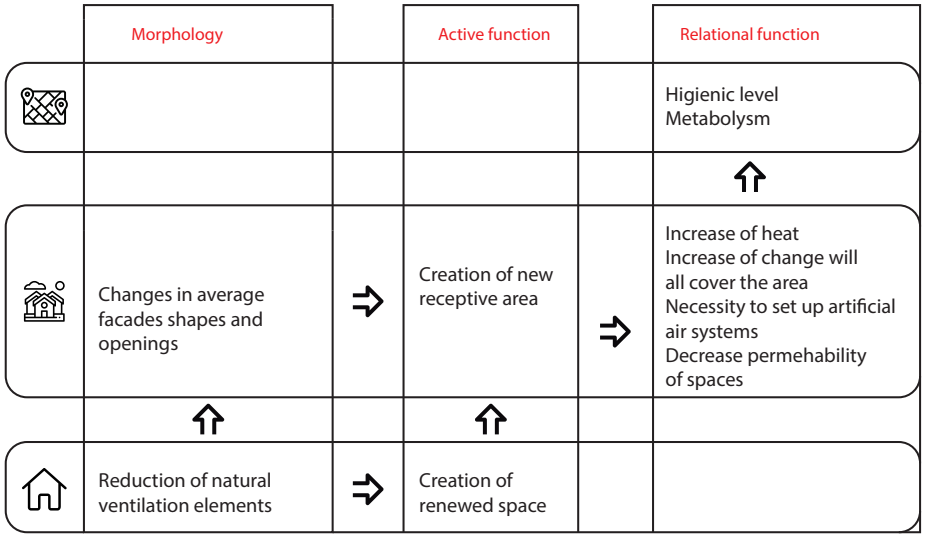
- 30% average addition of new walls
- 35% average volumetric reduction on the total size of the house of natural ventilation elements
- 11% average horizontal growth of the buildings toward the street
- 45% average vertical growth
- 39% average elimination of elements
- 29% average quantity use and morphology preserved spaces
- 32% average quantity of adapting reused spaces



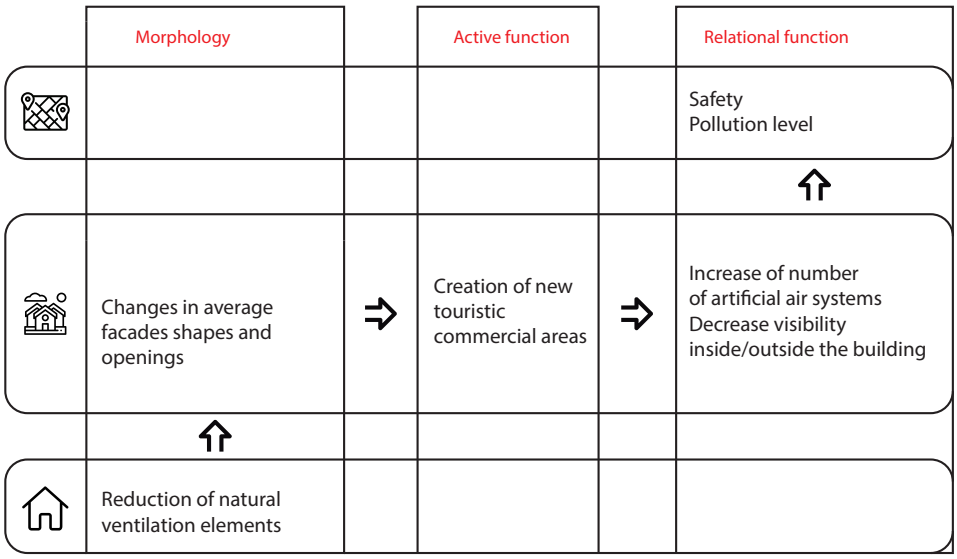
Thanks to the data is possible to highlight some average modification factors of the buildings in the surveyed areas that can represent with an accuracy due to the number of case studies that influence on the Heritage Walk.

Because of the Elimination of historic elements of the last few years is possible to understand the risks of the area due to this kind of modification that will bring in this case a reduction of the Touristic Attractiveness.

In fact the decrement of historic elements and the conversion of the asset of the street into a new one in the relational function of the street scenario reduces the coherence in the color system and the main historic aspect of the facades because of a diminution of the historic technological elements that characterize the Heritage outfit of the walk.



Meanwhile because of a reduction of 35% of natural ventilation system, because of a new willingness of changing the main feature of the house (conversion of usage or will of change the visibility factor) the vision concerns an increment of a heat on the road because of the necessity to install artificial air treatment systems. This influences the metabolism and the hygiene level of the area.



On the other hand, because of the same factor of 35% of reduction of natural ventilation vernacular systems, the relational indicator for the street scenario environment shows a decrement on the visibility inside-outside the houses. Together with the growing pollution level, this reduction of openings creates a changes in the usage of external spaces that are not more visible from inside and reduces consequentially the safety level.

PART 7 – Future development and conclusions of the research

The research applications are various and embrace, with the modification required case by case, a huge number of possible case studies. First, in order also to refine the documentation method and to enrich the initial methodology with other important indicators, other Indian cities in similar situations are important bases for increasing the database.

Municipalities that find difficulties in monitoring the informal structures' developments inside the heritage centres can approach the usage of this methodology to have first overview of the possible areas where to start new non-intrusive monitoring actions. This gives the possibility, in the same moment, to launch awareness actions on the significance and the opportunity of the already present heritage.

Trusts and NGOs, in order to better enhance and preserve the heritage sites listed and recognized, with the application of this methodology have the possibility to highlight and cooperate with the municipalities in order to start new actions of conservation and valorisation of the nearby old city areas. The identification of different trends can rise the attention towards new needs of the population in a certain area: this gives the opportunity to identify a possible path for the solution (architectonic and/or urban planning) to undertake in order to evidence the most appropriate way to satisfy the same need, but in a heritage-conscious method.

Another application field of the study is the educational one: the creation of heritage city centres that promote the study of heritage on-field, understanding new possible utilization of the documentation methodology and of the checking instruments. One first action towards this direction has been already undertaken in the city of Jodhpur, where the *Mehrangarh Museum Trust* and the NGO *JDH - Urban Regeneration Project*, promoted together the creation of the "City Heritage Centre Gaj Singh II": the old haveli, is becoming the centre for the conservation of the old city of Jodhpur and the actions undertaken are:

- museum (to make the tourists and jodhpurians be aware of the heritage of the old city)
- costless counseling with experts for the conservation of the building

- educational for young professionals that wants to approach the field of conservation of heritage centres

The enhancement target could be an interest of many other stakeholders: construction agencies, museums, shop keepers and manager of the new kinds of receptive activities previously listed, as restaurants, guest houses, bed and breakfasts.

Conclusions

Need of analysis toward the conservation and enhancement

The conception of heritage grows daily in significance, embracing more actions and processes. The difficulties to face towards the preservation are different because of many variation in between the factors architects, conservators, urban planners are facing in approaching different issues almost every time.

As proved in the case studies, where the complete methodological process described in this research was tested, the ideation of a documentation method that embraces and considers the entire set of present variable in an over layered urban complex is difficult. However, with the aim of understanding some common characters that highlight an average change in the main attributes of a prevalently organic structure, this study examined possibilities of a first approach on the theme of preservation of historical centres in economically emerging nations.

Possibilities of future research developments

As per the last part of the outputs, the average mutation, with a number of case studies limited at the time of one on-field inspector, does not have a normal distribution (Gaussian distribution), because of some prominent outliers. One of the possible development on this thematic is the study of the plurimodal distribution of the changes: this means that the major trend inside one area has different tendencies. A future study could take in charge the challenge to focus on the definition of the precise typology of tendencies inside a certain area and highlighting the causes.

Nevertheless, the research analysed that, not considering the outliers during the process of veracity check, the average percentage of truthfulness of the data goes around the 85%. This index, as previously explained, is sufficient in order to understand the area where is important to prompt the initial process of conservation and highlights the main urban planning and architectonic orientation to work on. The important action to schedule, together with the documentation and the check of area possibilities, problems and opportunities, is the awareness' one.

Adoption in the construction works

The presented methodology could be the first approach that Municipal Corporation and Heritage cells adopt in the catalogation of issues of different areas: the possibility to highlight the peculiar problems and the geographical distribution can help towards the identification of areas that need quick changes in the morphology and it'll possible to understand the direction and rules to follow.

Creation of onsite Heritage Conservation Centres

Nowadays Trusts, NGOs and Foundations have the possibility to change the dangerous direction the liberalization of construction industry in emerging nations left regarding the historic centres. As a matter of facts, some of them are moving towards this direction, but without a planned and shared development scheme.

The methodology presented in this research could be one first step in the creation of that mutual conservation and enhancement process and the creation of committed places for study and elaboration of plans for the conservation processes: with a precise and detailed action of documentation, followed by planned conservation, planning and awareness activities, it will be possible to preserve in a more efficient way that Heritage.

The same Heritage that nowadays, is not even named as Heritage: the same one that in future can be one of the most important and ancient, all over the planet.

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