

Self-help made viable: the importance of management of resources and data

Alberto Giacardi

Dipartimento di Ingegneria dei Sistemi Edilizi e Territoriali
Politecnico di Torino, Torino, Italia e-mail: alberto.giacardi@polito.it

Key words: self-help made viable, users' construction autonomy, self-help building manual, Gantt diagrams, specifications and instruction fiches, simplified and dry assemblage, self-help construction nodes, temporary wooden structures, management of buildings in border-line areas, sustainability

Abstract

This contribution aims at proposing "simplified assemblage" wooden building strategies, to face the problems linked to the self-help building of temporary structures in border-line areas. To manage the whole process, "driven procedures" have been adopted, using a multimedia system for handling information. Main results of the research are:

- allow users' independence in construction operations, respecting every kind of environment;
- adopt self-help building and "dry assembly" procedures;
- define and realize easy-to-handle 3D details and an "all in one" tool to build up all the structures;
- simplify shape of elements, promptly interchangeable;
- foresee repeatable construction phases, easily and quickly understandable;
- separate units in parts simple to be reproduced;
- conceive comprehensible procedures for anyone, to avoid injuries of operators and minimize risks of erroneous laying;
- manage "driven choices" which define typology of territorial development, geometry of plant, foreseen use and number of people hosted in temporary houses;
- print and fill out Gantt diagrams to link processing;
- overlap digital and paper supports (self-help building manual, specifications and instruction fiches, ...), so that everyone can choose the most familiar and clearer ones;
- organize data and handle 2D/3D models simultaneously;
- guarantee interaction of users with multimedia, to support self-builders in construction phases;
- permit flexible consultation and usability of topics, especially on web (<http://www.polito.it/eas/>);
- design building system with details and tools able to:
 - a) suit the context found on site;
 - b) employ recyclable and easy to work materials, functional to possible adjustments during assembly phases [4 & 5].

The final outcome is a Multimedia CD-Rom in which all these contributions are related, helping users to attend self-building of a “self management village”. Due to flexibility of use of prototype, the expression “self management village” will be referred to different contexts, to point out all the management and construction phases. Some examples are emergency situations preceding reconstruction steps, self-help building communities or houses useful for meetings, shows, ...

1 Introduction

Since the dawns of civilizations, man has always satisfied his personal need of house adopting strategies and constructive systems in line with territorial, social and economic context of affiliation. In many cases, even today and for very different reasons (sometimes tied up to natural catastrophes or more simply for the acceptance of vagrant shows, fair events, concerts, ...), it is economically advantageous and respectful of context, to resort to temporary receptive structures. In such sense, therefore, it appears of great actuality to propose self-help made viable housing solutions, able to satisfy this kind of temporary need of middle and long term, in respect of local traditions as well as of the manual dexterity of future users. A lot of studies (see in chronological order: Butler, Fuller, Prouvè, Sive, Bini, Spadolini, Shigeru Ban, Zambelli, Firrone, C.L.E.A. Project, ...) and solutions (tent, container, trailer, ...) have tried to investigate the problems of self-help made viable in different and personal ways [1,3,8,9]. This research, resulting from experiences gained over the PhD in Ingegneria Edile inside the Dipartimento di Ingegneria dei Sistemi Edilizi e Territoriali of Politecnico di Torino [2], aims at introducing a building prototype open to evolution. Its aim is to allow users to satisfy their own needs in an autonomous and self-help made way. For this reason my project is conformed to the respect of the followings:

- take care of the safety of workers;
- simplify buildings activities and shape of elements;
- manage to the best unit connections;
- reduce waste of time and discard of material during all construction and management phases;
- respect individualities, allowing complete integration of subjects differently skilled;
- foresee constructions which can be built up by unqualified workers;
- be fully adapted to requirements and to various territorial contexts (not only Italian one).

Besides, planning and organization of single constructive phases have been taken care of. Results are:

- implementation of a self-help building manual to be filled in by coordinators of processes and some detailed Gantt diagrams for correct administration of times linked to the various phases;
- design of all technological units constituting single building;
- planning of assembly fiches and specifications able to assist workers during edification;
- realization of an “all-in-one” tool supporting all constructive stages;
- building up of a technological unit to obtain interesting guidelines about its design;
- organization of a multimedia equipment and a web site (<http://www.polito.it/eas/>) to share all necessary information and have adequate access to data available on web and on CD-Rom.

The above is aimed to let users be independent in respect of construction operations and allow fruitful discussion among professionals. An interactive process may lead to new solutions or to improve suggested ones. In addition, the principle of economic, social and environment sustainability has to be underlined. This does not mean “a reduction of employed resources to maximise advantages for man and environment”, but rather “an ensemble of procedures to optimise employed items to obtain a result (valid for material, human or information technology articles) in function of a general reduction of costs and impacts on man and environment”.

2 Organizational aspects

When you have to cope with self-help made viable, you must consider some aspects, without which all processes irretrievably end up failing. A few important and hierarchical steps can be recognized:

- 1) psychological and technological training of individuality and groups (to prepare final users to do their best for community) [7];
- 2) safety (during work and following life phases) and security of village in its whole;
- 3) cleaning, order and organization (to avoid epidemics and useless loss of time) [10];
- 4) adequate organization of yard and correct choice of leaders, widely recognized by their groups of affiliation (to whom submit organizational assignments and management of particular aspects of work);
- 5) severe respect of realization times of single operations (through efficient Gantt diagrams);
- 6) continuous control of real autonomy of groups involved in job;
- 7) definition of procedures, encoded through "driven choices", which point out with precision to workers/users what kind of selections to operate for attainment of anticipated objectives and final results;
- 8) support of groups during construction phases through consistent tools, such as:
 - a) assembly instructions fiches and specifications which clarify and make rapid and unailing (both from a static and work safety point of view) execution of interface between various constructive details;
 - b) adoption of a limited number of tools, safe and easy-to-use for any type of employ and any kind of end-user.

In order to treat in an exhaustive way matters above only mentioned, it is preferable to divide them in "connection paragraphs", deepening them in "thematic points" eventually supported by sample images. Such methodology of analysis, after all, is adapted to underline - in synthesis - peculiar aspects of single topics, leaving ample autonomy to the reader for possible following closer examinations. The summing up character of this paper, in fact, does not allow to push over certain limits detailed analysis of single items (this means that there is always only one element to represent a whole category).

2.1 Safety, security and psychological aspects of "self-help made village"

In this case some precise statements have to be made. Safety can have two meanings: guardianship of singles from possible accidents provoked by themselves (i.e. "safety"); security of group and village in general from external perturbation events (i.e. "security"). In both cases, some measures have to be set to make phases of autonomous assemblage of structures "sure" from all points of view. We will have:

Safety against:	Way of satisfaction:
- epidemics	- set up of some thematic paragraphs in self-help made manual in which to: <ol style="list-style-type: none"> a) signal possible hotbeds of epidemic or risky situations; b) make water, food and clothing immediately available; c) keep clean and tidy every place of village; d) foresee "dirty" and "clean" material in two different routes; e) provide users with equipment for personal and village hygiene (Figure 1); f) verify that there are no water or food pollutions;
- accident and loss of time	- organization of briefing about "how to be useful without hurting oneself" and "quick training" on use of the "all in one" tool (Figure 2) and of the procedures of common work and assemblage of construction details; - adequate specifications and instruction fiches (Figure 3-4);

	<ul style="list-style-type: none"> - multimedia and/or papery “driven choices” (Figure 5); - visualization of 2D/3D building details to simplify learning stages of constructive detail assemblage (Figure 8); - employment of non toxic materials and easy to work elements [4 & 5]; - configuration of details according to dimensional coordination (Figure 9); - compilation of Gantt diagrams, adequate to situation found on site (Figure 10); - use of non sharp materials, hard to break (plastic rather than glass, wood instead of plate, and so on...); - people interaction with officers in charge of their aid (International Red Cross, The Forces, Voluntary Associations, ...);
- revolts of groups	<ul style="list-style-type: none"> - isolation of dangerous people and individuals who want to impose their will; - definition of group leaders and annotation of all their addresses on self-help made manual (so that it’s possible to keep in touch in a very fast way); - frequent meetings among people responsible for various trials to verify reached results and the ones to be defined (all information has to be written down on self-help made manual); - annotation of failures (to avoid them in future) and possible measures to be taken;
- depression and sense of uselessness	<ul style="list-style-type: none"> - sense of affiliation to the group with psychological and religious support; - involvement of users (also and above all of disabled people) in activities according to their personal attitudes; - reinvigoration of economic activities and of ordinary ones; - quick return to normality (in case of catastrophic events).

Security against:	Way of satisfaction:
-------------------	----------------------

- not authorized entries in the village, equivocal behaviour	<ul style="list-style-type: none"> - set up of procedures with which: <ol style="list-style-type: none"> a) to control access of external and internal people; b) to identify and isolate extremist groups and subjects who want to impose their ideologies; c) to foresee a continuous control of police at edge of self-help made village;
- not authorized entries into single housing unities	<ul style="list-style-type: none"> - design of building details which make very difficult for thief entrance inside houses, favouring instead the phases of abandonment of residence from the occupants in case of fire, ... (Figure 11); - employment of zippers on doors and windows inside and not outside the residence; - adoption of fit padlocks (inside residence); - external blind fixing pivots (therefore impossible to screw from outside - Figure 12); - diurnal and night-time passage of groups of vigilantes selected among same occupants of houses.

<p>Attività e Dotazioni Indispensabili (check list)</p> <ul style="list-style-type: none"> <input type="checkbox"/> Dormire (letto, coperta, finestra); <input type="checkbox"/> mandare, cucinare, scagionare (frigorifero, lavello, piccolo spazzatura, piano di appoggio, fornelli, tavolo da pranzo, divano o poltrone); <input type="checkbox"/> lavarsi ed asciugare i ricami frastuono (lavandino, doccia, water, specchio, porta-asciugamani); <input type="checkbox"/> vestirsi (cfr. voce "Materiale da Distribuire"); <input type="checkbox"/> servizi di base (carica portabile, riscaldamento, luce, scarico delle acque nere, strade di collegamento). <p style="text-align: right; font-size: small;">pag. 15</p>	<p>Materiale da Distribuire (1) (check list)</p> <ul style="list-style-type: none"> <input type="checkbox"/> Verificare innanzitutto quante persone sono già in possesso di alcune dotazioni tra quelle elencate e distribuirle in numero e quantità congrua soltanto a chi ne è sprovvisto. <p>Materiale per la sopravvivenza dell'uomo</p> <p>dotazione di base (per strada persona)</p> <ul style="list-style-type: none"> <input type="checkbox"/> 1 coperta; <input type="checkbox"/> 1 lenzuolo; <input type="checkbox"/> 1 pigiama in cotone; <input type="checkbox"/> 1 materassino gonfiabile; <input type="checkbox"/> 1 sapone; <input type="checkbox"/> 1 spazzolino; <input type="checkbox"/> 1 tubetto di dentifricio; <input type="checkbox"/> 2 slip; <input type="checkbox"/> 1 maglietta di cotone (maniche corte); <input type="checkbox"/> 1 maglietta di lana (maniche lunghe); <input type="checkbox"/> 2 maglie di cotone (manica lunga); <input type="checkbox"/> 2 paia di calze (in lana); <input type="checkbox"/> 2 paia di calze (in cotone); <input type="checkbox"/> 1 paio di pantaloni (in cotone); <input type="checkbox"/> 1 paio di pantaloni (in lana); <input type="checkbox"/> 1 maglione di lana (continua...); <p style="text-align: right; font-size: small;">pag. 16</p>
---	---

Figure 1: A page taken from the self-help building manual distributed to management team

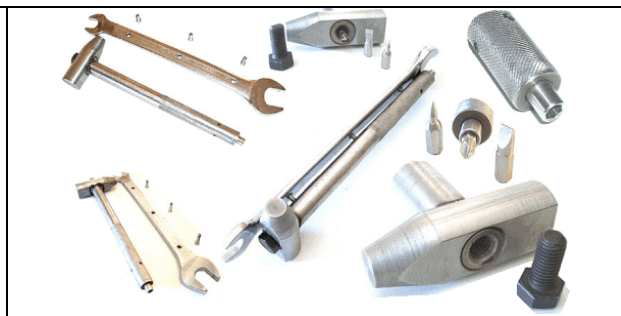


Figure 2: The "all in one" tool to build up entire construction without using other utensils

Scegliere sezione - Struttura di fondazione	
SEZIONE	COORDINATE
Altezza (fuso tutto):	
240 mm	+1 mm +0 mm
Larghezza (fuso tutto):	
360 mm	+1 mm +1 mm
Profondità (anchura esatta):	
240,0 mm	+1,0 mm +0,2 mm
Dimensionamento dettaglio numero "1" (struttura)	
altezza (fuso tutto)	450 mm +1 mm
altezza "colletto" di testa	6 mm +1 mm
diametro trafilato	30 mm +0 mm
diametro "colletto" di testa	54 mm +0 mm
diametro foro (portato sulla testa) M10	18 mm +0 mm

Figure 3: Exemplification of a specifications regarding features of foundation node



Figure 4: An example (only one page) of assembly instruction fiche about foundation basement

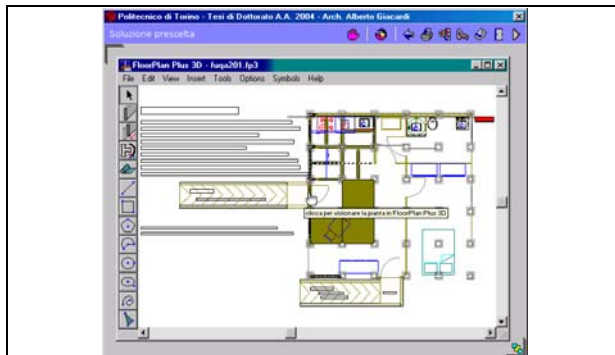


Figure 5: One of conclusive displays obtained running the "driven choices"

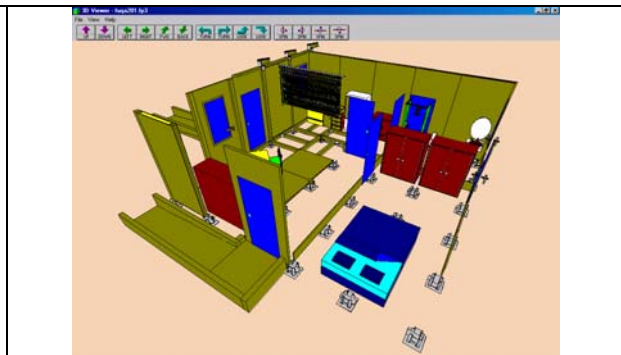


Figure 6: A 3D navigable view of an hypothetical layout ready to be built up

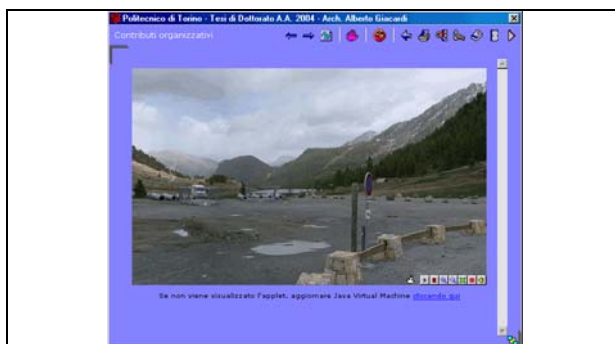


Figure 7: A 3D spot related to the position on territory of self-help made houses

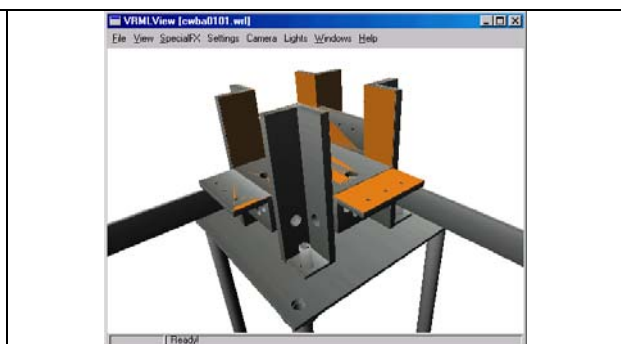


Figure 8: A three-dimensional setting about the node of foundation

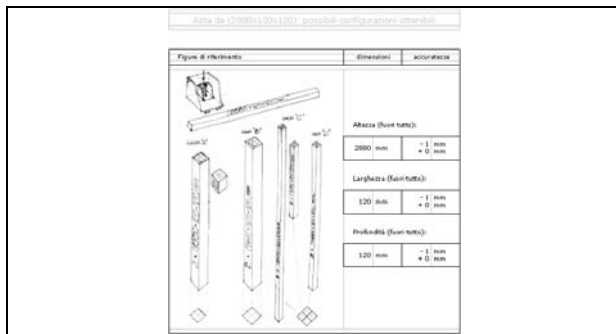


Figure 9: A dimensional coordination fiche

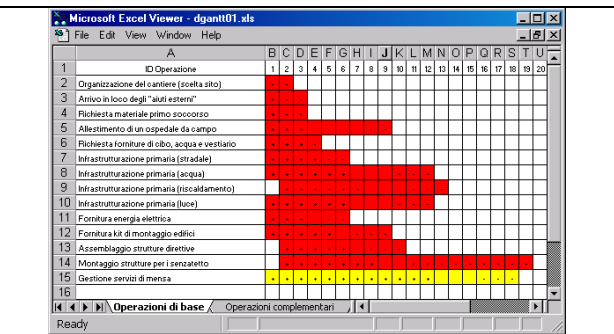


Figure 10: An example of a Gantt diagram

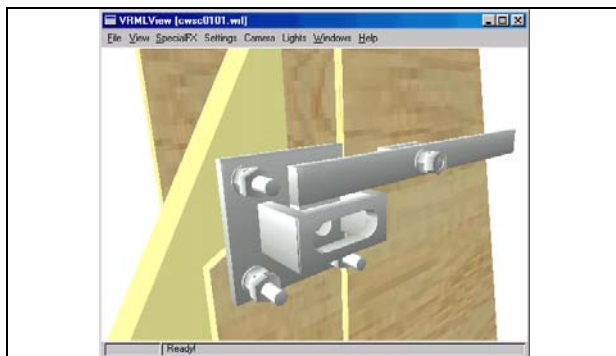


Figure 11: One of the studied lock configuration (interior side)

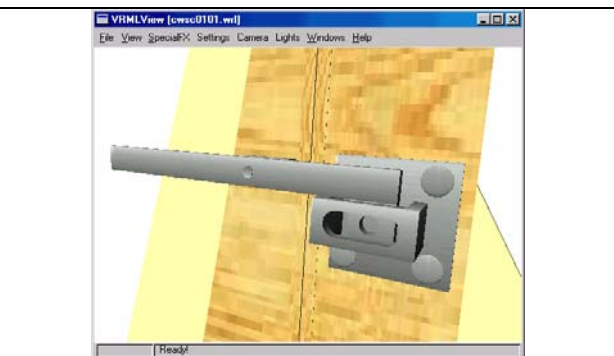


Figure 12: Lock self-help made configuration (seen from exterior side)



Figure 13: Photo of the foundation prototype realized in 1:1 scale



Figure 14: The web site of this research: <http://www.polito.it/eas/>

2.2 Importance of “driven choices” during assemblage phases

This organization system does not require a specific kind of education and can be adopted by:

- people of different social extraction, job, habits of life, even by unqualified workers lacking manual skills;
- individuals that have never taken part in self-help made viable initiatives.

Therefore, I have prepared multimedia describing the process. However, papery runs are also available in case a laptop PC is not present on site. These contributions follow choices of self-help builders step by step during the organization and construction passages. A few basic steps can be recognized:

- choice of type of installation (above or under the 1000 meters of altitude);
- layout development to be adopted (square or rectangular);
- final use of construction (housing or of other kind);
- total number of single unity users (from 1 to 12 and more people).

At this point a layout is introduced (an example among the 56 typologies preinstalled is furnished in Figure 5). The end user can adopt it as it is or freely modified for satisfying choices previously operated. Beginning from the two-dimensional plant, self-help operator is able to:

- a) surf inside - in three-dimensional mode - selected model (Figure 6);
- b) view a possible scenery of how to put such building at maritime, mountainous, suburban and urban level (having available 3D interactive maps in which useful suggestions are brought to suit single housing units to context - Figure 7);
- c) consult Gantt diagrams related to the specific kind of environment (both on PC or on paper) (Figure 10);
- d) make reference to specifications and assemblage papery fiches (Fig. 3-4);
- e) read syntheses (some examples: architect's handbook, manuals about software usable inside multimedia, summaries and sprouts of reflection for self-help builder and management responsible [6], tips for solar panel assemblage, characteristics of the employable materials),

... so that it's possible to supply workers with all useful PC or papery tools to a suitable organization of various phases to obtain final result: autonomous building of housing related to self-management village. It must be remembered that all contributions listed in this paper are presented in full and constantly updated on web at this address: <http://www.polito.it/eas>. In fact it is impossible to analyze everything in detail in this study.

3 Design: “all in one” tool, node of foundation and multimedia

3.1 Adequate “all in one” tool to build up self-help housing

The tool realized (Figure 2) implies adoption of two utensils, able to concentrate the 6 principal functions necessary for self-building structure assembly.

Being constituted only by two parts, occupied space and loss are minimised.

The multi-function tool contains:

- an opposition of a spanner for M18 metal screws and nuts and another for M12 bolts. Both keys have been properly studied to enable tightening of all types of bolts reduced to measures above mentioned;
- alloy steel mallet with a magnetic hexagonal pin holder, fastened to the hollowed bottom of handle through 4 mm diameter threaded bars, for the fitting in of pins necessary for installation of self-building structures, enabling following functions:
 - screwing/unscrewing of phillips screws;
 - tightening/un-tightening of plane screws;
 - carving of wood elements to make screwing easier (the ferrule can have different shapes).

As regards the alloy steel mallet, its substitution with a traditional wood handle mallet has not been taken into consideration because it would not be feasible to insert hexagonal pin holder at the extremity, fixing it with threaded bars. In the case of the wood handle - after a continued usage - rotation phenomena would have occurred in the pin holder, making tightening of screws ineffective. Moreover, the feature of being hollow and closed on one extremity by the pin holder and on the other by a thread screw (M12), enables the keeping of all ferrules inside handle (preventing eventual loss) and a considerable lighting of mallet weight.

3.2 Foundation prototype: summary of design criteria

The prototype of basement relative to foundations (Figure 13) is constituted by several parts, combined together in order to obtain a cross groin support where single pillar and main beams will be

inserted to brace structure. Tightening bolts will be very easy thanks to some devices, studied in order that a face of screw head beats against one of bracing sides of central block.

Operating on easy-to-reach nuts located on external side, a safe and quick installation will be performed, both from static and operator safeguard point of view. Besides, limited weight (the heaviest element weighs 14 000 g on whole weight) and peculiar shape of various components, allow the effortless lifting. Steel alloy bracings, which can be installed only in rigid positions, reduce possible misunderstanding or erroneous installations (also thanks to clear explanations provided in relative assembly fiches - see Figure 4).

Manifold are devices adopted for other building details. For synthesis reasons, analysis has been intentionally limited to prototype which has been physically realised (Figure 13).

3.3 Multimedia product for organization and diffusion of various contents

It is important to dwell upon relevance of multimedia used to diffuse information. To this regard, design and realisation of a hypertext on CD-Rom has been adopted, consultable on site, properly combined with self-help building manual (which can be filled out in hard copy). Their objectives are:

- propose some previously tested layout, ready to be reproduced on territory;
- define responsibilities to be covered by different stakeholders which will act in situ;
- supervise activities assigned to charged people, organising intervention teams;
- verify that timing fits the one pointed out in Gantt diagrams;
- establish priorities, to prevent possible shortages and reduce risks for man and environment, helping people to foster sense of belonging to community;
- evaluate critical points, thanks to effective tools of survey.

3.4 “Glocal” dimension of web site (<http://www.polito.it/eas/>)

The web site (Figure 14) has been realised to allow:

- examination of real validity of technical and design solutions proposed in this study;
- real comparison between experts, to increase research subjects in real time;
- support to operators who work in site, thanks to useful sections aimed at complete handling of village yard.

4 Conclusion

The main aim of the proposed research is to represent the basis to deepen various topics related to the handling of a temporary building intervention using self-help made viable. The study of prototypes presented and constant update of building solutions, demonstrate that progress must still be made in this field. However it is certain that the success of this kind of intervention implies a raising awareness of the importance of “collaborative training” [7], to help the subjects involved in construction and education phases to reach the final goal: full autonomy during all building and management steps and resolution of critical aspects linked to organization of building site. Moreover, thanks to multimedia tools and web, a real integration of knowledge becomes feasible, as well as a comparison between experts. Then, creation of sections which allow to collect data and handle virtual models, makes information clearer for anyone. New frontiers of development are opened. This study represents only one of the many solutions to face - in a “supported but autonomous way” - the problems associated to the need of a house. For this reason in my research, all necessary tools are designed and presented to cope with a self-help made viable construction.

Reference

- [1] Leti A., *Progetto CLEA*. <http://www.arsia.toscana.it/filfor/cas-clea.htm> (03.08.2005).
- [2] Giacardi A. L'ABITAZIONE TEMPORANEA SECONDO I PRINCIPI DELLA SOSTENIBILITA'. Soluzioni costruttive lignee «a montaggio semplificato reversibile» e sistemi di comunicazione ed interazione multimediali. *Politecnico - DISET*, Torino, 2004.
- [3] Bologna R. *La reversibilità del costruire*. Maggioli Editore, Rimini, 2002.
- [4] Giordano G. *Tecnica delle costruzioni in legno - Quinta Edizione*. Hoepli, Milano, 1999.
- [5] Natterer J. *Atlante del legno*. UTET, Torino, 1998.
- [6] Prestinenz Puglisi L., Prestinenz Puglisi A. *Prontuario per l'edilizia*. Tipografia del Genio Civile, Roma, 1998.
- [7] Wei B. Pianificazione della gestione amministrativa in situazioni di emergenza (Alluvioni). *Facoltà di Architettura di Torino*, Torino, 1995.
- [8] Comoglio-Maritano D. *Sperimentando l'autocostruzione*. CELID, Torino, 1992.
- [9] Foti M. *Progettare per l'autocostruzione*. CLUT, Torino, 1991.
- [10] Winstanley G.T.B. *Conservation and protection of building materials*. Cement and Concrete Association, Great Britain, 1973.