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REQUISITI DI RESILIENZA
Metodologia adattiva per l'emergenza abitativa

RESILIENCE REQUIREMENTS
Adaptive methodology for the housing emergency

Ilaria Montella

ABSTRACT

L'esposizione a molti fattori di rischio legati al cambiamento climatico, scarsità di risorse, migrazioni e situazione economica critica, pone le città in condizioni continue di stress e instabilità. Si richiede ad esse di incrementare l'attitudine alla resilienza, e il City Resilience Framework, ideato da Arup per il progetto 100 Resilient Cities, tra i settori di azione per l'incremento della resilienza, include anche l'housing. Attraverso l'analisi di casi studio, e mutuando da essi buone pratiche di resilienza, il contributo indaga l'apporto dell'architettura al Framework e propone uno strumento metaprogettuale strutturato in Schede Tecniche per la progettazione, con indicazioni progettuali e procedurali, quali ausilio agli attori coinvolti in processi progettuali, dagli esiti resilienti.

The exposure to many risk factors related to climate change, scarcity of resources, migration and a critical economic situation place cities under constant stress and instability. Therefore, increasing their resilience is required. Arup developed the City Resilience Framework for the 100 Resilient Cities project. This framework places housing among the action sectors to enhance resilience. This analysis borrows best practices for resiliency from case study analyses while investigating how architecture can contribute to the Framework. It then proposes a meta-design tool in the form of Design Technical Data Sheets. These are meant to support the actors involved in design processes with resilience-oriented design and procedural guidelines.

KEYWORDS

classi esigenziali, standard abitativi minimi, emergenza abitativa, requisiti di resilienza, metodologia adattiva di progettazione

requirement classes, minimum housing standards, housing emergency, resilience requirements, adaptive design methodology

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L'esposizione crescente a numerosi e concomitanti fattori di rischio dovuti al cambiamento climatico, alla scarsità di risorse, alla pressione migratoria e alla condizione economica difficile, rappresentano motivo di forte stress e continua instabilità per le persone e per i contesti urbani, ponendo al centro delle sfide globali le attuali questioni ambientali, economiche e sociali. Tali sfide, di cui si riportano qui segmenti parziali, ma tendenti allo stesso focus, influiscono e contribuiscono tutte in modo diretto, o per le loro ricadute, all'inasprimento dell'emergenza abitativa, soprattutto nelle grandi città.

Il recente quadro economico che delinea l'ISTAT (2018) individua più di 1,8 milioni di famiglie italiane in condizioni di povertà assoluta, che si registra più elevata tra le famiglie con un maggior numero di componenti, tra i giovani (con ben 1,26 milioni di minori) e tra gli stranieri, e che si impone con un'incidenza pari al 7%, per un numero complessivo di 5 milioni di individui (8,4% del totale). Allo stesso tempo anche le famiglie in condizione di povertà relativa nel 2018 sono più di 3 milioni, con un'incidenza pari all'11,8%, per un numero complessivo di quasi 9 milioni di persone – 15,0% del totale (ISTAT, 2019). Inevitabile è l'impatto che la situazione economica ha sulla condizione abitativa delle famiglie tanto che, dei 59.609 provvedimenti esecutivi di sfratto emessi nel 2017 (ultimo dato disponibile), escludendo quelli per finita locazione e per esigenza del locatore, ammontano a ben 52.590 quelli per morosità o altra causa (Ministero dell'Interno, 2018).

Il reddito rappresenta una delle cause prevalenti della vulnerabilità abitativa tanto che la crisi ha avuto negli anni un forte impatto, immettendo nella cosiddetta 'area grigia' del disagio abitativo (Cittalia – Fondazione Anci ricerche, 2011) una fascia consistente di persone del ceto medio impoverito per le quali, in passato, la casa non rappresentava un problema e che adesso non hanno redditi così bassi da accedere all'edilizia popolare, ma neanche così alti da poter ricorrere al mercato. Tuttavia si evidenzia che, nonostante l'esistenza di un segmento cospicuo in 'area grigia', e a fronte di una gestione carente del patrimonio edilizio pubblico, le consuete pianificazioni urbanistiche a lungo termine non prevedono né la possibilità di risposte abitative rapide né l'esistenza di alloggi temporanei a basso costo di realizzazione e a canone calmierato.

L'Osservatorio Permanente dell'Edilizia Residenziale Pubblica Italiana, istituito di recente da Federcasa con il supporto di Nomisma, riporta che 1,4 milioni di italiani vive in un alloggio popolare e che gli alloggi di edilizia residenziale pubblica sono 790 mila; di questi ultimi l'88,8% è locato regolarmente e l'11,2% è sfitto o occupato abusivamente. I dati che lasciano dunque riflettere sull'indisponibilità di una risposta rapida (sono infatti oltre 600 mila le domande di alloggi popolari inevase) ed esaustiva al problema dell'emergenza casa sono sia quello sul rapporto tra edilizia residenziale pubblica e persone in povertà sia quello sugli alloggi sfitti (11,2%), il 60% dei quali è in ristrutturazione e/o in mobilità, il 20% in attesa di assegnazione da parte del Comune, il 20% non assegnabile perché inadeguato (Federcasa, 2019).

Un altro aspetto da considerare nel valutare l'adeguatezza del sistema di risposta abitativa è rappresentato anche dal mutare della morfologia sociale. Il processo di semplificazione delle strutture familiari, che ha interessato l'Italia negli ultimi decenni, ha registrato l'aumento del numero di famiglie (dai 21 milioni nel 1997 ai 25 milioni 500 mila nel 2017), cui corrisponde la progressiva riduzione della dimensione familiare, un aumento delle famiglie unipersonali (dal 20,8% al 31,9%) e un numero medio di componenti per famiglia sceso da 2,7 a 2,4 – media 2016-2017 (ISTAT, 2018). Questi dati, inevitabilmente, impattano con un patrimonio edilizio obsoleto dal punto di vista tecnologico, tipologico, materico e impiantistico inadatto ai profili esigenziali della nuova struttura sociale.

Un altro fattore di rischio è legato all'impatto delle migrazioni sul sistema abitativo delle città perché, sebbene le presenze straniere non siano tendenzialmente in crescita, esse rappresentano comunque un ampio numero e una fonte di preoccupazione, a causa della scarsa integrazione e del profilo esigenziale che la multiculturalità richiede. Gli ampi spazi riservati dai media al tema dell'immigrazione, come una delle principali questioni dei Paesi dell'Unione Europea, non sembrano essere supportati da dati reali. Si stima infatti che, nonostante la drammatizzazione e la strumentalizzazione messa in atto soprattutto nel 2018, i movimenti migratori verso l'Europa siano molto diminuiti, sebbene la popolazione straniera in Italia, al 1° gennaio 2018, abbia raggiunto comunque i 6 milioni e 108 mila unità (ISMU, 2018), e sia cresciuta fisiologicamente, rispetto all'anno precedente, del 2,2% rappresentando l'8,7% degli abitanti dell'Italia.

Inoltre, è da rilevare che l'Italia non il Paese che ospita il maggior numero di rifugiati e, a causa del considerevole calo degli sbarchi di migranti via mare, anche il numero di richieste di asilo sul sistema di accoglienza italiano è diminuito, registrando una contrazione delle richieste del 59% tra il 2017 e il 2018 (ISMU, 2019). Infatti, al 31 Ottobre 2019 il numero di migranti sbarcati a decorrere dal 1° gennaio è pari a 9.648, rispetto ai 22.031 nello stesso periodo del 2018 e agli 111.401 nello stesso periodo del 2017 (Ministero dell'Interno, 2019). Va tuttavia tenuto in conto che, a questi numeri, si aggiungono i circa 50 mila senza fissa dimora e tutti i rifugiati e richiedenti asilo che non sono inseriti nel sistema di accoglienza, stimati da Medici Senza Frontiere in più di 10 mila, che trovano alloggio in insediamenti informali all'aperto o in edifici occupati (MSF, 2018).

A tali fattori di rischio, che impattano potenzialmente sulla condizione abitativa, va inoltre aggiunto che un ruolo sempre più destabilizzante nella geopolitica mondiale sarà determinato dal caos climatico di origine antropica, quale sintomo più acuto della crisi ecologica che stiamo vivendo e che potenzialmente andrà a impattare sugli ambiti urbani e sulla condizione abitativa. Non a caso, l'organizzazione internazionale Global Footprint Network (2019)

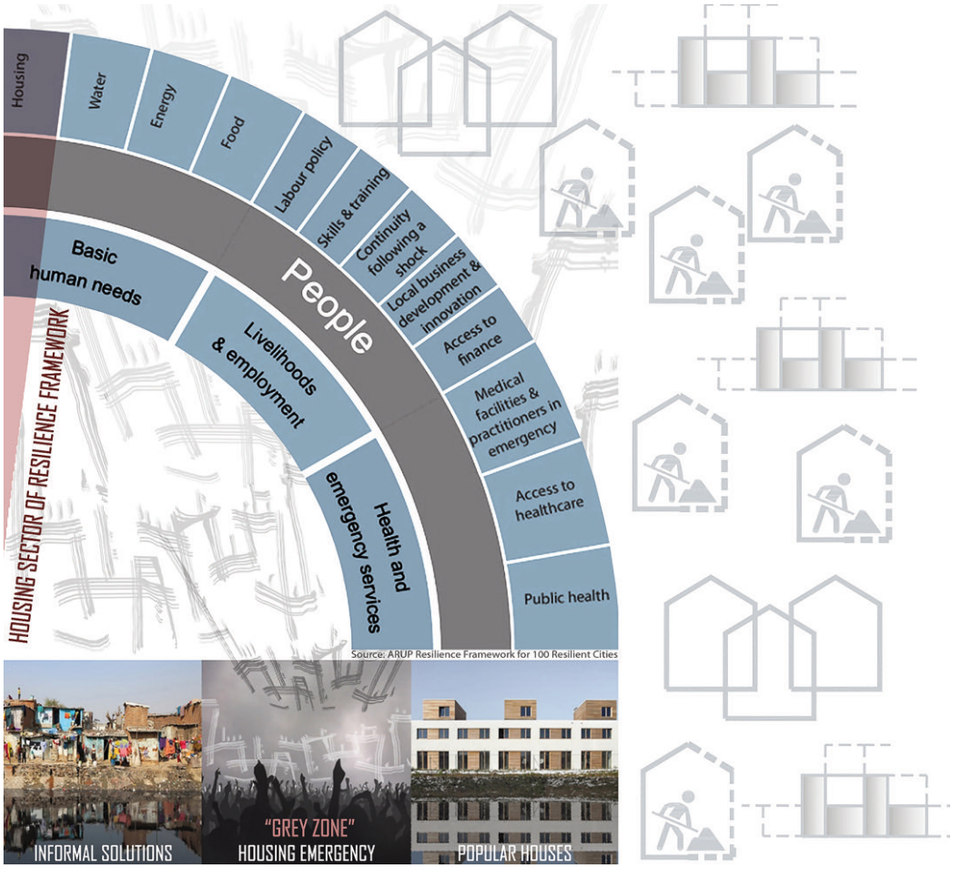
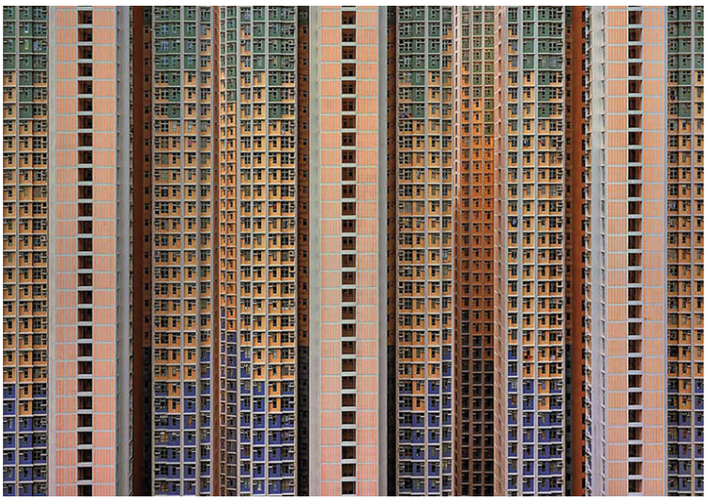
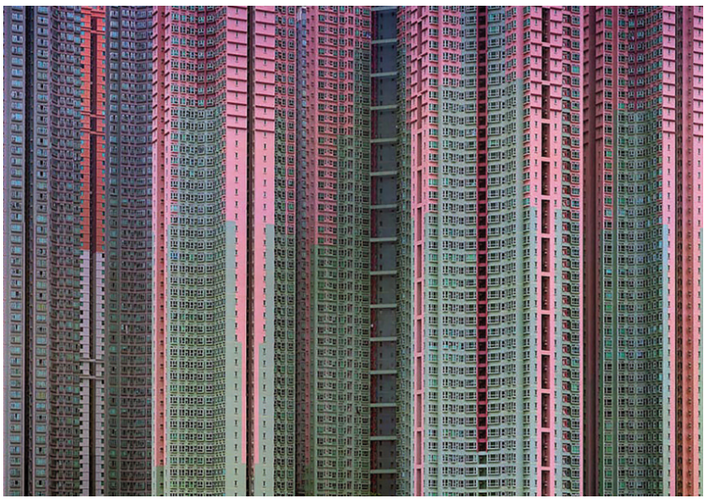


Fig. 1 | City Resilience Framework, Housing sector (reworked by the author from ARUP and Rockefeller Foundation, 2014).





Figg. 2, 3 | Architecture of Density, Hong Kong (credits: M. Wolf).

segnala che nel 2019 consumeremo in media le risorse di 1,75 pianeti e che, a fronte di una crescita prossima ai 9,7 miliardi di persone, entro il 2050 arriveremo a consumare il doppio di quanto la Terra sia in grado di produrre.

L'aumento dei livelli dei mari, mette a rischio le isole e le zone costiere costringendo allo spostamento verso i centri urbani, mentre l'aumento delle temperature accelera la desertificazione e accresce i terreni improduttivi, l'insicurezza alimentare e le migrazioni forzate. Sulla base di questo scenario catastrofico, l'Intergovernmental Panel on Climate Change (IPCC, 2019) ha rilanciato l'allarme su clima, fame e migrazione, evidenziando l'urgenza di un uso sostenibile del suolo per contrastare il riscaldamento globale; la Banca Mondiale invece ha stimato che, entro il 2050, il clima causerà 143 milioni di migranti (Rigaud et alii, 2018), le cui rotte verso l'Italia e i Paesi mediterranei sono state di recente dimostrate (Pasini and Amendola, 2019).

Questo quadro emergenziale così variegato sembra non trovare una risposta esaustiva e immediata nella pianificazione prevista dai piani urbanistici, che destinano poche aree agli alloggi a basso costo di natura sociale; allo stesso tempo, il perdurare di queste concause diviene fonte di stress continuo per le città e per gli abitanti, spingendo, in molti casi, a cercare nelle soluzioni abitative di natura informale per il soddisfacimento del bisogno primario di avere una casa. Ci si chiede dunque se le città siano in grado di rispondere in modo adeguato alle esigenze abitative di un profilo di utenza così vasto e multiculturale, se siano attrezzate per rispondere in modo adattivo e resiliente alle sollecitazioni imprevedibili e continue, e se – in un quadro di complessità e di cambiamento delle infrastrutture economiche e sociali – le risposte abitative canoniche siano in grado di adeguarsi, nelle prestazioni, a un quadro esigenziale rinnovato.

Sebbene non sia possibile prevedere gli esiti dell'effetto combinato tra i diversi fattori di rischio, è prevedibile che essi saranno causa di perturbazioni importanti a livello urbano. Dunque, accogliendo l'invito alla resilienza – inserita da alcuni anni tra gli obiettivi delle agende urbane – questo contributo, nell'intento di strutturare una metodologia preventiva anticipatoria, prova a definire un avanzamento del concetto di resilienza (da applicare all'architettura) volto a soddisfare i nuovi profili esigenziali attraverso innovazioni di prodotto e di processo, a supporto dell'emergenza abitativa per l'edilizia sociale e a servizio di tutti gli attori coinvolti nei meccanismi di pianificazione urbana.

Tra auspicio di resilienza e stato limite ultimo di resilienza. Il contributo della ricerca all'emergenza casa | Dal punto di vista metodologico, nell'intenzione di individuare un segmento di intervento in cui l'architettura potesse dare un contributo alla strategia di resilienza, lo studio[1] ha indagato dapprima le interpretazioni che di essa sono tracciate nella letteratura e poi strutturato un avanzamento adattivo. Anche se applicata all'ambito urbano, il concetto di resilienza oscilla tra la staticità della permanenza dell'architettura e l'esigenza evolutiva e adattiva, certamente più affine alle caratteristiche intrinseche di un sistema definibile, appunto, resiliente.

In letteratura il concetto di resilienza è declinato in diverse teorie che attribuiscono al concetto di equilibrio del sistema un significato sostanzialmente differente. Talvolta intesa come resistenza al disturbo e velocità di ritorno allo stato di equilibrio stazionario (Pimm, 1984), altre volte come ritorno a uno stato precedente, come unica possibilità di recuperare una condizione di equilibrio (Holling, 1973), altre volte ancora come status in continuo divenire, intendendo l'oscillazione tra stati di equilibrio come caratteristica fondante dei sistemi resilienti (Sheffer, 2009).

Un'altra accezione della resilienza è definita Evolutionary Resilience, che considera possibile il passaggio tra vari stati di equilibrio a condizione che vengano ripristinate le funzionalità del sistema (Davoudi, 2012). Proprio in questa accezione viene superato l'approccio deterministico di prevedere e prevenire, puntando invece ad affinare le caratteristiche del sistema nel mantenere il funzionamento garantendo l'evoluzione verso l'equilibrio, anche in condizioni di stress continuo o shock improvviso. Con questa intenzione, per il progetto 100 Resilient Cities, Arup in collaborazione con la Fondazione Rockfeller ha strutturato nel 2012 il City Resilience Framework (Ove Arup & Partners, 2015), utilizzato in molte città del mondo, sia per supportare l'autovalutazione di resilienza dello stato dell'arte sia per la pianificazione di resilienza della condizione futura (Fig. 1).

Tra i segmenti inseriti nel Framework c'è il settore dell'housing, ed è in considerazione della staticità del patrimonio edilizio esistente (dalle istanze tecnologiche e tipologiche obsolete) che questo studio indaga se il concetto di resilienza possa avanzare in innovazioni metodologico-procedurali dell'architettura ed essere considerato come nuovo requisito nella revisione del sistema esigenziale-prestazionale. Prendendo atto che l'emergenza abitativa impatta continuamente sui contesti urbani (e intendendo la resilienza come un insieme di processi che coordinati tra loro hanno ricadute nell'aumento delle capacità di adattamento della città e dei suoi abitanti) lo studio si è posto l'obiettivo di individuare, per il target di popolazione in emergenza abitativa, azioni e requisiti connotanti di natura tipologica, tecnologica e procedurale che, se applicati in modo preventivo fin dalla fase progettuale (nell'agire sull'emergenza) possano fornire un contributo indiretto alla strategia di resilienza.

Nell'affrontare le caratteristiche degli insediamenti informali, e nell'ipotizzare requisiti minimi, una provocazione interessante del percorso di ricerca è stata quella di chiedersi dove risieda il limite tra l'auspicio di resilienza (previsto dai più celebri Framework di resilienza) e il suo stato limite ultimo, inteso come condizione limite oltre la quale lo stato di equilibrio conseguente non contempla più condizioni di vita umane e non garantisce più la tutela dei diritti fondamentali dell'uomo. Imbracciando questa provocazione, si riporta la soluzione estrema all'emergenza abitativa che a Hong Kong si sostanzia nelle cosiddette 'case-bara' (Figg. 2-5), documentate da lavori fotografici che pongono l'accento proprio su quello che potrebbe esse-

Figg. 4, 5 | Cage-Homes, Hong Kong, 2017 (credits: B. Lam).

re considerato lo stato limite ultimo di resilienza.

Dal momento che in letteratura non sono codificate delle indicazioni tecnologiche o progettuali definibili come resilienti, la metodologia proposta individua un'accentuata similitudine tra gli insediamenti informali e i processi resilienti, e abbraccia la teoria dell'urbanista Rahul Mehrotra (2015) il quale, in opposizione alla tradizionale città statica, definisce la città informale come Città Cinetica, modello di flessibilità, dinamicità, reversibilità, mobilità, temporaneità, riciclabilità.

Percorrendo questa traccia nella metodologia di deduzione dei requisiti minimi, connotanti una risposta abitativa essenziale[2], è stato strutturato un Framework Metodologico Deduttivo (Fig. 6) che tenesse in conto anche eventuali deroghe normative agli standard minimi previsti dal DM 5/7/75 e che ipotizzasse, come auspicio di resilienza, di mutuare dalla città informale (definita appunto 'cinetica') delle caratteristiche connotanti applicabili all'edilizia formale, in una visione di pianificazione evolutiva, partecipativa e inclusiva. Le macro-categorie di analisi prese in conto nel Framework sono state: abitazioni informali, Buone Pratiche estratte dall'analisi di 19 casi studio, Soluzioni Formali Italiane.

Per le Soluzioni Formali Italiane, come margini per il downgrading (Fig. 7) degli standard, sono stati considerati gli standard dell'Edilizia Residenziale Sovvenzionata e i parametri del sistema ambientale dei moduli standardizzati uso alloggio contenuti nel 'Manuale Tecnico per l'allestimento delle aree di ricovero per strutture prefabbricate di protezione civile' (Dipartimento della Protezione Civile, 2005), perché comunemente intesi come prima soluzione essenziale (standardizzata) utilizzata come abitazione. Per le Soluzioni Formali Italiane, come margini per l'upgrading degli standard, sono state prese in considerazione le soluzioni abitative informali autocostruite, da cui sono stati estratti i caratteri comuni degli slum[3] e le occupazioni informali di edifici esistenti[4], con finalità abitativa, perché intese come delle risposte pratiche a un'esigenza da parte degli abitanti, fonte privilegiata di indicazioni sui profili esigenziali di quel tipo di target e sulle risposte affini a processi resilienti.

Per le Buone Pratiche dei casi studio, la ricerca ha analizzato gli standard delle soluzioni formali e analizzato gli aspetti tipologici (tipologia di alloggio, tipologia distributiva, utenza, aggregazione, funzioni), tecnologici (tecnologia prevalente, tipologia impiantistica), progettuali di mixitè (di utenza e funzionale), gestionali e organizzativi (gestione dell'operazione, coinvolgimento utente nel processo costruttivo) di 19 casi studio[5], scelti perché hanno già fornito nel mondo contributi tangibili all'emergenza abitativa e, dunque, utilizzati come fonte di Buone Pratiche per risposte abitative resilienti (Fig. 8).

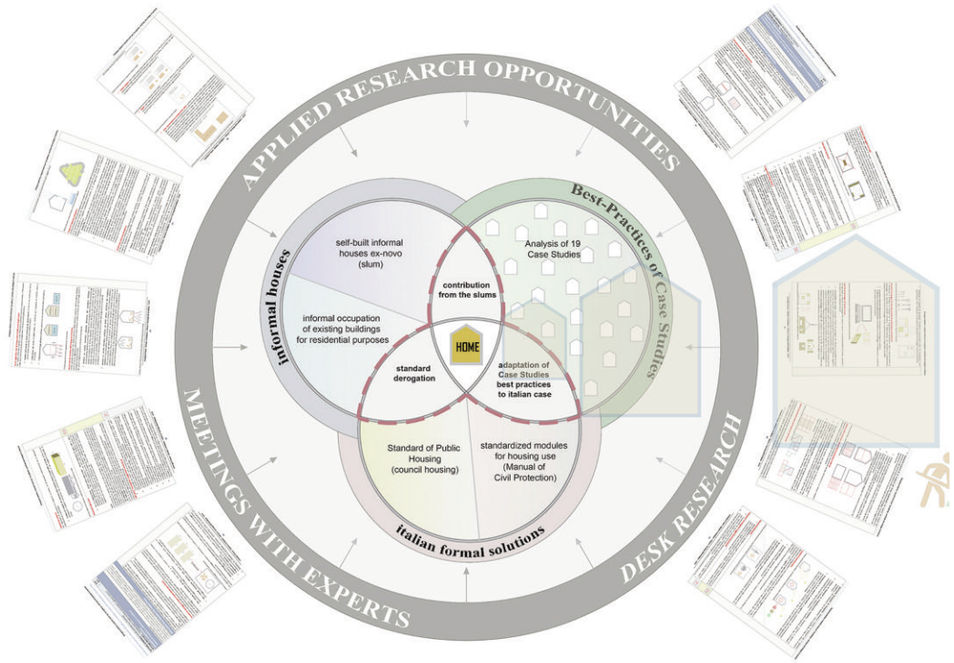
I requisiti di resilienza come risposta adattiva all'emergenza | Da ognuno dei settori del Framework Metodologico Deduttivo sono state elaborate informazioni sul profilo esigenziale e sui requisiti connotanti comuni al target selezionato; sono state poi strutturate indicazioni dimensionali di superficie e dotazioni di base raccolte in Schede di Requisiti Connotanti Progettuali (Fig. 9), contenenti informazioni sulle esigenze dell'utenza, i requisiti connotanti comuni al segmento di utenza, gli indicatori dimensionali di superficie, le dotazioni di base essenziali e comuni. Operando una sintesi per similitudine tra i requisiti e le esigenze contenuti nelle Schede dei Requisiti Connotanti, è stata elaborata una griglia di esigenze e requisiti propri di un'abitazione essenziale di natura temporanea, riportata nelle schede finali.

In particolare, i requisiti sono stati suddivisi in due settori generali, 'in relazione al contesto' e 'in relazione all'edificio', a loro volta definiti da settori specifici ed esigenze conseguenti come meglio specificato in Figura 10. Per ogni esigenza, sono seguiti dei requisiti connotanti che, descritti in modo puntuale, hanno generato l'elaborazione delle schede finali. Inoltre, individuando le Buone Pratiche come prestazioni tecniche conseguenti a requisiti affini alla resilienza, sono state raccolte indicazioni progettuali e procedurali e confezionate in un prodotto finale di natura metaprogettuale, strutturato in Schede Tecniche per la Progettazione (Figg. 11, 12). Come esempio, si riportano qui solo alcune delle indicazioni estratte dall'analisi dei casi tudio e delle soluzioni informali.

Dall'analisi delle soluzioni informali, le caratteristiche prevalenti mutuabili in soluzioni resilienti sono, ad esempio, l'utilizzo di spazi collettivi (come volano di relazioni sociali), la promiscuità d'uso dello spazio abitativo anche per lavoro, la propensione all'estensione dello spazio abitativo all'esterno e al massimo utilizzo dello spazio anche in altezza, la conservazione e il riutilizzo di tutte le risorse disponibili, la vicinanza ai centri urbani, l'aspirazione a personalizzare il proprio spazio, la condizione di comfort di base che risulti migliorativo della condizione di vivere per strada.

Si riportano inoltre alcune delle indicazioni estratte dai casi studio che hanno mostrato caratteristiche affini ai processi resilienti e mutuabili in abitazioni essenziali. Sono stati ad esempio considerati più efficaci i modelli abitativi che non superino i 4 piani, che prevedano anche servizi di quartiere e spazi collettivi, che consentano aspetti evolutivi, e che prevedano il coinvolgimento degli abitanti nei processi di autocostruzione e di gestione. Sono risultati più efficaci i sistemi prefabbricati, soprattutto se realizzati in materiali naturali e con tecnologie a secco, e gli impianti fuori traccia per le possibilità di manutenibilità e sostituzione agevole nel tempo. L'analisi consiglia come virtuoso il preferire mixitè di utenza e mixitè funzionale (prevedendo anche canoni modulati in funzione del reddito) e, con l'intento di favorire l'integrazione sociale, l'inserire i complessi residenziali non lontani dai centri economici d'interesse.

In ragione della circoscrizione del campo d'indagine alla popolazione in emergenza abitativa (condizione in cui i fattori tempo e costo sono determinanti) è stata ipotizzata una griglia di parametrizzazione dei tempi e dei costi per la realizzazione di un'abitazione essenziale con dotazioni di base desunte dalle indicazioni contenute nelle schede tecniche. Inoltre, scorporando alcune voci realizzabili dagli abitanti, è stato ipotizzato di attribuire un valore economico anche alla collaborazione dell'utente per il completamento della casa e per le successive evoluzio-



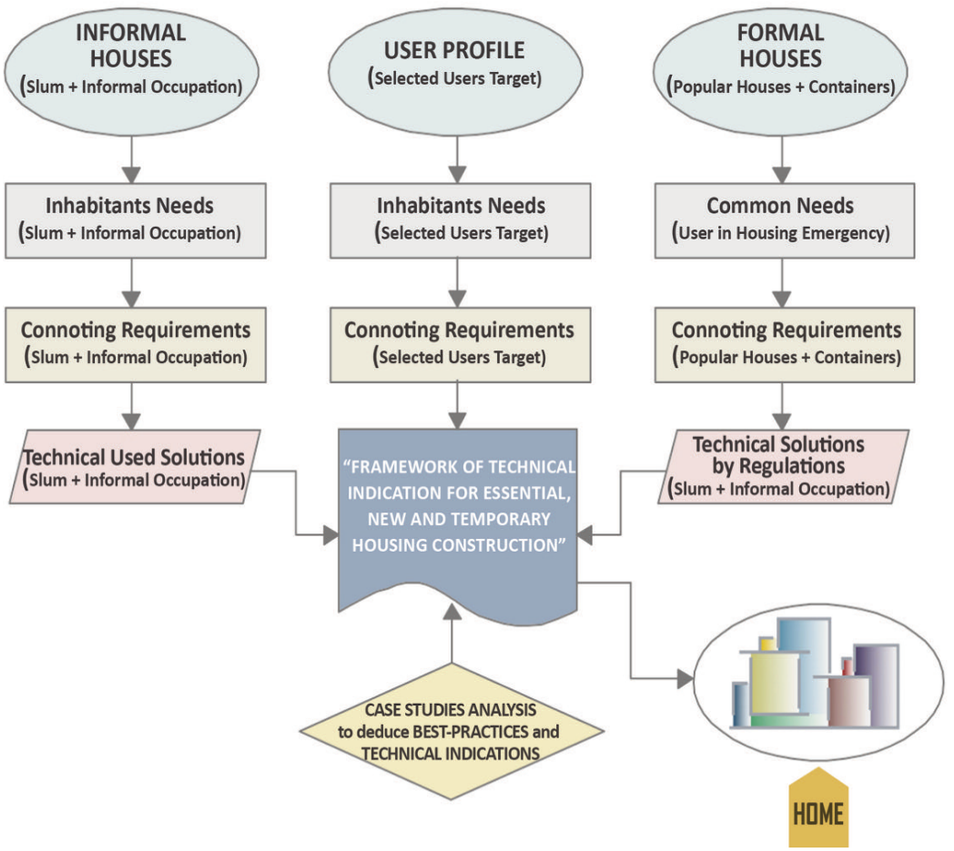


Fig. 6 | Deductive Methodological Framework of minimum resilience requirements (credit: I. Montella).

Fig. 7 | Flowchart of the methodology used (credit: I. Montella).

ni in autocostruzione. Per il modulo abitativo essenziale il costo è di circa 780 euro/mq; la partecipazione dell'utente al completamento (arredo, pitturazioni, posa pavimenti) può abbattere tale valore di circa il 18%, portando a un costo di circa 641 euro/mq. Inoltre, ipotizzando la produzione industriale in kit costruttivi assemblabili direttamente dall'utente esperto, il costo può essere ulteriormente decurtato di circa il 10% arrivando a 577 euro/mq.

Infine, tenendo in considerazione anche la resilienza propria del manufatto architettonico, la ricerca ha ipotizzato l'avanzamento del concetto di resilienza in 'resilienza tecnologica', individuando dei requisiti utili a strutturare un progetto resiliente misurabile, prevedendo categorie d'intervento che tengano in conto l'aspetto aggregativo, costruttivo, distributivo, funzionale, impiantistico, energetico, manutentivo, le quali potrebbero restituire indicatori per la valutazione preliminare o ex-post di resilienza affiancando, in via preventiva, le scelte decisionali di pianificatori, progettisti, amministratori. In considerazione poi di come l'aspetto sociale impatti sulla resilienza complessiva, viene considerata anche la dimensione della partecipazione dell'utente nel processo costruttivo e gestionale, la presa in carico di mixitè di utenza, e la dimensione della collocazione urbana (Fig. 13).

Conclusioni | Esposte a molteplici fattori di rischio, in un contesto di forti cambiamenti sociali, demografici ed economici, le città sono costantemente sottoposte a fonti di stress cronico e a conseguente instabilità. Nella dicotomia tra ambiente costruito (ancora troppo statico e ancorato alle istanze tecnologiche, antropologiche e tipologiche del passato) e le esigenze mutevoli in divenire di classi di utenza rinnovate, diviene necessario lo sforzo tra adattamento, mitigazione e presa in carico anche nei processi progettuali e pianificatori dell'architettura delle istanze di resilienza. Tuttavia, non essendo quest'ultima codificata in letteratura da caratteristiche o indicatori che ne facilitino la progettazione, si è reso necessario individuare criteri di supporto nel definire procedure preventive che tengano in conto le istanze di resilienza, in fase di progettazione, gestione, evoluzione, dismissione e riuso.

La ricerca, arricchita con l'esperienza di casi studio reali (Fig. 14), affonda le radici nella teoria esigenziale-prestazionale di matrice tecnologica, individuando un avanzamento adattivo dei requisiti prestazionali canonici. Il lavoro trae spunto dalla letteratura sulla resilienza applicata agli ambiti urbani e si addentra nello studio delle pratiche di autorecupero, autocostruzione e mutuo aiuto, e in quello delle soluzioni abitative informali, individuando in esse delle affinità con i processi resilienti. La ricerca, dopo l'esito dottorale, è proseguita con approfondimenti sulle tematiche e attraverso la partecipazione dell'autrice, in qualità di Consulente scientifico, al progetto HABITO[6], un video-documentario in tre puntate incentrato sul disagio abitativo nella città di Roma, che ha fornito l'occasione di aggiungere ai casi studio presi in analisi anche altri modelli di occupazione[7], e che ha rappresentato l'occasione per tracciare spunti possibili per un ri-

pensamento della politica sul problema casa.

Gli esiti di questo contributo, di natura procedurale e metaprogettuale, propongono alcuni criteri di codifica, di progettazione e di avanzamento della resilienza applicata agli edifici, strutturando un corpus di Schede Tecniche per la Progettazione, e tracciando dei requisiti di 'resilienza tecnologica', intesi quali focus cui un progetto resiliente deve rispondere. L'originalità del contributo consiste nel tentativo di individuare requisiti che codifichino la resilienza e di proporre nell'architettura procedure metodologiche preventive e di validazione ex-post, di processi di progettazione e pianificazione urbana i cui esiti diventino misurabili.

Le procedure proposte aspirano alla riduzione di costi, tempi e sprechi, pur individuando come limite una chiusura del contesto italiano verso nuove forme di abitare. Allora, probabilmente, la relazione tra queste possibili istanze di resilienza e l'auspicabile adattamento al contesto italiano, si può intravedere riprendendo il concetto fondante dell'Evolutionary Resilience, che considera possibile il passaggio tra vari stati di equilibrio purché vengano ripristinate le funzionalità del sistema (Davoudi, 2012). Nell'intenzione di migliorare i sistemi urbani, mantenendo il funzionamento che garantisce l'evoluzione verso l'equilibrio, s'intravede nelle Dimensioni di Resilienza Tecnologica l'auspicio a superare la staticità della permanenza dell'architettura. Nel futuro occorrerà optare per edifici dalle caratteristiche evolutive, controllate e previste fin dalle fasi iniziali del progetto, passando per un adattamento normativo che, attraverso l'espediente della temporaneità dell'utilizzo e della permanenza del manufatto in un luogo, pur garantendo sicurezza e salubrità, consenta la densificazione a tempo determinato anche nei centri urbani (Fig. 15).

L'auspicio futuro è quindi nel superamento del limite verso nuovi modelli abitativi (Aravena, 2012), disposti ad accogliere deroghe agli standard residenziali e urbanistici vigenti, ormai obsoleti. I requisiti di resilienza proposti prendono in carico l'esigenza di ridimensionamento degli standard e il risparmio di risorse, e mirano a incentivare procedure partecipative e di coinvolgimento degli utenti in autocostruzione come volano di risparmio economico, inclusione sociale e di resilienza complessiva degli interventi. L'avanzamento della ricerca prevede di testare il prodotto attraverso l'inserimento dei requisiti di resilienza quali requisiti aggiuntivi in un sistema di valutazione dei parametri di costo e della qualità, integrabili in programmi BIM.

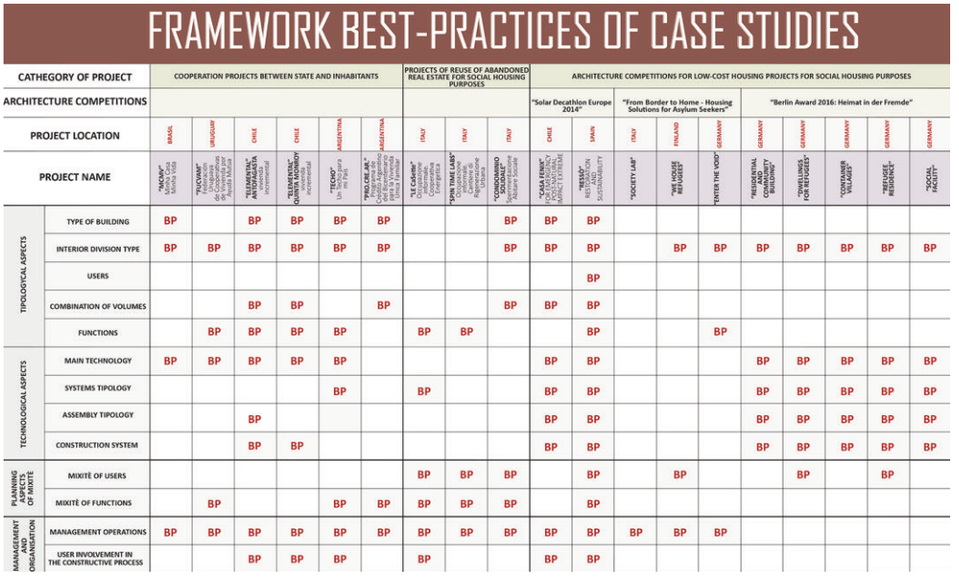


Fig. 8 | Summary of best practice case studies (credit: I. Montella).

The increased exposure to numerous and concurrent risk factors due to climate change, scarcity of resources, migratory pressure and difficult economic conditions represent a source of great stress and constant instability for people and urban contexts. Current environmental, economic and social issues are, therefore, at the core of global challenges. Here, we report some partial but converging segments of these challenges which, directly or indirectly, influence the housing emergency, especially in large cities.

In its recent economic view, ISTAT (2018) reported more than 1.8 million Italian families in absolute poverty. The phenomenon is higher among larger families, young people (including 1.26 million minors) and foreigners. It affects 7% of families and 5 million individuals (8.4% of the total). At the same time, more than 3 million families lived in relative poverty in 2018 with an incidence of 11.8%, nearly 9 million people, i.e. 15.0% of the total (ISTAT, 2019). The inevitable impact that the economic situation has on the housing situation of families is that out of the 59,609 executive eviction orders issued in 2017, based on the most recent available data, excludes those of finite tenancy and the landlord's need while 52,590 depend on arrearage or other causes (Ministero dell'Interno, 2018).

Income represents one of the main causes of housing vulnerability. Over the years, the impact of the crisis has pushed a significant part of the impoverished middle class into the so-called 'gray area' of housing distress (Cittalia – Anci Research Foundation, 2011). Housing never used to be an issue for these people who now have an income that is not low enough to access public housing yet not high enough for the market. Despite the existence of a large 'gray area' segment and poor public building stock management, the usual long-term urban planning does not provide for rapid housing responses nor low-building-cost and low-rent temporary dwellings.

The Permanent Observatory on Italian Social Housing, recently established by Federcasa with Nomisma's support, states that 1.4 million Italians live in a council house and that there are 790,000 social shelters. Of these, 88.8% are regularly leased and 11.2% are vacant or illegally occupied. The absence of a rapid and exhaustive response to the home emergency (over 600,000 social housing requests are pending) is highlighted by the ratio between public housing and people living in poverty, as well as the figure of the vacant buildings (11.2%). The latter includes 60% under renovation and/or on the move; 20% awaiting assignment by the Municipality and 20% unable to be assigned due to inadequacy (Federcasa, 2019).

Further, one should consider the transformation of social morphology when appraising the housing response system. The abridging of family that has affected Italy over recent decades has seen an increase in the number of families (from 21 million in 1997 to 25.5 million in 2017) and a reduction of their dimension with an increase in single-member households (from 20.8% to 31.9%) and a drop of average family members from 2.7 to 2.4 in 2016-2017 (ISTAT, 2018). These data inevitably clash with the building heritage, which is obsolete from technology, typology, material and plant engineering perspectives, as well as unsuitable for the new social structure's requirements.

Another risk factor involves the migratory impact on urban housing systems. Although foreign presence is not growing, it still comes with concerning, large figures due to poor integration and the need for multiculturalism. Indeed, despite the media's image of immigration as one of the top European Union (EU) issues, real data do not justify such an alarm. Despite manipulative dramatization, especially in 2018, migratory movements towards Europe have decreased considerably. The foreign population in Italy has, in any case, reached 6,108,000 units by January 1st, 2018 (ISMU, 2018), grown by 2.2% compared to the previous year and now represents 8.7% of Italy's inhabitants.

Further, Italy is not among the main host countries, even for refugees and, due to the considerable drop in migrants arriving by sea, the number of asylum requests to the Italian reception system has also decreased by 59% from 2017 to 2018 (ISMU, 2019). In fact, 9,648 migrants arrived from January 1 to October 31, 2019, versus 22,031 during the same period in 2018 and 111,401 during the same period in 2017 (Ministero dell'Interno, 2019). However, it

VI.2.3b Deductive sheet design indications - technological aspects

DESIGN INDICATIONS | **Iprg N°2**

- **Object:** Case Studies
- **Building type use:** housing
- **Type of stay:** permanent
- **User category:** without formal accommodation
- **Accommodation duration:** temporary / permanent
- **Legislative Recognition:** formal

Motivation for the choice: the Case Studies have been chosen because they have already provided solutions to the housing need in other contexts. The analysis of cooperation projects between Government and inhabitants for the prevention of informal settlements, through elements and practices can provide responses similar to resilient processes.

TECHNOLOGICAL ASPECTS

PREVALENT TECHNOLOGY:

- It is preferable to construct buildings that, even if intensive, do not exceed 4 storeys in height.
- It is desirable to realize the separation infill between the part already made of the dwelling and that destined to the expansion, in panels structurally separated from the rest to facilitate its easy removal during the growth phase.
- It is preferable to provide interior finishes with pre-finished panels (plasterboard, OSB etc) that guarantee adequate finishes without long processing times.
- It is desirable to use a wood technology (more sustainable and with lower costs) according to a predetermined and serial assembly scheme of standard elements.
- The use of serial technologies according to a pre-established assembly scheme, is desirable to favor, in the assembly, the involvement of the user as a non-specialized labor and the realization in reduced times.
- It is desirable to use modular technologies that take into account, both in the two-dimensional and in the three-dimensional hypothesis, the maximum dimensions of the means of transport (2.55m x4m x12m).

SYSTEM TYPE:

- It is preferable that the plant systems can be inspected (or off-track or in cavity), achievable in short times, and that they allow the elements to be replaced over time.
- It is preferable that, from an energy efficiency perspective, homes will be equipped with saving and energy production systems but oriented towards maximizing the use of passive strategies rather than active ones (rainwater harvesting, photovoltaic electricity production, exploitation of the thermal power of the mass etc).
- With the purpose of reducing costs and system efficiency, it is preferable to predict the concentration of the same in unique mechanical modules (preferably three-dimensional and produced in the factory) and prepared for growth in height and in plan.

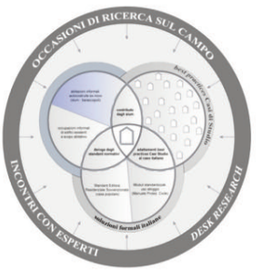
ASSEMBLY TYPE:

- it is preferable to use dry assembly techniques, which provide for tight construction times, which allow the replacement of the elements, disassembly and possible re-use of the same at the end of life.
- it is preferable to equip the system with an assembly manual that allows it to be built with common tools, even by unskilled labor.
- It is preferable to insert the window systems in the walls already in the production phase in the plant in order to reduce costs, assembly times and to guarantee the quality of the laying.

VI.2.1a Characterising Requirements Design Sheet for informal housing solution ex-novo built

PLANNING CHARACTERISING REQUIREMENTS | **RC. N°1**

INFORMAL HOUSING SOLUTION *EX-NOVO* BUILT



- **Object:** Informal Housing solution ex-novo
- **Building type use:** housing
- **Type of stay:** permanent
- **User category:** without formal accommodation
- **Accommodation duration:** temporary / permanent
- **Legislative Recognition:** informal
- **Motivation for the choice:** the analysis of the typological aspects of informal settlements has been chosen because they, as user practical responses to a need, provide both information on the user's need profile and indications on responses from attitudes related to resilient processes.

USERS NEEDS	CHARACTERISING REQUIREMENTS
Have a fast, low-cost housing solution	Presence of an assembly system that is easily mountable in self-construction, and with the recovery of available materials
Possibility to extend the house	Equipped with empty spaces around the edges or in height for the evolution of the house over time
Use the house also to work or have a business	Providing flexibility to use the spaces to allow different activities
Use the space even in 3 dimensions	Availability of usability in the height of the spaces
Have a "permeable" home and use collective spaces to offer services and have social relations	Provision of additional housing services that foster social relations
Living in places very close to the economic centers of the city	Integration with the city and the services connected to it
Reduce waste - store - reuse - collect everything possible	Provision of resource recovery systems (water, food waste, recovered materials and objects, etc.) for their reuse
Have a private space but share common services	Presence of private areas for private services and semi-private areas for sharing common services

DIMENSIONAL AND SURFACE INDICATORS

	N° rooms	N° inhab	Sup. Tot.(mq)	H (m)	Mq/ab	K (mq)	B (mq)	L 2 (mq)	L 1 (mq)	S (mq)	K+S (mq)
minimum	1	1	16	-	9	4	1,40	8	6	7	8
maximum	4	4	37	-	12	6	2,5	10	7	9	14

It is specified that the values contained in the table are extrapolated from the plant of the favela Jardim Colombo in São Paulo in Brazil, averaging the dimensional values of some houses.
K (kitchen); B (bath); L2 (double room); L1 (single room); S (living room); K + S (single-room living room and kitchen)

ESSENTIAL AND COMMON BASIC EQUIPMENT								COMMON FURNISHINGS	
	B	K	C 1	C 2	K+S+L	S	K+S	ROOMS	FURNISHINGS
Private toilets	•	•	•			•		kitchen	Cooker, fridge, table, chairs, food storage, sink
Shared toilets			•				•	room	Bed, bedside table, wardrobe
Single-room housing					•			bath	Wc, sink, shower
Housing more rooms	•		•	•			•	optional	Sofa, additional furniture

Fig. 9 | Example of Characterising Requirements Design Sheets (credit: I. Montella).

should be taken into account that these figures exclude approximately 50,000 homeless and all refugees and asylum seekers unreported by the reception system, which Médecins Sans Frontières has estimated at over 10,000. This population finds accommodation in informal outdoor settlements or occupied buildings (MSF, 2018).

One might add to these risk factors, which potentially impact the housing condition, the ever more destabilising geopolitical role played by the anthropic climatic disruption. This acute symptom of the ecological crisis that we are experiencing can impact urban areas and housing conditions. Not surprisingly, the international organisation, Global Footprint Network (2019), reports that we will consume the resources of 1.75 planets in 2019. Moreover, while the population reaches 9.7 billion people we will consume twice as much as the Earth can produce by 2050.

Rising sea-levels put islands and coastal areas at risk, forcing people to move to urban centres. Rising temperatures accelerate desertification and expand unproductive land, food insecurity and forced migration. Not by chance, the Intergovernmental Panel on Climate Change (IPCC, 2019) sounded the alarm on climate, hunger and migration, as well as the urgency of sustainable land use to counter global warming. Likewise, the World Bank estimated that the climate will lead to 143 million migrants by 2050 (Rigaud et alii, 2018). Migratory routes to Italy and other Mediterranean countries have recently demonstrated this (Pasini and Amendola, 2019).

Urban plans seem incapable of an exhaustive and timely response to such an urgent, multi-faceted scenario. Planning allocations of low-cost social housing are too small while these concauses persist and become a source of constant urban stress. Therefore, inhabitants are often pushed to look for informal living solutions to meet their primary need for having a home. What is questioned here, then, is the capability of cities to adequately respond to the housing needs of such vast, multicultural user profiles; unpredictable and continuous solicitations and if the performance of canonical housing can cope with the new framework of complexity and socio-economic transformation.

Although foreseeing the outcomes of combined risk factors is impossible, it is highly likely that they will cause major disturbances at the urban level. Resilience has been placed on urban agendas for quite some time. To structure an anticipatory preventive methodology, this contribution tries to define an advancement of the concept of resilience and apply it to architecture. The goal is to meet new requirement profiles through product and process innovations to support social housing emergency and all the actors involved in urban planning.

Between a resilience wish and the ultimate limit state of resilience: a research contribution to the housing emergency | This work[1] aims at identifying an intervention area where architecture can contribute to the resilience strategy. It methodologically starts from the study of how literature interprets the concept of resilience and then structures an adaptive advancement. Even if applied to the urban environment, the concept of resilience oscillates between the static nature of architectural permanence and the evolutionary and adaptive need. The latter is certainly more akin to the intrinsic characteristics of a resilient system.

Resilience as a concept is discussed throughout the literature of several theories attributing a substantially different meaning to system balance. Often, resilience is defined as resistance to disturbance and the capability to quickly return to a stationary equilibrium state (Pimm, 1984). At other times, it is understood as a return to the previous state as the only possibility of recovering a balanced condition

(Holling, 1973). A third hypothesis sees it as a condition of continuous transformation oscillating between different states of equilibrium (Sheffer, 2009).

Another definition of resilience, known as Evolutionary Resilience, allows for the transition between various states of equilibrium provided that the functionality of the system is restored (Davoudi, 2012). Hence, the deterministic approach of predicting and preventing is overtaken. The purpose is instead to refine the characteristics of the system to keep functioning and guarantee the evolution towards equilibrium, even under conditions of constant stress or sudden shock. It is in this spirit that Arup, in collaboration with the Rockefeller Foundation, structured the City Resilience Framework (Ove Arup & Partners, 2015) for the 100 Resilient Cities project in 2012. This Framework has been used in many cities around the world both for self-assessing their resilience and planning a more resilient future (Fig. 1).

The Framework includes the housing sector among various segments. We are aware of the static nature of the existing building heritage and the obsolescence of its technological and typological instance. Through this work, we investigate whether methodological and procedural innovations in architecture can evolve the concept of resilience. Also, we aim at classifying resilience as a new requirement in the system of performance-based building design. The research aims at identifying the specific requirements of emergency housing responses, given that housing emergency continuously impacts urban contexts and considering resilience as a set of coordinated processes that then increase urban fitness. These requirements have typological, technological and procedural nature. Used as a form of prevention during planning, they can provide an indirect contribution to the resilience strategy.

We met an interesting provocation on our research path that involves the characteristics of informal settlements and speculating about the minimum housing requirements. We questioned where the limit lies between the wish for resilience, as foreseen by the most famous Resilience Framework, and the resilience ultimate limit state understood as a condition beyond which the consequent state of equilibrium no longer contemplates humane living conditions nor guarantees fundamental human rights. In embracing this provocation, the extreme solution to the housing emergency involves what are known as 'coffin-homes' in Hong Kong (Figg. 2-5), as documented by photographic works emphasising precisely what could be considered the ultimate limit state of resilience.

Since the literature does not codify technological or design guidelines that may be defined as resilient, we propose a methodology to identify a noticeable similarity between informal settlements and resilient processes. This follows urbanist Rahul Mehrotra's theory (2015), who defines the informal city as a Kinetic City in opposition to the traditional static city and sees it as a model of flexibility, dynamism, reversibility, mobility, temporariness and recyclability.

By following this journey through the minimum requirements of an essential housing response[2], we designed a methodological tool known as the Deductive Methodological Framework (Fig. 6). This Framework also takes into account any regulatory derogations to the minimum standards set by the Italian Ministerial Decree 7/5/75 and hypothesises, as a wish for resilience, to borrow the informal, 'kinetic' city's characteristics that can be applied to the formal building for evolutionary, participatory and inclusive planning. The Framework considers the following analytical macro-categories: informal dwellings, Best Practices from 19 case studies and Italian Formal Solutions.

The Italian Formal Solutions have been held as margins for downgrading (Fig. 7) the standards. We studied the standards of the subsidised residential buildings and the parameters for the standardised housing modules environmental system following the 'Manuale Tecnico per l'allestimento delle aree di ricovero per strutture prefabbricate di protezione civile' – Technical Manual for setting up prefabricated civil protection shelter areas (Dipartimento della Protezione Civile, 2005), because there is a common agreement in seeing them as a first, essential and standardised dwelling solution. The Italian Informal Solutions have been held as margins for upgrading the standards. We focused on informal self-built housing solutions, selecting the qualities they share with slums[3] and squats[4] as practical responses to the inhabitants' needs and, therefore, a privileged profiling source of that type akin to responsive patterns for resilient processes.

The research analysed formal solution standards and 19 case studies in their typological (accommodation, distribution, users, aggregation and functions) and technological (prevailing technology, type of plant) aspects. Their mixité (of both users and functions), as well as their organisation and management (operation management and involvement of the user in the construction process). These case studies[5] have been chosen because they have already provided tangible contributions to the housing emergency in the world and, therefore, represent a source of Best Practices for resilient housing responses (Fig. 8).

Resilience requirements as an adaptive response to the emergency | Each Deductive Methodological Framework sector contributed to profiling the requirement and the selected target. Such information provided for basic space and equipment guidelines that were collected in the Characterising Requirements Design Sheets (Fig. 9). These contain information

With regards to the building	• **Perception of home** o Living in a place that gives the idea of "feeling home" (physical and mental place of social and individual identification) borrowing best-practices from informal practice to give the opportunity of feeling home; o Ability to fulfil technological, functional and spatial imitation need; • **Technologies, Completion Time and Low Cost** o Having a housing that is easily available and easy to build in a limited timeframe; o Having a housing with low construction and management costs as well as low rent costs; • **Flexible Functional Organisation and Evolutionary Potential** o Enjoying space flexibility and adaptability (also in height) to the changing needs and use of additional functions (working, hosting people), also with derogations from standards; o Having the possibility to develop the house outdoors over time • **Comfort and Sustainability** o Enjoying a basic comfort that is an upgrading of the previous conditions; o Having an energy self-sufficient house to reduce management costs and safeguard resources; • **Sharing** o Having a crossable border between public and private spaces on the ground floor with the introduction of additional services; o Enjoying basic services in the private space and sharing common services and semi-private spaces with the other inhabitants;
With regards to the context	• **Proximity of Interests and City Services** o Living near an urban context, near the workplace and the educational services; • **Social Relations** o Living in a place that fosters the interaction between social groups and favours a participatory and sharing-based lifestyle; • **Soil Conservation** o Guaranteeing the protection of the environment through a low soil consumption;

Fig. 10 | Consequent needs and characterising requirements of the temporary house (credit: I. Montella).

VI.3.3b Technical data sheet in relation to the building: low-cost technologies and construction times

***GENERAL SECTOR:** IN RELATION TO THE BUILDING* — **STP N°3**
***SPECIFIC SECTOR:** "TECHNOLOGIES AND TIMES OF CONSTRUCTION AND LOW COST"*

CHARACTERISING REQUIREMENT
"speed of transport and construction on site "

Description of the Requirement:
An essential dwelling, even if of a temporary nature, due to the aspect linked to the need is particularly sensitive to the time factor. For this reason it is preferable to use standardized systems, easily mountable and transportable on the road, and the design with parametric modeling software, which include standardized assembly and assembly operations in a short time, that allow to produce in the factory, to be able to stack, or to prepare together for assembly, modules two-dimensional or three-dimensional directly on site, moved by means.

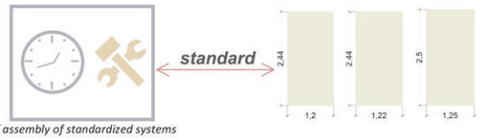
RECOMMENDED DESIGN INDICATIONS

In order to safeguard the need to reduce construction times, at the same time increasing the speed of construction on site it is desirable that, in an essential temporary home, the use of systems and components contemplating assembly operations is envisaged easy and therefore fast.

To achieve this goal it is advisable to use already existing standardized systems or the establishment of both 2D modules and 3D modules, following parametric design. Specifically, with reference to the construction speed on site, for the categories identified, the operations described below are recommended.

Assembling speed of existing standardized systems:
For existing standardized systems, the reference is to the use of beams, uprights, panels, coatings and plant equipment already commonly present on the market and used in construction processes related to the home. The use, during the design phase, of these standardized elements, significantly reduces the assembly time on site because:

- ✓ **It does not require ad hoc production:** "oversized" or "made to measure" and therefore does not require additional timelines for assembly of a particular nature;
- ✓ **It does not require further training:** workers for training in specific types of assembly which, being already known, require less time to complete.



Scheme of assembly of standardized systems

To facilitate the assembly speed, therefore, the reference to the already existing standardized systems is to the preparation of:

- ✓ **Fast-to-understand fastening systems:** in order to be assembled by skilled labor, or by the user himself in self-construction, in compliance with the construction site timelines suitable for the type of work.
- ✓ **Modular design:** in order to intuitively speed up the assembly phase and prepare the project for a more versatile possibility of variation and evolution over time.
- ✓ **Provision of instruction manuals:** easily understood even by unskilled labor

***GENERAL SECTOR:** IN RELATION TO THE BUILDING* — **STP N°8**
***SPECIFIC SECTOR:** "COMFORT AND ENERGY SUSTAINABILITY"*

CHARACTERISING REQUIREMENT:
"safeguarding of resources and energy self-sufficiency "

Description of the Requirement:
An essential dwelling, even if of a temporary nature, in order to reduce management costs, it is desirable that it foresees systems for the recovery of resources (water, food scraps, materials and objects found, etc.), their reuse and minimum energy production assisted by the presence of a discrete insulation of the casings, by typological devices aimed at improve the energy behavior in a passive perspective and reduce the aid of the plants to the minimum necessary.

RECOMMENDED DESIGN INDICATIONS

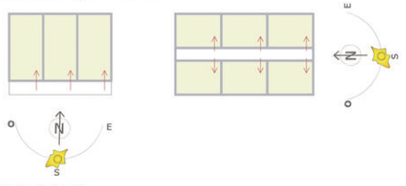
Although it is an essential temporary home, in a framework of reduction of building management cycle costs and reduction of climate-changing emissions, it is advisable to introduce, already in the design process, a combined synergy that includes recovery systems of resources, re-use of the same, reduction of energy expenditure and energy production on site. To this end, therefore, it is desirable that a temporary home, although built with simple and low-cost technologies, should have typological, technological and managerial characteristics capable of contributing towards sustainability and energy saving.

Formal contribution of the typological model:
In order to support the contribution that the typological model is able to provide towards sustainability and energy saving it is desirable that:

- ✓ **Shape ratio:** compact, multi-storey typological forms are preferred (up to a maximum of 4. Please refer to Design Technical Data Sheet No. 6), to the advantage of the S / V ratio (Heated Surface / Volume).

Shape ratio scheme - prefer the compact shape

- ✓ **Orientation:** it is preferred, where possible, and compatibly with the external obstructions already present in the urban environment, the longitudinal orientation on the East-West axis, if the internal distribution provides for the Southern exposure of the functional units used mainly during the day, and the one to the north of the services block and the bedrooms. In the event that the typological installation provides for central distribution of the distribution block and of the services, it is advisable to have an exposure on the North-South axis which guarantees, to both East and West fronts, a direct solar supply during the day. Between the two options, if possible, it is desirable to opt for the first.



Scheme of desirable orientation in the site

VI.3.1a Technical Sheet in relation to the building: perception of the house

***GENERAL SECTOR:** IN RELATION TO THE BUILDING* — **STP N°1**
***SPECIFIC SECTOR:** "HOME PERCEPTION"*

CHARACTERISING REQUIREMENT:
"Predisposition to personalize the space according to one's habits and with the modifiability of the systema in self-construction and, possibly, with the recovery of the materials found by oneself"

Description of the Requirement:
An essential home, even if of a temporary nature, must be prepared to give the perception to the user of feeling at home. This perception can be assisted by the possibility of customizing the space, the surfaces, the equipment, even if temporary, to bring back the traces of its past, traditions and habits.

RECOMMENDED DESIGN INDICATIONS

In order to reduce the total costs of the work, and to support the sense of belonging, through the participation of the user in the construction process, it is desirable that, in an essential temporary home, it collaborates thanks to self-constructive procedures. However, in order to **protect system safety** and **structural safety**, it is preferable to arrange for self-construction collaboration exclusively for the following categories:

Construction for completion:
By "self-construction by completion" we mean the participation only in completing the work within predetermined spaces, already predefined by the designer, with the help of standardized elements, easily available on the market, and mountable by the user.
The procedure of "self-construction by completion" is therefore preferable that:
exclude: the intervention of the user in the personal conception of any element foresees the pre-dimensioning (structures, beams, stairs, plant elements) and the installation of the plants or structures;
allows: the use and installation of elements pre-dimensioned by the designer, or for which a choice is given between standardized common elements, and without margin of personalization. The reference is to the installation of:i comuni standardizzati, e senza margine di personalizzazione.

- ✓ **additional floor slabs:** made with prefabricated elements and for which the sizing, anchoring structures and instructions for dry installation are already envisaged;

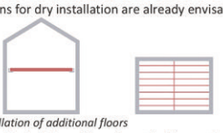


Diagram in section and in plan - installation of additional floors

- ✓ **laying of flooring:** preferably laid dry with systems that have already been run in for laying even from unskilled labor (pre-finished laminates, linoleum on a wooden base, floating floors, decking, etc.)

sectional diagram - laying of flooring

- ✓ **laying the closing panels of the outer casing:** made using materials indicated and pre-dimensioned by the designer that have impermeable characteristics, which preserve water tightness and guarantee the closure of the casing and adequate tightening between the elements
- ✓ **Natural ventilation:** in order to prefer the passive behavior to the active one, it is advisable to position the openings on opposite sides to ensure cross ventilation, aimed at assisting summer comfort, without the aid of air conditioning systems.

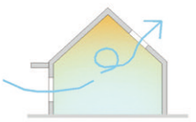


Diagram of natural cross ventilation

- ✓ **Thermal mass:** in order to prefer passive strategies to active ones, it is advisable to design the envelope with a good inertial behavior, both in the stratigraphic choices and in the exploitation of the thermal flywheel potential of the internal mass. It is therefore considered desirable to introduce simple thermal storage systems capable of providing passive contributions both in summer and in winter conditions.

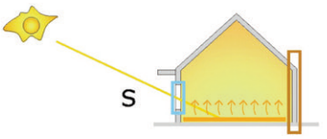
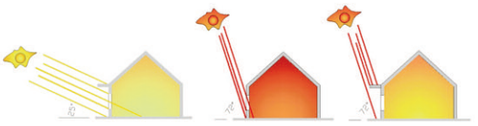


Diagram of use of the thermal mass of the casing and of the internal thermal mass

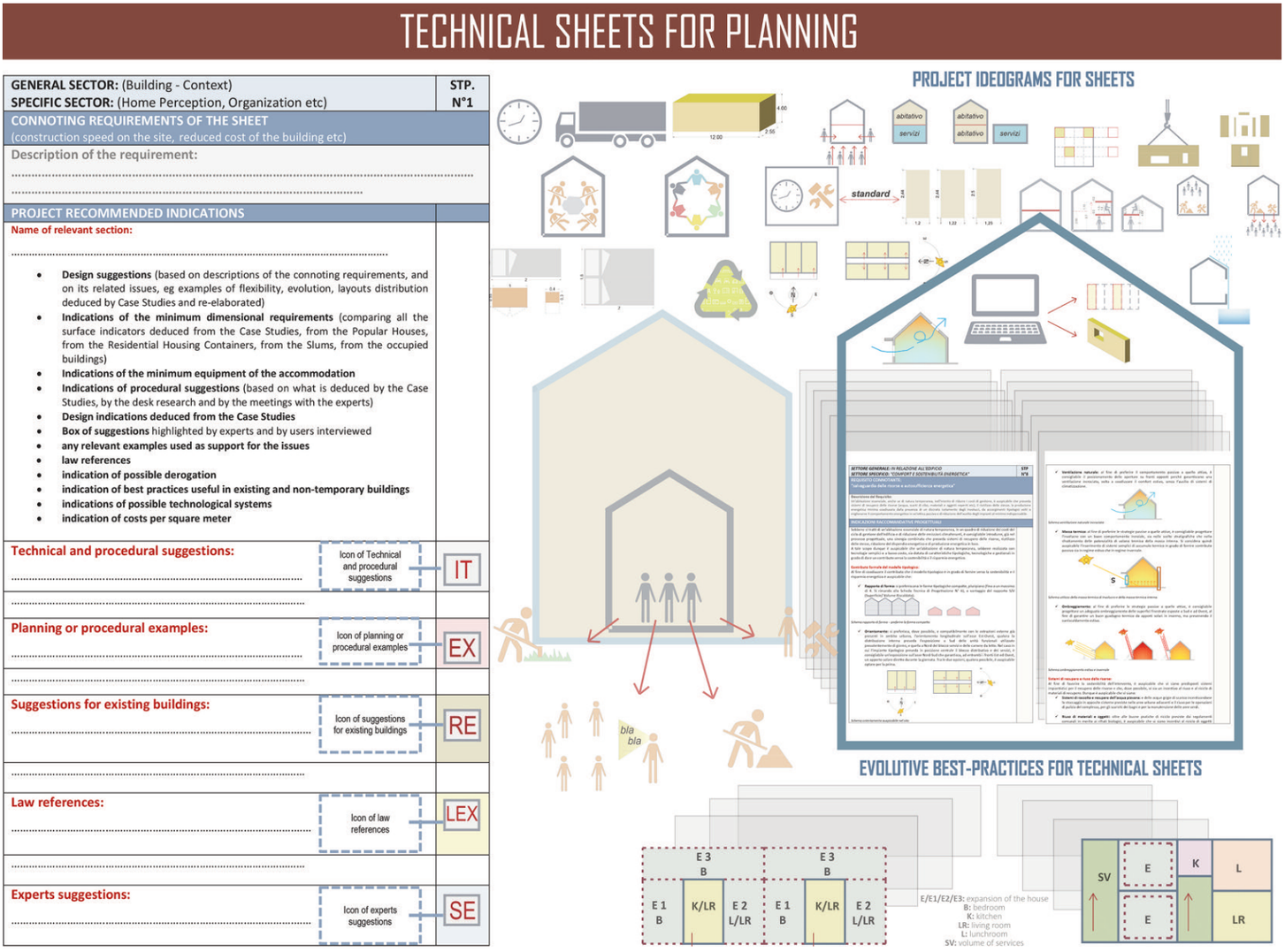
- ✓ **Shading:** in order to prefer passive strategies to active ones, it is advisable to design an adequate shading of the south and west exposed window surfaces, in order to guarantee a good thermal gain from solar contributions in winter, but preventing summer overheating.



Summer and winter shading scheme

Resource recovery and reuse systems:
In order to favor the sustainability of the intervention, it is desirable that there be prepared plant systems for the recovery of resources and that, where possible, there is an incentive to reuse and recycle recycled materials. Therefore it is desirable that there are:

- ✓ **Rainwater collection and recovery systems:** and gray waste water systems encouraging their storage in special tanks in adjacent urban areas and re-use for complex cleaning operations, for bath drains and for area maintenance greens.
- ✓ **Reuse of materials and objects:** in addition to the good recycling practices provided for by the municipal regulations regarding biological waste, it is desirable that there are incentives for the recycling of objects



Figg. 11, 12 | Graphic of Technical Sheets for Planning (credits: I. Montella).

on the users' needs, the requirements that characterise the users' segment, the dimensional surface indicators and the essential and basic equipment. The final sheet reports a grid of needs and requirements specific to a temporary and essential dwelling. This stemmed from synthesising a similarity between the needs and the requirements contained in the Characterising Requirements Design Sheets.

In particular, the requirements have been divided into two general sectors: 'context-related' and 'building-related'. These were in turn defined by specific sectors and consequent needs, as outlined in Figure 10. Every need brings about its characterising requirements that are described in detail. The final sheets derive from them. The collected best practices case study and technical performances of resilience-related requirements became the design and procedural guidelines. These were put together in a meta-design final product in the form of Design Technical Data Sheets (Figg. 11, 12). As an example, here are some of the guidelines extracted from the analysis of the case studies and informal solutions.

The most relevant characteristics of informal arrangements that can become resilient solutions are, for example: the use of collective spaces for encouraging social relations; mixed use of space for both living and work; propensity to extend the living environment outside and take maximum advantage of the space, even in terms of height; preserve and recycle all available resources; proximity to urban centres, and the aspiration to personalise one's own space and basic comfort as an improvement from homelessness.

Some guidelines extracted from the case studies follow, which have resilient-like features and can apply to essential housing. Buildings with no more than four floors that include neighbourhood services and common spaces allow for evolutionary aspects. They involve inhabitants in self-construction and management processes and are to be considered more efficient. The analysis also found that prefabricated systems are more effective, especially if built in natural materials and with dry mortarless construction methods using surface wiring and featuring ease of maintenance and replacement over time. Users and functions mixité, also by modulating rental cost to income for favouring social integration and vicinity to economic centres, are further virtuous solutions.

Time and cost are decisive factors in the housing emergency. Therefore, we set up a time and cost parameterisation grid for realising an essential dwelling with basic equipment following the technical data sheets guidelines. By separating some items that can be realised by the inhabitants, we envisaged attributing an economic value to the users' collaboration in finishing the house and afterwards developing it with self-building. The cost of an essential housing module is around 780 euros/sqm. The user's participation in the completion (furniture, painting and flooring) can cut the cost by approximately 18% to roughly 641 euros/sqm. Furthermore, if construction kits that can be assembled by an expert user are produced industrially, then the cost can drop by a further 10% and reach 577 euros/sqm.

Finally, also taking into consideration the resilience of the architectural artefact, we thought to expand the concept of resilience to 'technological resilience'. Our work identified the requisites of a measurably resilient project assuming intervention categories that take into

TECHNOLOGICAL RESILIENCE DIMENSIONS: ON BUILDINGS, USERS AND URBAN LOCATION		
AGGREGATIVE	Static	• does not allow for different aggregations, evolutions and adaptation in urban places
	Evolutionary	• allows for different aggregations, evolutions and adaptation in urban places
CONSTRUCTIVE	Prefabricated	• made with prefabricated products, fast assembly, can be replaced
	Traditional	• made with traditional methods and materials, prolonged assembly operations, no possibility for quick replacement
	Mixed	• has the advantages of prefabrication, the disadvantages of the traditional types
DISTRIBUTIVE	Fixed	• does not allow for distribution modifications or flexibility
	Modifiable	• allows for distribution modifications and flexibility
FUNCTIONAL	Single-function	• has a single prevailing housing function and fewer possibilities of social relations
	Functional mix	• has the prevailing housing function, many other functions and ease of social relations
SYSTEM DESIGN	Traditional	• mainly made up of chased systems, does not allow for quick maintenance or flexibility
	Innovative	• mainly made up of non-chased systems, made with innovative channelling systems that allow for flexibility
ENERGY DESIGN	Fossil sources	• mainly made with fossil fuel sources
	Only renewable	• mainly made with renewable sources
	Mixed energy	• made with a mix of fossil and renewable sources
MAINTENANCE	Traditional	• mainly with wet technologies, provides for the use of traditional materials and does not allow for reuse
	Replacement of the element	• has prefabricated elements, dry-made, with innovative components, allows for short replacement times and reuse
USER INVOLVEMENT	Only user	• the user utilizes the house and does not participate in the construction phase
	Participation in the completion	• the user participates in the completion of his/her own house and participates in the construction phase
	Complete self-construction	• the user participates entirely in the construction and customization phase, self-building his/her own house
USER	Users mix	• has a mix of different users, prevents segregation and allows for relations among users, decreases the distances between house and services
	Similar users	• does not have a mix of different users, does not allow for relations among users, does not prevents segregation, long distances between house and services
URBAN LOCATION	Central	• located in central areas, reduces movement, allows for better functional and social mixing
	Peripheral	• located in peripheral areas, has a greater distance from central services, increased movement, does not allow for better functional and social mixing

Fig. 13 | Technological Resilience dimensions referring to buildings, mixité, involvement in self-construction, urban location (credit: I. Montella).

Fig. 14 | Photos taken by the author during the inspection of Spin Time Labs (informal occupation of an office building) and the interview in the occupants' home.

Fig. 15 | Jakub Szczesny, Keret House, Warsaw, 2012. Designed for a lot measuring 92 cm at its narrowest point and 152 cm at its most lake point (credit: J. Szczesny, 2012).

account the following features: aggregation; construction; distribution; function; plant engineering; energy, and maintenance. These could provide preliminary or ex-post assessment indicators of resilience and support prior to the decisions of planners, designers and administrators. The dimensions of participation in the construction and management process, as well as users' mixitè and location, are also considered because sociality impacts the overall resilience (Fig. 13).

Conclusions | Cities are constantly subjected to sources of chronic stress and consequent instability in their exposure to multiple risk factors within strong social, demographic and economic changes. In the dichotomy between built environment – which is still too static and anchored to the technological, anthropological and typological needs of the past plus the changing needs of new classes of users – the need to adapt, mitigate and take responsibility for resilience emerges within design processes. However, since the literature did not codify resilience with design facilitating characteristics or indicators, it was necessary to identify support criteria in defining preventive procedures. These must take into account the instances of resilience during every phase: design; management; evolution; disposal and reuse.

The research, enriched by real case study field experiences (Fig. 14) is rooted in the tech-oriented performance-based building design theory. It identified an adaptive advancement of canonical performance requirements. Furthermore, the work draws inspiration from the literature on resilience applied to urban areas. It studies self-recovery practices, self-construction, mutual aid and informal housing solutions by identifying affinities between them and resilient processes. The research led to a PhD and continued with a more in-depth study on the topic. The Author has been a scientific consultant for the HABITO project[6], which is a 3-episode video documentary on housing issues in Rome. This provided an opportunity to enrich the case studies through additional squatting models[7] and allowed for drafting a possible rethinking of the entire housing policy.

This contribution offers procedural and meta-design results. It proposes some criteria for codifying, designing and evolving the quality of resilience applied to buildings. Accordingly, it presents a corpus of Design Technical Data Sheets and defines some 'technological resilience' requirements, intended as the focus to which a resilient project must respond. The originality of the contribution lies in the attempt to identify requirements that codify resilience while proposing preventive methodological and ex-post validation procedures of urban planning and design processes whose results are measurable.

The proposed procedures aim at reducing costs, time and waste. They also highlight Italian cultural limitations towards new forms of living. Quite possibly, the relationship between these instances of resilience and the desirable adaptation to the Italian context can be glimpsed by taking up the founding concept of Evolutionary Resilience, which considers the transition between various states of equilibrium provided that the functionality of the system is restored (Davoudi, 2012). To improve urban systems and maintain the functioning that guarantees the evolution towards equilibrium, it is important to consider the Dimensions of Technological Resilience as a way of overcom-

ing the static nature of architectural permanence. In the future, we should opt for buildings with evolutionary characteristics that can be controlled and planned from the initial design phases. This is why we need adapting rules through the expedient of temporary use of a permanent building. In ensuring health and safety, such a process should allow for temporary densification, even in urban centres (Fig. 15).

The wish is to overcome the hindrance against new housing models (Aravena, 2012) and accept derogations from the current and obsolete residential and urban planning standards. The proposed resilience requirements take into account the need to downsize standards and save resources. These aspects aim to encourage participatory and self-building procedures as a driving force for economic savings, social inclusion and resilience intervention. The research is still in progress. It points towards testing the product by adding resilience requirements in a cost and quality assessing system that can be integrated into BIM software.

Notes

1) This article stems from the Author's doctoral research in Architecture Technology, 'Emergenza abitativa e requisiti minimi per l'accoglienza: contributo alla strategia di resilienza' (Housing Emergency and Minimum Accommodation Requirements: A Contribution to the Resilience Strategy), presented at the University of Florence in March 2017.

2) 'Essential housing responses' refers to temporary housing solutions for users in the 'gray area'. The latter is currently unattended by both the traditional planning system and the social housing policy. Due to the need for a quick implementation at reduced costs and the temporary nature of their use, these housing solutions are meant to be an upgrade of informal solutions and a downgrade of formal solutions from the performance point of view.

3) A typological study to deduce the dimensional 'standards' was conducted on the Jardim Colombo favela in São Paulo, Brazil.

4) The analysis was conducted on the Torre David in Caracas and on Spin Time Labs, which has been a squat in Rome since 2013.

5) The case studies were chosen from the following categories: a) State-inhabitants' cooperation projects for the prevention of informal settlements ('Minha Casa, Minha Vida', 'PRO.CRE.AR. BICENTENARIO – Programa de Crédito Argentino del Bicentenario para la Vivienda Única Familiar', 'FUCVAM – Federacion Uruguaya de Cooperativas de Viviendas y de Ayuda Mutua', 'Techo – Un Techo para mi País – UTPMP' and 'Elemental', Chile); b) projects for the re-use of abandoned real estate assets for social housing purposes ('Spin Time Labs' and 'Le CaSette' in Rome, and innovative forms of living, such as 'Condominio Solidale' in Turin); c) architectural competitions for low-cost housing and social housing projects ('Solar Decathlon Europe 2014', which related to resilient processes in the 'From Border to Home – Housing Solutions for Asylum Seekers' competition and the '2016 Berlin Award: Heimat in der Fremde', with results exhibited at the 2016 Venice Architecture Biennale).

6) The HABITO documentary was presented and produced by the Order of Architects, Planners, Landscapers and Conservationists of Rome and the province. It was performed with the support of the Italian Ministry for Cultural Assets and Activities (MiBAC) and the Italian Society of Authors and Publishers (SIAE) as part of the 'Sillumina – Copia privata per i giovani, per la cultura' program. The episodes can be viewed at the website: ordine.architettiroma.it/progetti-dellordine/habito-2/. Creator, Subject and Screenplay Co-Author and Project Director, G. Dal Bianco; Subject/Screenplay Co-Author and Scientific Coordinator, M. Ricci; Filming and Editing, C. Barbalucca, and Scientific Advisor, I. Montella.

7) Occupation of Via di Casal Boccone n. 112; Metropoliz occupation; autonomous recovery in Piazza Sonnino, and autonomous recovery of a former school at Via dei Lauri and La Collina del Barbagianni solidarity condominium.

References

Aravena, A. and Iacobelli, A. (2012), *Elemental – Incremental Housing and Participatory Design Manual*, Hatje Cantz.

Cittalia – Fondazione Anci Ricerche (2011), *L'abitare sociale – Strategie locali di lotta alla povertà: città a confronto*. [Online] Available at: www.cittalia.it/images/file/abitare_sociale_bassa.pdf [Accessed 1st November 2019].

Davoudi, S. (2012), "Resilience: a bridging concept or a dead end?", in *Planning Theory & Practice*, vol. 13, n. 2, pp. 299-307.

Dipartimento della Protezione Civile (2005), *Manuale Tecnico per l'allestimento delle aree di ricovero per strutture prefabbricate di protezione civile – Approvato con Decreto del Capo del Dipartimento della Protezione Civile (n° 1243 del 24 marzo 2005)*. [Online] available at: www.protezionecivile.gov.it/amministrazione-trasparente/provvedimenti/dettaglio/-/asset_publisher/default/content/direttiva-2-febbraio-2005-linee-guida-per-l-individuazione-di-aree-di-ricovero-di-emergenza-per-strutture-prefabbricate-di-protezione-civile [Accessed 1st November 2019].

Federcasa (2019), *Federcasa informa – Non solo casa, insieme per il futuro*, Giugno, anno II, numero 1. [Online] Available at: www.federcasa.it/wp-content/uploads/2019/07/04.-Federcasa_Informa_GIUGNO_2019-1.pdf [Accessed 1st November 2019].

Global Footprint Network (2019), *EU Overshoot Day – Living Beyond Nature's Limit, 10 May 2019*, World Wide Fund For Nature. [Online] Available at: www.footprintnetwork.org/content/uploads/2019/05/WWF_GFN_EU_Overshoot_Day_report.pdf [Accessed 1st November 2019].

Holling, C. S. (1973), "Resilience and stability of ecological systems", in *Annual Review of Ecology and Systematics*, vol. 4, pp. 1-23. [Online] Available at: doi.org/10.1146/annurev.es.04.110173.000245 [Accessed 1st November 2019].

IPCC – Intergovernmental Panel on Climate Change (2019), *Climate Change and Land – An IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems – Summary for Policymakers*. [Online] Available at: www.ipcc.ch/site/assets/uploads/2019/08/Edited-SPM_Approved_Microsite_FINAL.pdf [Accessed 1st November 2019].

ISMU – Fondazione per le iniziative e gli studi sulla multietnicità (2019), *Comunicato stampa Fondazione ISMU per la Giornata Mondiale del Rifugiato che si celebra il 20 Giugno*. [Online] Available at: www.ismu.org/wp-content/uploads/2018/10/CS-giornata-rifugiato-20-giugno-2019.pdf [Accessed 1st November 2019].

ISMU – Fondazione per le iniziative e gli studi sulla multietnicità (2018), *Comunicato stampa Fondazione ISMU – XXIV Rapporto sulle migrazioni*. [Online] Available at: www.ismu.org/wp-content/uploads/2018/10/Comunicato-Stampa-XXIV-Rapporto-Ismu-sulle-Migrazioni.pdf [Accessed 1st November 2019].

ISTAT (2019), *Le statistiche dell'Istat sulla povertà – Anno 2018*. [Online] Available at: www.istat.it/it/files//2019/06/La-povert%C3%A0-in-Italia-2018.pdf [Accessed 1st November 2019].

ISTAT (2018), *Popolazione e Famiglie*, pubblicazione 31 Dicembre 2018. [Online] Available at: www.istat.it/it/files/2018/12/C03.pdf [Accessed 1st November 2019].

Mehrotra, R. (2015), *Kumbh Mela – Mapping the Ephemeral Mega City*, Hatje Cantz.

Ministero dell'Interno (2019), *Cruscotto statistico giornaliero,* a cura del Dipartimento per le Libertà civili e l'Immigrazione. [Online] Available at: www.interno.gov.it/sites/default/files/cruscotto_giornaliero_31-10-2019.pdf [Accessed 1st November 2019].

Ministero dell'Interno (2018), *Annuario delle Statistiche Ufficiali dell'Amministrazione dell'Interno*. [Online] Available at: ucs.interno.gov.it/ucs/contenuti/Le_statistiche_ufficiali_del_ministero_dell_interno_ed._2018-7358400.htm [Accessed 1st November 2019].

MSF (2018), *Fuori Campo – Insediamenti informali – Marginalità sociale, ostacoli all'accesso alle cure e ai beni essenziali per migranti e rifugiati – Secondo Rapporto*, Medici Senza Frontiere. [Online] Available at: www.asylumineurope.org/sites/default/files/resources/fuoricampo2018.pdf [Accessed 1st November 2019].

Ove Arup & Partners (2015), *City Resilience Framework,* The Rockfeller Foundation. [Online] Available at: assets.rockefellerfoundation.org/app/uploads/20160105134829/100RC-City-Resilience-Framework.pdf [Accessed 1st November 2019].

Pasini, A. and Amendola, S. (2019), "Linear and non-linear influences of climatic changes on migration flows: a case study for the Mediterranean bridge", in *Environmental Research Communication*, vol. 1, n. 1, pp. 1-10. [Online] Available at: iopscience.iop.org/article/10.1088/2515-7620/ab0464 [Accessed 1st November 2019].

Pimm, S. L. (1984), "The complexity and stability of ecosystems", in *Nature | International Journal of Science*, n. 307, pp. 321-326. [Online] Available at: doi.org/10.1038/307321a0 [Accessed 1st November 2019].

Rigaud, K. K., de Sherbinin, A., Jones, B., Bergmann, J., Clement, V., Ober, K., Schewe, J., Adamo, S., McCusker, B., Heuser, S. and Midgley, A. (2018), *Groundswell – Preparing for Internal Climate Migration*, The World Bank, Washington (DC). [Online] Available at: openknowledge.worldbank.org/handle/10986/29461 [Accessed 1st November 2019].

Sheffer, M. (2009), *Critical transitions in nature and society*, Princeton University Press, Princeton, NJ (US).