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THE VIRTUAL OFFICE: A COLLABORATIVE APPROACH TO SURVEYS AND GIS FOR URBAN RENOVATION IN THE *BETHLEHEM AREA CONSERVATION AND MANAGEMENT PLAN* BY UNESCO

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ABSTRACT

The work related to the first phase of the *Bethlehem Area Conservation and Management Plan* (BACMP) has been developed according to a program of «Developing capacities through technical cooperation». The Plan, funded by the Italian Cooperation with the support of UNESCO and under the technical and scientific supervision of a group of international consultants, had a dual purpose. Parallel to the conventional work on conservation and planning, a *Capacity Building* process was developed in order to overcome the lack of local specialists in the field of survey and GIS for urban rehabilitation and renewal.

1. INTRODUCTION

The aim of this text is to present the type of approach and criteria adopted in dealing with this rather unusual situation, though nonetheless stimulating, arising from the occasion of the *Bethlehem Area Conservation and Management Plan* (BACMP) which allowed us to develop innovative collaborative solutions taking maximum advantage of the potentialities of web technologies.

Under specific request of the host institutions, the Conservation Plan for the area of Bethlehem has become an opportunity to develop and consolidate skills on urban conservation and planning of a group of young local professionals, as part of a more general project of raising awareness that always accompanies the work of UNESCO in the developing countries. The project, therefore, was structured as a broad program of *developing capacities* aimed at transmitting knowledge, awareness and know-how between the international consultants involved (*International Team of Experts* – ITE) and a group of local young architects (*Local Working Team* – LWT).

2. LEARNING BY DOING

2.1 Learning to learn

The program of *developing capacities* has had an impact on all the work phases and was carried out as a real project inside the project of the Plan, according to the idea that the knowledge of a process and a work methodology cannot only be 'transferred' but rather must be 'acquired' in an interactive and endogenous way.

In this sense, the *Capacity Building Program* has been structured according to a *Problem Based Learning* pedagogic approach aimed at strengthening the capacity of self-learning. Architects-apprentices learn facing concrete problems in a real work environment in which theoretical concepts are immediately tested and actively developed. The coordination of *tutors*, with a role of 'facilitators' in learning, lighten as students become more experienced and competent and gain confidence with the work to be developed.

The BACMP, in conclusion, became a ‘learning project’ in which the young architects involved acquired the skills and the comprehension of the work by developing directly specific tasks within the activities of the Plan. In this sense, the process of *learning by doing* involves a gradual approach to the discipline of planning and urban rehabilitation along the various stages of the work and through the progressive acquisition of a broad understanding of the issues to be worked out.

In the first stage of work the activities developed were focused on setting a new cartographic base. In particular, during the first propaedeutic studies, it was found out that the properties of the available cartography were not sufficient to meet the requirements of an investigation to be developed at the scale of the historic fabric according to scientific standards. The documentation, such as the aerial photographs and the photogrammetric surveys, as a matter of fact, although produced in recent times, was conformed to the elaboration of a general urban instrument (*masterplan*) at 1:10000 scale and therefore not sufficient for a conservation Plan that requires a much better understanding of the town and of the urban territory.

The impossibility to acquire in short time a cartography with the necessary requirements led to the choice of carrying out a topographic survey on field, aimed at achieving a completely new map through the revision of the existing one and on the basis of a new high definition aerial photograph. This represented the opportunity to start a complex work of knowledge and documentation of the historic town main sites, bringing forward, at the same time, the training program of the LWT.

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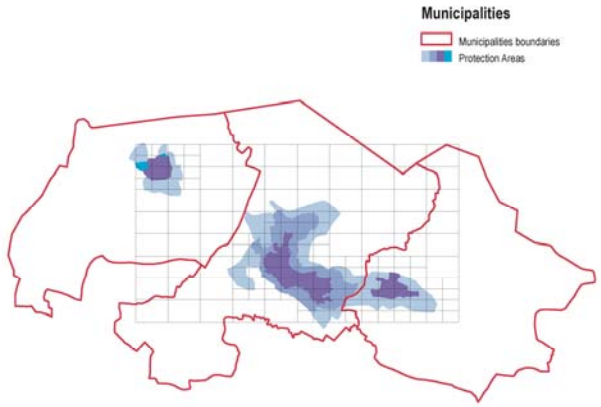
2.2 Contextualize knowledge

Since the real beginning the approach of the Plan was aimed at defining an original strategy that, through a process of methodological contextualization, was properly calibrated on local specificity. Procedures and criteria tested and developed in Italy have been adjusted gradually on the existing situation and refined on the base of local feedbacks. Therefore, much of the preliminary work was developed directly through on-site researches and surveys finalized to the acquisition of a comprehensive understanding and to a project modeled on the territorial and town context.



1. The three Municipalities of the BACMP, the protection areas and the new cartography index map with 108 tablets in scale 1:500

In a complex process in which the Plan has to benefit from the *capacity building* activities and *vice versa*, a conventional 'transmission of knowledge' was not deemed sufficient. As a matter of fact, in addition to the working methods and the well established practices for the preparation of a plan, the main objective of the program was to teach the ability to reuse the feedbacks of the work in progress directly from the process itself through its active re-elaboration. This strategy intended to create 'sustainable knowledge' in the sense that the concepts acquired by the group of architects-apprentices can be replicated and further developed subsequently according to an endogenous process determined by the local context and the people involved.

The *Capacity Building* program was customized on the skills, attitudes, motivation of each member of the LWT in Bethlehem. Individual tasks were assigned to each member of the group that become responsible for a specific area of the work according to the idea of *task person* (or *focal point*). The main fields covered were:

- the data retrieval for the town archive (Repository);
- the data storage in the town archive (Repository);
- the *morphological survey* on site (aimed at creating a new cartographical base in scale 1:500);
- the *morphological survey* data storage in the GIS database (data uploading);
- the *qualitative survey* on site (aimed at the creation of thematic maps of the urban territory);
- the data storage of *qualitative survey* in the GIS database (data uploading);
- the verification and refinement of the *typo-morphological survey*.

The process includes, along all the work phases, a first moment of testing and adjusting the methodology and the tools (surveys, legends, questionnaires, digital process, etc.) on a small area and, afterwards, its extension on the whole Bethlehem area.

The work carried out by the LWT with the supervision and the technical-scientific coordination of the ITE between July 2007 and August 2008 produced, according to the objectives previously set, the following documents and tools:

- a new cartography of the Bethlehem area on paper in scale 1:500 consisting of 108 tablets in A3 format;
- a new digital cartography of the Bethlehem area in 1:500 scale consisting of 108 tablets in A3 format, geo-referred in GIS environment;
- a site survey of the Bethlehem area on paper in 1:500 scale consisting of 96 tablets in A3 format (qualitative survey of the territory);
- a digital survey of the Bethlehem area in 1:500 scale consisting of 96 tablets in A3 format (qualitative survey of the territory geo-referred in GIS environment);
- researches and tests finalized to the *typo-morphological surveys* of the Bethlehem area aimed at the identification of the distribution units, the minimum units of intervention and the transformations;
- an archiving system for the storage of data and documents (historical, cartographic, iconographic, etc.) related to the city and the territory of the Bethlehem area (*Repository*);
- researches and tests finalized to the production of the *Preliminary Strategic Document*;
- guidance of the process of discussion, negotiation and approval of the *Bethlehem Charter* and of the *Preliminary Strategic Document* with the municipal technical offices of the Bethlehem area.

In order to direct and orient the work in progress, detailed instructions and a set of guidelines in the form of 'user manuals' were designed for the surveyors in Bethlehem. It was also carried out a wide-ranging training program with specific lectures on the various topics handled during the work of the Plan. The lectures developed in detail the theoretical and practical foundations related to the cartography design techniques, to the realization of the field surveys, to the design of a Conservation Plan, to the GIS tools for urban planning.

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2. Field survey digitalized in scale 1:500, tablet 65a

3. Qualitative field survey legend for buildings and open spaces

3. THE VIRTUAL OFFICE

The *Capacity Building* program, parallel to the process of the Plan of Conservation implied a constant supervision and scientific coordination by the ITE for the described activities. The tutorage of the working group was conducted in part directly in Bethlehem, during several missions on behalf of UNESCO, in part through the *Virtual Office*, a digital platform on internet designed especially in order to share the work developed, transfer data and supervise the work between the offices in Bethlehem and in Florence.

We preferred to focus our attention here on methodology and the overall layout rather than enter into specific details regarding content or single functionalities, which will only be referred to in passing, as we believe that it might be of interest to reflect on the more infrequently discussed aspects of GIS and computer instrumentation, or rather, on their value in terms of their utility in a collaborative approach of this type.

As we were dealing with geographical data which was highly complex from a management standpoint, the task ahead was quite daunting. One of the BACMP work group's specific tasks was to organize the framework through which to process all of the information, geographic and otherwise, produced in Italy and Palestine and finalized for the realization of the urban plan.

The data base was restructured in accordance with the standards of a modern geographic database. The elements were subdivided into thematic layers according to how they worked within the rendering of the readings and for the production of thematic maps. Different levels were identified, from simple volumetric elements, working up to placement in more complex units such as groupings of units or buildings with common specific qualities.

The new cartography, thus achieved, served as the basis upon which the collection and filing of the data compiled by the collaborators was developed.

3.1 Training Method and Collaborative Work

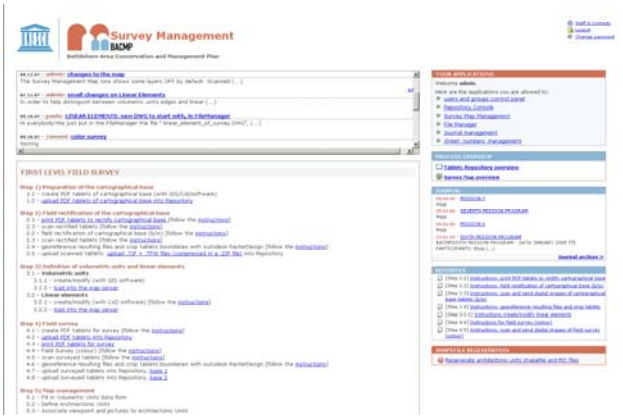
The cooperative approach arises from the intention to supply not only a technical solution and a series of instruments for urban recovery, but also a finalized format in order to render the Local Working Team (LWT) autonomous in the daily management of the various phases of the project.
To this end, the formative method was essentially conceived on three central points:

- the sharing of work methods, thereby avoiding the exportation of a prepackaged project;
- the utilization of cooperative and distributive work instruments, including long distance assistance in real time;
- the specific training to use ad hoc instruments, not exclusively desk-to*p based* but also *web-based*.

3.2 Distributive and Cooperative Work

For this project, the choice of relying on the potential of Internet based instruments may seem obvious, after all it is a transnational project centered on a territory in conflict with all the evident problematic and logistic implications contained therein.

Less obvious, however, is the choice to base the entire technological infrastructure on web technologies, even for those tasks traditionally carried out with desktop products. Beyond the apparent technical advantages, this set-up allowed for the creation of a veritable Virtual Office: one instrument CSCW (Computer Supported Cooperative Work) developed *ad hoc*, made daily cooperation possible even under conditions of considerable geographical distances between the various components of the team.



4. Virtual office main page: the Message Board, the instructions step-by-step for the Field Survey, the Survey Map Management, the Repository Console, the File Manager, etc.

The Virtual Office is accessible through a web page and consequently easy to consult with any device connected to the Internet. Once authorized, the user can access to a series of functions according to the role they play on the team: electronic message boards, work logs, file sharing, contacts' address book, etc, but the heart of the project lies in the functions which are strictly tied to the urban planning project:

- the step by step work procedures with textual and visual instructions;

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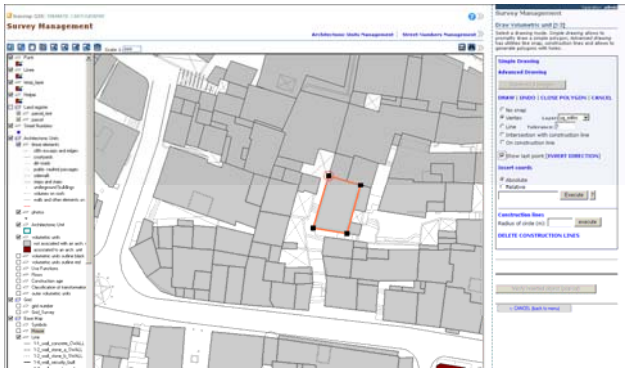
- the Survey Map, the interactive map that makes up the fulcrum of the surveying work, bringing together the various thematic layers (basic cartography, aerial photos, scans of survey tables made in situ, vectorial design elements, etc.), and also offering access to design and management functions of the tabular data related to the registered buildings.
- the Repository Console, the archive of the survey readings which go to make up the interactive map, with related indications of the project's progress for each sector of the area covered.

The choice to center the collaborative work on this web platform made it possible to carry out the various phases of the project assuring continuous methodological and practical assistance to the Local Working Team (LWT). Indeed, after a few *in loco* training sessions, the LWT was able to proceed autonomously in the various phases of surveying, gradually uploading the various survey readings into the system in the raster format, appropriately scanned, and video digitalizing the various vectorial elements.

All of this took place under the constant tutelage of the International Team of Experts (ITE), who monitored the progress through Virtual Office. The possibility for everyone to visualize the same results, by way of the Survey Map, enormously facilitated the collaboration. The ITE coordinators were able to verify each single survey reading as is was uploaded, assuring quality control, and whenever needed, the LWT was able to request assistance in real time from ITE and the technical personnel via chat or Skype audio/video conferencing.



5. Survey Management: drawing Volumetric Units directly on interactive cartography.

3.3 Integration of the offline and online paradigms

Another fundamental aspect of the project set-up was precisely the relation between desktop instruments and the web platform: neither of the two alone was considered sufficient. On the contrary, it was considered opportune to project the entire flow of work (and thus calibrate the related training activities) on the integration of the two paradigms.

In other words, some of the phases of the work were directed towards the LWT with commonly used software for the manipulation of raster images and the vectorial design, thereby avoiding the reliance on specific, expensive and complex GIS software. This meant that it was possible to focus the training more on the content of the work than on the technique of the software. Afterwards the LWT was instructed on how to insert (again, via Internet by way of Virtual Office) the work which had been carried out locally onto the geographical database.

This integration served to optimize the distribution of the work, transferring the more challenging and complex parts, in terms of cartographic design and re-elaboration with sophisticated instruments, to the Italian team, which worked offline with desktop instruments which were more efficient and suited to this task. The correction of the cartographic base, for example, was carried out in accordance with this modality. The results of this elaboration were integrated bit by bit into the geodatabase, rendering the new cartographic base available in real time, and at the same time modifiable via Internet for point by point correction. In turn, the LWT made use of this new base to proceed with the surveying work, adhering to the established procedural outline.

3.4 Distributive System and Data Modeling: the geographical database

Technically, the entire project is centered upon a geographical database which is accessible online for both reading and authoring. The geographical database, which brings together the cartographic and tabular data relative to the historic-architectural patrimony of the Bethlehem area, is physically located in a data center in Siena. This limited the technical difficulties of having an *in loco* data center, without, however, jeopardizing the usability and the updating of the data themselves by the remote users, the LWT *in primis*.

The geographical database is opportunely interfaced with a web server thereby supplying the cartographic data through HTTP protocol. The data are visible from a normal web browser through a cartographic viewer which can be connected to the server of the maps. This allows for visualization operations and editing in real time on vectorial maps. The web viewer, thanks to the functions which were fine-tuned in Siena, allows the user to effectuate design and editing operations of linear, point and polygonal geometry, of activation and deactivation of thematic layers, of pan and zoom with different levels of detail in the visualized data, etc.

The high quality of the data present in the archive should not lead one to think that the web application is slow and unmanageable. On the contrary, the success of this project has demonstrated that even in the presence of technologically limited infrastructures, it is possible to maintain a high level of quality. This is due to the convenient granularity of the data themselves and to punctilious design of the geographical database, which succinctly applies the appropriate level of detail to a given situation without uselessly overloading the connection.

The geographical data, nevertheless, are only a part of the database: directly from internet through the interactive map, it is possible to get a precise correlation of every element of the map and the related tabular data which, in this case, were collected during the surveying.

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6. The interactive cartography overlap different thematic layers such as functions, number of floors, site surveys, aerial photos, historic cartography, etc.

These data might be, for example, the category of use of each volumetric unit, the number of floors or the number of inhabitants, the infrastructures present (energy sources, telecommunications networks, etc), historical type data such as the era of edification, but also photographic data such as images of the building with related localization of point of view and of its orientation. Data input can be loaded onto the web in real time and immediately become part of the geo-data base, thereby eliminating the chance of duplication, misalignment and delays in updating.

4. CONCLUSIONS

The approach is therefore based on methods and instruments aimed at constructing a training laboratory directed towards the local operator which allows to center the focus on urban and architectural issues rather than on the complexities of software and GIS editing; even in the presence of technologically compromised infrastructures and limited connectivity we were able to safeguard the quality of the surveying data without penalizing the consultation or the production of the data themselves.