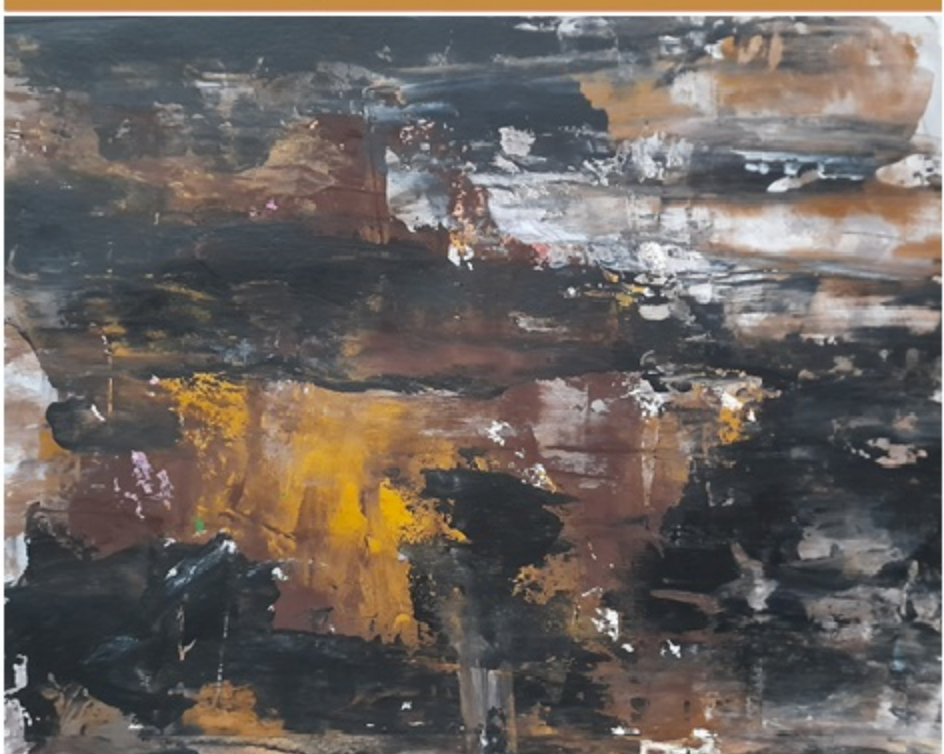
22

Plurimondi

An International Forum for Research and Debate on Human Settlements

22

war and peace



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Prefazione, مقدمة, Foreword

Enzo Scandurra*

Questo numero, uno dei tanti della rivista Plurimondi, ha, però, un'importanza unica, direi eccezionale; è dedicato allo sterminio di un popolo, quello palestinese, e alla loro città principale: Gaza City.
Genocidio, parola fino a qualche tempo fa impronunciabile, ora forse addirittura inadeguata a rappresentare quanto sta accadendo ad opera di quegli stessi che un tempo avevano conosciuto l'umiliazione, la deportazione e l'eliminazione, fattisi oggi carnefici.
Noi tutti di una certa anagrafe abbiamo interiorizzato la terribile esperienza dell'olocausto, quella tragedia che aveva segnato un confine netto tra il Bene e il Male, oltre il quale, si pensava, non si sarebbe mai potuti andare.
Non si poteva andare.
Si sta avverando la terribile profezia di Primo Levi: "È accaduto, può accadere di nuovo. […]. La violenza «utile» o «inutile», è sotto i nostri occhi: serpeggia, in episodi saltuari e privati, o come illegalità di stato […]. Attende solo il nuovo istrione (non mancano i candidati) che la organizzi, la legalizzi, la dichiari necessaria e dovuta e infetti il mondo" (Levi, 2014).
"Levi pensa (e ha evidentemente ragione) non tanto a una ripetizione dell'identico, nell'avvento cioè di un regime nazista nel centro Europa, quanto piuttosto a una proliferazione di quei fattori che hanno reso l'orrore possibile, magari in altri paesi, sotto altro nome, con nuove

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giustificazioni, non raggiungendo lo stesso parossismo ma producendo, quantomeno, massacri e sofferenze senza fine. Contro questo propagarsi del male, pensa l'autore, il richiamo del passato può essere salutare: non bisogna stancarsi mai di ricordare l'orrore antico" (Todorov, 2014).
Il richiamo del passato, l'orrore del presente, la testimonianza di quanto sta accadendo in Palestina, sono gli argomenti di questo numero che esce dall'università, quel luogo, quasi sacro, che dovrebbe ergersi a difesa contro ogni pensiero di guerra, di morte, e sviluppare, al contrario, un pensiero critico, un pensiero di convivenza, un pensiero di speranza nell'umanità.
Come pensiamo che possano sopravvivere i palestinesi in un territorio totalmente distrutto da guerra, carestie, devastazioni? E dove pensiamo possano trasferirsi se ogni Stato oppone solo muri e milizie contro coloro che fuggono e che non hanno più casa e nemmeno una terra nella quale essere seppelliti?
Se segnali di follia provengono dal mondo, spetta all'università, seppure con la sua poca forza, di contrastarli, combatterli in nome di un'umanità che non ha smarrito la sua storia di specie e le sue tradizioni, culturali, scientifiche. Gaia, è stato detto, è un esperimento per abituare i popoli a convivere con lo sterminio altrui e ad accettarlo come inevitabile,
"Custodite voi la memoria di Gaza. Non lasciate che il silenzio copra le voci spezzate. Non permettete che la menzogna diventi storia. Fate che almeno domani ci sia qualcuno che abbia il coraggio di dire: «Abbiamo imparato. Non abbiamo dimenticato»" (Iannacone, 2025).
"Mai più" avevamo gridato ogni volta al seguito di tragedie cruente (l'Olocausto, la Pandemia), per, subito poi, ri-cominciare con gli orrori, come se la memoria fosse solo fragile ricordo sbiadito nel tempo.

Siamo ora chiamati a ripetere quel "mai più" rinnegato di fronte allo sterminio di un intero popolo, donne vecchi e bambini compresi, colpevoli solo di essere nati in quei luoghi. Non c'è soltanto l'obiettivo di distruggere ogni cosa – fa impressione vedere le case non solo distrutte ma letteralmente sbriciolate – ma quello di ridurre attraverso l'affamamento le stesse persone in animali alla ricerca di un poco di cibo.

Disumanizzati verrebbe da dire, come lo furono gli ebrei nei campi di sterminio; in fila per supplicare un po' di cibo per sé e per i figli. Che caricano suppellettili e pochi stracci su improbabili carrette trasportate a mano sulla spiaggia per sfuggire al fuoco annientatore.

A vedere i telegiornali tv che riprendono i palestinesi di Gaza, si ha l'impressione di guardare dei formicai: gente che va da tutte le parti, alcuni che dopo brevi tratti tornano indietro, poi nuovi gruppi che si formano, altri che si sciolgono e le persone si avviano verso luoghi sconosciuti.

Fra cumuli di macerie.

E gli israeliti che fanno il tiro al piccione. Sparano nel mucchio, sono obiettivi facili, soprattutto i bambini.

In nome della terra loro promessa (da chi? Da quale Autorità?).

Poi uno scoppio, polvere che si solleva, grida che in TV non si sentono. Dalla polvere a poco a poco escono di nuovo le formiche che si agitano, provano a soccorrere chi è rimasto ferito (per portarlo dove? Visto che non ci sono più ospedali).

Ma le formiche, si sa, sono indistruttibili, risorgono da luoghi devastati e riprendono a correre come prima.

Ci saranno sempre.

Non sappiamo come faranno questi due popoli a convivere nel prossimo futuro. Certo è che dovranno passare generazioni di giovani palestinesi per dimenticare l'umiliazione e le sofferenze provocate. Così come noi – occidentali, impotenti e ignavi – pagheremo cara questa nostra inerzia che ci fa volgere il viso dall'altra parte.

È utile ricordare le parole ultime di Franco Cassano su una riflessione dell'occidentalismo e della modernità: "il problema fondamentale è che la tradizione europea ed occidentale delle libertà è da tempo uscita fuor di misura, è una tradizione che, ribollendo su se stessa, è traboccata violentemente sulle altre. Il fondamentalismo dell'economia è questo traboccare senza misura" (Cassano, 2024, p.52).
Dunque è già il momento di far sentire la nostra voce in difesa di questa mostruosa ingiustizia. Per noi a partire dall'università, soprattutto, da quel luogo ove si predica e si pratica la tolleranza, il rispetto dell'altro, delle sue idee diverse dalle nostre, luogo di pace. Gli studenti si aspettano da noi delle risposte altrimenti non avremo più il coraggio di guardarli negli occhi e ogni nostra giustificazione avrà, per loro, il sapore di viltà.
Le università possono costituire le tradotte per lanciare appelli alla convivenza pacifica, per dire no alle armi. Non sarà molto e forse non riuscirà a fermare la barbarie, ma questo solo possiamo, e dobbiamo, fare.

هذا العدد، واحد من بين العديد من أعداد مجلة بلوريموندي، يحمل مع ذلك أهمية فريدة، بل أقول استثنائية؛ إنه مكرّس لإبادة شعب، هو الشعب الفلسطيني، ولمدينتهم الرئيسية :مدينة غزة.
،الإبادة الجماعية، تلك الكلمة التي كانت حتى وقت قريب لا يمكن التلفظ بها أصبحت اليوم ربما غير كافية حتى لوصف ما يحدث، على يد أولئك الذين عرفوا في الماضي الذلّ، الترحيل، والإبادة؛ والذين أصبحوا اليوم جلادين.
نحن جميعاً، ممن ينتمون إلى جيل معين، قد استوعبنا التجربة المروعة للهولوكوست، تلك المأساة التي شكّلت فاصلاً واضحاً بين الخير والشر، وتخيّلنا أنه لا يمكن للبشرية أن تتجاوزه.
لكن لم يكن بالإمكان تجاوزه.
وها نحن نشهد تحقّق نبوءة بريمو ليفي الرهيبة:
لقد حدث، ويمكن أن يحدث من جديد [...] .العنف، سواء كان «مفيداً «أو"

عديم الفائدة«، هو أمام أعيننا :يتسلّل في حوادث فردية، أو كخرق للقانون»
ترعاه الدولة .[...]إنه فقط بانتظار المهرّج الجديد)ولا تنقصنا
”.المرشّحون (لينظّمه، ويشرّعه، ويعلنه ضرورياً، ويُعدي به العالم
ليفي لا يتحدث عن تكرار حرفي لما حدث، أي ظهور نظام نازي في وسط أوروبا، بل عن انتشار تلك العوامل التي جعلت الرعب ممكناً، في دول أخرى، وبأسماء مختلفة، وتبريرات جديدة، قد لا تصل إلى نفس درجة .الجنون، لكنها تنتج، على الأقل، مجازر ومعاناة لا تنتهي
ضد هذا الانتشار للشر، يرى الكاتب أن الرجوع إلى الماضي قد يكون :نافعاً
”.لا يجب أن نتعب أبداً من تذكّر ذلك الرعب القديم“
الرجوع إلى الماضي، ورعب الحاضر، وشهادة ما يحدث في فلسطين، هي المواضيع التي يتناولها هذا العدد، الذي يخرج من أسوار الجامعة؛ ذلك المكان الذي يُفترض أن يكون مقدساً، يدافع عن الحياة، ويرفض الحرب والموت، ويُغذي بدلاً من ذلك فكراً نقدياً، فكراً للتعايش، وفكراً للأمل في .الإنسانية
لكن كيف نتصور أن الفلسطينيين يمكنهم البقاء على قيد الحياة، في أرض دُمّرت بالكامل بالحرب، والجوع، والخراب؟
وإلى أين يمكنهم الذهاب، إذا كانت كل الدول تردّ عليهم بالجدران والمليشيات، ضد من لم يعد لديهم لا منزل ولا أرض تُدفن فيها أجسادهم؟
إذا كانت علامات الجنون تصدر عن العالم، فعلى الجامعة، ولو بقليل من قوتها، أن تواجهها، وتحاربها، باسم إنسانية لم تنسَ بعد تاريخها كنوع .بشري، ولا تقاليدها الثقافية والعلمية
لقد قيل إن غايا)الأرض (هي تجربة لتعويد الشعوب على التعايش مع إبادة .الآخرين وقبولها كأمر لا مفر منه
احفظوا ذاكرة غزة .لا تسمحوا للصمت أن يُخفي الأصوات المحطّمة .لا“ تسمحوا للكذب أن يصبح تاريخاً .اجعلوا على الأقل من الغد شخصاً يجرؤ .على أن يقول‘ :لقد تعلّمنا .لم ننسَ’”.
لن يتكرر ذلك أبداً ”– هكذا كنا نصرخ بعد كل مذبحة دامية“)الهولوكوست، الجائحة(، ثم ما نلبث أن نعود للرعب من جديد، وكأن .الذاكرة مجرد ذكرى باهتة وهشّة
واليوم، نحن مدعوون لتكرار ”لن يتكرر أبداً“، هذه المرة في مواجهة إبادة شعب بأكمله – نساءً، شيوخاً، وأطفالاً – لا ذنب لهم سوى أنهم ولدوا في .هذه الأرض

الهدف ليس فقط تدمير كل شيء – من المؤلم أن ترى البيوت ليست فقط مدمّرة، بل مفتّتة حرفياً – بل الهدف هو تجويع الناس حتى يعودوا حيوانات تبحث عن فتات الطعام.

جرى تجريدهم من إنسانيتهم، تماماً كما حدث مع اليهود في معسكرات الإبادة؛ يقفون في طوابير يتوسلون قليلاً من الطعام لهم ولأطفالهم. يحملون ما تيسر من أشياء بسيطة على عربات بدائية، يجرّونها بأيديهم على الشاطئ، هاربين من نيران الإبادة.

عند مشاهدة نشرات الأخبار التي تنقل صور الفلسطينيين في غزة، يشعر المرء وكأنه يرى مستعمرات نمل:

ناس يذهبون في كل اتجاه، بعضهم يعود، آخرون ينقسمون، مجموعات تتكوّن وأخرى تتفكك، ويتجه الناس نحو مجهول، وسط أكوام من الركام. والإسرائيليون يمارسون الرماية على الحمام؛ يطلقون النار على الجموع، والأطفال أهداف سهلة.

(من مَن؟ وبأي سلطة؟) باسم أرضهم الموعودة.

ثم انفجار، وغبار يتصاعد، وصراخ لا يُسمع على شاشة التلفاز.

ومن الغبار تظهر مجدداً "النملات"، تتحرك، تحاول إنقاذ من أُصيب (لكن إلى أين؟ فلم تعد هناك مستشفيات).

لكن النمل، كما نعلم، لا يُقهر. يعود من تحت الأنقاض ويواصل الركض كما من قبل.

وسيظل دائماً موجوداً.

لا نعرف كيف يمكن لهذين الشعبين أن يتعايشا في المستقبل القريب. لكن من المؤكد أن الأمر سيتطلّب أجيالاً من الشباب الفلسطينيين ليتسوا ما تعرّضوا له من ذلّ ومعاناة.

كما أننا – نحن الغربيون العاجزون والمتخاذلون – سندفع ثمناً باهظاً على هذا التواطؤ بصمتنا، الذي يجعلنا نذير وجوهنا للجانب الآخر.

من المفيد أن نستعيد كلمات فرانكو كاسّانو الأخيرة في تأمله حول الغرب والحداثة:

"المشكلة الأساسية هي أن التقاليد الأوروبية والغربية للحريات قد تجاوزت حدودها منذ زمن، إنها تقاليد فاضت على ذاتها، ثم طغت بعنف على الآخرين. والأساس في ذلك هو التطرف الاقتصادي، هذا الفيض الجامح الذي لا يعرف قيوداً."

إذن، لقد حان الوقت لرفع صوتنا ضد هذا الظلم الوحشي.

بالنسبة لنا، يجب أن تكون البداية من الجامعة، من ذلك المكان الذي

يُفترض أن يُعلّم التسامح، واحترام الآخر، وأفكاره المختلفة، ويكون مكاناً للسلام.
الطلاب ينتظرون منّا أجوبة، وإلا فلن نستطيع النظر في أعينهم، وستبدو كل مبرراتنا في نظرهم جبناً وخيانة.
الجامعات يمكن أن تكون منصّات تطلق نداءات للتعايش السلمي، ولرفض السلاح.
ربما لن يكون ذلك كافياً لإيقاف الهمجية، لكن هذا ما نستطيع، ويجب علينا، فعله.

This Plurimondi issue, one of many, is unique in importance, I would say exceptional: it is dedicated to the extermination of a people, the Palestinians people, and their main city: Gaza City.
Genocide, a word that until recently was unpronounceable, is now perhaps inadequate to describe what is happening at the hands of those who once knew humiliation, deportation, and elimination, those who now become executioners.
All of us of a certain age have interiorized the terrible experience of the Holocaust, the tragedy that marked a definite boundary between Good and Evil, beyond which, we thought, one could never go. One could not go.
Primo Levi's terrible prophecy is coming true: "It happened, it can happen again. […]. "Useful" or "useless" violence is before our eyes: it snakes, in occasional and private episodes, or as state illegality […] It is only waiting the new histrion (candidates abound) to organize it, legalize it, declare it due and necessary, and infect the world" (Levi, 2014).
"Levi thinks (and is evidently right) not so much of a repetition of the same, that is, the advent of a Nazi regime in Central Europe, but rather of a proliferation of those factors that made the horror possible, perhaps in other countries, under another name, with new justifications, not reaching the same paroxysm but producing, at the very least,

massacres and endless suffering. Against this propagation of Evil, the author thinks, the call of the past can be salutary: being never tired to remember the ancient horror" (Todorov, 2014).

The call of the past, the horror of the present, and the witness of what is happening in Palestine are the topics of this journal issue which comes from a university, that almost sacred place, that should stand as a defense against every thought of war, of death, instead developing critical thinking, a thought of coexistence, a thought of hope in humanity.

How do we think Palestinians can survive in a territory totally destroyed by war, famine, and devastation? And where do we think they can move if every State only opposes walls and militias against those who flee and who no longer have a home or even a land in which to be buried?

If signs of madness come from the world, it is up to the university, however small its strenght, to counter them, to fight them in the name of a humanity that has not lost its history as a species and its cultural and scientific traditions. Gaza, it was said, is an experiment to accustom people to coexist with the extermination of others and to accept it as inevitable.

"You must be the custodians of the memory of Gaza. Do not let silence drown out the broken voices. Do not allow the lie to become history. Let at least tomorrow there is someone who has the courage to say «We have learned. We have not forgotten»" (Iannacone, 2025).

"Never again" we had cried out each time in the wake of cruel tragedies (the Holocaust, the Pandemic), only to immediately begin again with the horrors, as if memory were only a fragile remembering faded over time.

We are now called to repeat that "never again" denied in the face of the extermination of an entire people, including women, old people, and children, guilty only of being born in those places. There is not only the goal of destroying

everything – it is shocking to see homes not only destroyed but literally crumbled – but also that of starving the people themselves persons into animals searching for of a little food.

Dehumanized, one might say, like the Jews in the extermination camps, queuing up to beg for a little food for themselves and their children. Loading household goods furnitures and a few rags onto improbable carts carried by hand along the beach to escape the annihilating fire.

Watching the TV news broadcasts journals on the Gaza Palestinians the impression comes of watching anthills: people going in all directions, some turning back after short tracts, then new groups forming, others breaking up, and persons heading off towards unknown places.

Among piles of rubble.

And the Israelites do pigeons shooting. They shoot into the crowd. They are easy targets, especially the children. In the name of their Promised Land (by whom? By which Authority?).

Then an explosion, dust rising, shootings can't be heard on TV. From the dust little by little, the ants emerge again, scurrying about, trying to help those who were injured (to take them where? Since there are no more hospitals).

But ants, as we know, are indestructible; they rise from devastated places and resume their stride as before. They will always be there.

We do not know how these two peoples will coexist in the next future. What is certain is that generations of young Palestinians will have to wait to forget the humiliation and suffering that happened. Just as we – Westerners, impotent and indolent – will pay dearly for our inertia that makes us look the other way.

It is useful to remember the last words by writer Franco Cassano on a reflection on Westernism and modernity: "The fundamental problem is that the European and the Western tradition of freedom has long since gone out of proportion, it is a tradition that, boiling over within itself, has violently

overflowed onto others. Economic fundamentalism is this unrestrained overflowing" (Cassano, 2024, p.52).
So it is already time to make our voices heard in defense of this monstrous injustice. For us starting from the university, above all, from that place where tolerance, respect of others and their ideas different from ours, place of peace, are predicated and practiced. Students expect answers from us, otherwise we will no longer have the courage to look them in their eyes and any justification we offer will, for them, smack of cowardice.
Universities can constitute convoys to launch appeals for peaceful coexistence, to say no to weapon. It won't be much, and it may not be enough to stop the barbarity, but this is all we can, and must, do.

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Introduction

Dino Borri*, Domenico Camarda*

This special issue of Plurimondi contains the proceedings of the Gaza Seminar held in July 16 2025 in the Polytechnic University of Bari. It provides a complete report of the solidaristic work made in 2025 by an international group of experts, made of university professors and technical representatives of public institutions, with the aim of supporting the 2024 Gaza Phoenix strategic plan through preparation of some major projects of reconstruction and redevelopment. The major projects selected by the authors of GPsp (fundamentally pieces of the civil society of Gaza with their friendship and estimation relations with some persons from Palestinian universities, in our case Birzeit Univ. Ramallah) for the post-war time deal with water and energy provision, reconstruction of housing and social services with special attention to schools and hospitals, transportation, organization and planning, agriculture, traditional and innovative knowledge-based economy, protection of the environment, with the obvious corollary of a proiect for removing the enormous quantities of rubble created by the Israeli bombs.

The idea of preparing some detailed implementation projects came from the group of experts assembled by the Polytecnic University of Bari when some authors of GPsp having occasionally met in Nablus persons from the academic and family circles of PUoB demanded help to them for pushing forward GPsp with the explicit

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recommmendation of keeping the projects in strict adherence with the aspirations and indications of the local civil society.

During the work, notwithstanding some attempts of ceasefire, Gaza registered the death of almost 70,000 deaths or more (50% women and children) on a population of 2 million, the complete destruction of its physical structure, water and energy equipments included, and a persistent situation of siege which caused the end of all the essential means of survival of the population. With the arrival of the winter 2025-2026 the further worsening of this terrible situation can be easily predicted. Lubna Masarwa, a journalist based in Jerusalem, wrote in the last few days that 125,000 out of 135,000 tents have been destroyed by the increasingly bad metereological conditions (Internazionale no. 1645 Dec. 19, 2026, p. 33).

In this tragic scene, the Rafah corridor Egypt-Palestine remains closed. We hope that the projects in solidaristic preparation, which span from water and energy to housing and planning and knowledge, from economy to policies and agriculture and law, and from moral to ethical behaviors in the human community of Gaza in its war tragedy and give practical and spiritual life to the following pages of Plurimondi will be directly implemented by the local communities and that Gaza will soon come back to its long and important historical heritage. To be in tune with the starting encounters and the premises, the projects in preparation for donation are scalable in time, implementable by local agents and by local means and materials, environmentally sustainable, targeted to host the entire population of Gaza, friendly for their and referable to a sociotechnical culture and tradition.

Even if the work is heavy we feel ourselves highly honored for the moral and technical gifts that we are receiving from Gaza.

The central section of this issue includes brief scientific papers elaborated by each author from their presentations delivered during the Seminar. It opens with the Gaza Phoenix Recovery Framework itself, presented by Salem, Kittana and Gola as a locally led, interdisciplinary alternative to donor-driven reconstruction models, placing dignity, social cohesion, and local agency at the core of recovery. Then Abis and Barbone follow, who frame the reconstruction of Gaza's water and sanitation systems through a phased and operational approach that moves from emergency response to long-term resilience, emphasizing public health, environmental protection, and the rebuilding of local technical capacity. La Scala proposes solar microgrids as a scalable humanitarian response to Gaza's intertwined electricity and water crises, highlighting decentralized renewable energy systems as a foundation for resilience, autonomy, and rapid recovery. Subsequently, Mossa and De Padova contribute a study on sustainable seawater desalination in environmentally sensitive contexts, presenting modelling and monitoring approaches that reconcile freshwater production with the protection of marine ecosystems. In Ficarelli's and Neglia's paper, a culturally sensitive framework is developed for recovering Gaza's urban and cultural landscape, emphasizing heritage, memory, and identity as indispensable components of social healing and sustainable rebuilding. The next paper by Leone situates green infrastructure, ecosystem services, and nature-based solutions as key planning tools for post-crisis urban resilience, integrating environmental, social, and spatial dimensions of reconstruction. Then Giuffrida, Viscio, Binetti and Ottomanelli advance a short-term, low-cost mobility strategy designed to rapidly restore accessibility while remaining compatible with long-term spatial visions, prioritizing inclusion, flexibility, and sustainability. Barbanente and Khakee address the profound uncertainties

shaping Gaza's recovery by proposing a scenario-based, participatory methodology capable of transforming political, social, and economic instability into strategic guidance for the implementation of the Gaza Phoenix Recovery Framework. The paper by Borri and Scandale explores Gaza's reconstruction as a cognitive and cultural process, arguing that an endogenous, knowledge-based development model—rooted in tradition, youth, education, and human capital—is essential for building a resilient and autonomous future. Then Kubursi and De Lucia critically examine the distinction between reconstruction and redevelopment, arguing that Gaza's future depends on reclaiming sovereignty, policy space, and endogenous development capacities rather than reproducing pre-existing structural dependencies. 11 The devastation of Gaza's agricultural sector is analysed by Melozzi and Di Terlizzi, who outline a two-phase recovery strategy aimed at restoring livelihoods, food security, and long-term sustainability through locally adapted and water-efficient practices. 12 Finally, Sater et al. situate the ongoing destruction of Gaza within the framework of international criminal law, calling for recognition, prevention, accountability, and responsibility as ethical imperatives for the international community; this contribution is published courtesy of Times of Malta.

The volume concludes with a section of institutional and/or political remarks delivered during the Seminar, which frame the scientific contributions within a broader ethical, civic, and cultural horizon. These interventions reaffirm the shared responsibility of academic institutions, public bodies, and civil society in confronting destruction, safeguarding human dignity, and sustaining a collective commitment to peace, justice, and reconstruction.

SCIENTIFIC CONTRIBUTIONS

The Gaza Phoenix Recovery Framework: An overview

Yara Salem[*], Abdalrahman Kittana[*], Alessandra Gola[*]

Abstract

Developed amid the destruction of Gaza's built environment and of life, social networks, and cultural and institutional fabric, this paper introduces the Gaza Phoenix Recovery Framework as a locally led model for recovery. The framework challenges donor-driven reconstruction paradigms that have been shown to marginalise affected communities, as well as approaches that focus exclusively on the post-war period while neglecting recovery during the crisis itself. Grounded in local knowledge, engagement with local administrations, and networked interdisciplinary expertise, the framework pursues recovery by addressing simultaneously the material, social, heritage, and institutional spheres, understood as essential and intertwined components of a dignified, resilient, and just future.

Keywords

Locally led recovery, Reconstruction, Bottom-up, Local agency, Crisis-phase planning

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Background

Soon after the October 7th Israeli genocidal war on Gaza, drawing on extensive experience in conflict and post-conflict contexts, a predictable, recurring pattern could be anticipated: reconstruction would be swiftly captured by international and regional actors, while the communities most affected would be marginalised. Yet nothing could have prepared us for the scale of destruction — an annihilation unprecedented in history. Beyond collapsed buildings and shattered infrastructure, entire communities were erased, social networks obliterated, and the psychological, cultural, and social fabric of life profoundly disrupted. This magnitude of loss underscored an imperative long recognized but rarely acted upon: Palestinians must define the recovery of their own land before external actors impose visions divorced from historical, cultural, and social realities.

In response, along with a few like-minded colleagues, a small pool of initiators coming from different trajectories within international projects mobilised Palestinian experts across Gaza, the West Bank, and the diaspora to collaboratively design a reconstruction framework grounded in local agency and expertise. The resulting Gaza Phoenix Recovery Framework (hereafter, "the Phoenix") emerged from an interdisciplinary and intergenerational coalition of historians, architects, engineers, urban planners, economists, lawyers, public policy analysts, sociologists, and cultural practitioners. Their combined expertise merges technical precision with deep socio-cultural understanding, producing a recovery vision that is rigorously grounded, contextually informed, and strategically forward-looking. From the outset, professionals from Gaza's municipalities worked closely with the consortium to translate this vision into actionable strategies, ensuring that local capacities, knowledge, and

priorities shaped every aspect of the plan. The framework was formally inaugurated by Gazan municipalities in January 2025, marking a milestone in locally led, collaborative reconstruction.

The Phoenix confronts a recurrent global pattern: post-conflict reconstruction is frequently monopolised by war economies and institutional actors. As substantiated by a vast and longstanding scholarship, International agencies and NGOs often dominate funding through bloated operational structures, fragmented mega-programmes, and priorities centred on institutional visibility rather than local impact, leaving affected communities marginalised, dependent, and disempowered (Harvey & Lind, 2005; Murray Li, 2007; Chang et al., 2010; Sakue-Collins, 2021). In Gaza, where regional and international interests converge sharply, such capture threatens to transform recovery into further dispossession — not only of land, but also of memory, narrative, agency, and the capacity to determine one's own future. Therefore, the Gaza Phoenix Recovery Framework was developed on a fundamental assumption: when local communities do not lead reconstruction, rebuilding extends the violence that preceded it.

Setting a different paradigm: Rooted, dialogical, collaborative

The Phoenix was born two months into the 7th October war to respond to the instance of protection and support for Gaza's civic society. As such, from the beginning it qualified as a technical tool with no political connotation, but the defence of the essential rights of civilians and of their territory. This is the common basis necessarily shared by all contributors to the Phoenix, who join the activities as independents.

The framework rests on the determination to challenge this scenario. Amid annihilation and unparalleled destruction, the Gaza Phoenix Gaza Recovery Framework pursues recovery through restoring demonstrates theat recovery through the parallel and must restore life as decisively as it rebuilding structures. Its principles, criteria and guidelines rest on an underlying rationale that asserts that dignity, memory, and resilience are as essential as physical reconstruction, ensuring that rebuilding strengthens social cohesion, preserves cultural heritage, and safeguards institutional continuity. By integrating technical rigour with locally rooted knowledge and collaborative action, the Phoenix framework proposes a model for post-conflict recovery that is credible, transformative, dynamic, collaborative, and socially anchored, establishing a precedent for reconstruction that honours the past, safeguards the present, and shapes a just, resilient future for Gaza.

Extensive engagement with academics, professionals, youth, civil institutions, grassroots organisations, and municipal experts ensures that the framework consolidates diverse perspectives into a coherent, actionable roadmap. By embedding local knowledge and social priorities at every stage, the Phoenix transcends purely technical approaches, fostering reconstruction that is socially anchored, culturally resonant, and politically intentional.

The Phoenix was developed entirely on a voluntary basis by specialists with enduring ties to Gaza and the broader Palestinian context, hence contextually affirming that Palestinians are the most knowledgeable custodians of their land and the only legitimate authors of its future. Rejecting the notion of Gaza as a tabula rasa, the Phoenix rests on a nuanced understanding of the territory's lived history, spatial structures, cultural practices, and remaining assets, challenging externally imposed templates that erase context, undermine capacity, and replicate extractive patterns.

By including immediate wartime safeguards alongside long-term recovery strategies, the Phoenix aims to extend protection for material and immaterial heritage while destruction and violence unfold, securing, to the extent possible, the survival of urban assets and preparing the social and institutional conditions essential for meaningful reconstruction.

The Gaza Phoenix operates on a budget-0 system, with participants contributing on a wholly voluntary, non-remunerated basis, and outputs funded by contributors themselves. This working paradigm deliberately defies the dominant fund-based mechanism of projects of this kind. While the independent and non-monetary system emplaced by the Phoenix posits some limitations and challenges - from the necessarily part-time dedication of its experts, to the lack of a strong institutional backing lobbying and endorsing the plan-, the longstanding and far-reaching outcomes achieved so far estimated at around 2.000.000 EUR worth by several agencies, set a viable alternative, more accessible to smaller realities, freer from clientelisms and, especially, fairer to the local communities and their places of belonging. As such, the Phoenix offers an alternative to other contexts challenged -now or in the future- by similar crises, regardless of the extent to which the Phoenix will succeed in implementing its visions.

From the outset, the development of the Phoenix Framework followed a multi-stage, participatory process. It began with internal brainstorming meetings that established the foundational principles. These were followed by in-depth analyses of Gaza's social, infrastructural, and environmental conditions, a critical review of past reconstruction experiences, and lessons learned from relevant international models. The team also revisited pre-war municipal development plans and projects that local actors across the Gaza Strip had already envisioned.

Together, these inputs provided a comprehensive foundation for shaping a recovery framework that is both contextually grounded and forward-looking.

This process recognised early on that reconstruction in Gaza would not follow a smooth or linear trajectory. Given the settler-colonial nature of the Israeli regime of control, the extensive devastation of the built and natural environment, and the fragmentation of Gaza's social fabric, the team understood the need to move beyond ad hoc responses. Instead, the framework is built on clear principles and actionable guidelines that withstand political uncertainty and operational instability.

The central vision of the Phoenix Framework is to articulate a locally rooted, credible, and sustainable path toward Gaza's recovery. It advocates for a process that not only addresses material reconstruction but also revitalizes social, economic, and ecological life, enabling Gaza to transition toward a just and resilient future. To operationalise this vision, the plan is structured around six core planning criteria: wartime resilience, local agency and social cohesion, circularity and sustainability, productivity, mobility, and heritage preservation. These criteria emerged from iterative consultations with local planners, engineers, architects, and thematic experts, reflecting a commitment to design a pragmatic yet transformative framework.

The Phoenix rationale: Structure, principles, main aims

Building on this foundation, the Phoenix Framework envisions a roadmap for rebuilding that is organized around three interlinked stages: the emergency phase, the stabilization phase, and the long-term reconstruction and development phase. These are not conceived as isolated or sequential packages. Rather, they represent a continuum of

actions, structured to ensure that short- and medium-term interventions do not undermine long-term objectives. Seamless integration between phases is a defining feature of the plan, especially given the highly dynamic and constrained context of Gaza's political and logistical environment.

Within each phase, the framework identifies key actions across essential service sectors—such as housing, water, energy, mobility, and public health—while insisting on intersectoral coordination. For example, energy strategies are linked to waste management and environmental rehabilitation; water infrastructure is addressed in relation to sewage systems, land reclamation, and food production. These multi-sectoral intersections enlighten and shaped what the framework calls the "components" of masterplans or policies, offering planners and decision-makers an integrated toolbox for sectoral planning that aligns with broader recovery goals.

While the emergency and stabilisation phases are constructed as action-oriented frameworks focused on immediate and medium-term needs, the long-term reconstruction phase offers design- and planning-based recommendations. These outputs are conceived to be used as consultative and discussion tools rather than pre-packaged solutions. These are intended to guide urban designers, architects, and policymakers in laying the foundations for Gaza's sustainable and autonomous future.

In the long-term phase, spatial interventions are organised across four interconnected scales: the regional, urban, neighbourhood, and architectural. These scales are not treated as separate or hierarchical silos, but as a coherent and synchronised continuum of intervention, ensuring consistency from strategic territorial planning to detailed architectural design. For example, in addressing green infrastructure, the Phoenix begins at the regional scale by considering the Gaza Strip and its surrounding ecological

systems, then translates these principles into urban networks, neighbourhood-level spaces, and finally into architectural design guidelines, embedding environmental strategies across all levels of planning and design.

The structure of the Phoenix Framework document is composed of three main bodies. The first outlines the principles, methodology, team composition, and guidance for using the document. The second presents the reconstruction roadmap, divided into the three recovery stages, and includes sector-specific actions and strategies. The third comprises annexes that offer theoretical insights and extended policy recommendations for use by government actors and institutional planners.

Ultimately, the Phoenix is more than a technical document. It is a strategic, political, and institutional roadmap—one designed for use by municipal authorities, ministries, professionals, and planning practitioners engaged in the spatial and economic recovery of Gaza. It offers not just tools for rebuilding, but a vision of decolonial recovery rooted in local agency, structural justice, and long-term sovereignty.

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Reconstruction of the Gaza Strip: Water and sanitation infrastructures and services, a synthetic scenario

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Abstract

This document presents a structured, three-phase strategic framework developed by Acquedotto Pugliese for the reconstruction of the water, sanitation, and hygiene (WASH) sector in the Gaza Strip. The WASH system—encompassing Water supply, Sanitation (sewage and waste management), and Hygiene promotion—is a foundational pillar of public health and human dignity. Its near-total collapse in Gaza has created a dire humanitarian crisis.

The proposed methodology moves from an Emergency Phase—focused on rapid, temporary solutions like mobile desalination units, water trucking, and emergency sanitation to ensure survival and contain immediate public health risks—through a Stabilization and Rehabilitation Phase aimed at restoring minimum operational capacity, rehabilitating partially damaged networks, and building local technical skills via dedicated Workshop Areas. The final Reconstruction Phase adopts a long-term, systemic perspective, focusing on building a new, resilient, and efficient WASH system through the construction of modern infrastructure (e.g., desalination plants, advanced wastewater treatment), the integration of digital monitoring and smart

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control systems, and the implementation of certified quality management protocols.
The overarching goal of this phased approach is to transition from emergency response to the establishment of an autonomous, sustainable, and resilient water and sanitation system that not only restores services but also improves upon pre-conflict conditions, ensuring public health, environmental protection, and long-term community resilience.

Keywords

Gaza water crisis, Emergency sanitation plan, Infrastructure reconstruction plan

Introduction

The reconstruction of water supply and sanitation infrastructures in the Gaza Strip represents one of the most urgent and complex challenges within the broader framework of international cooperation, humanitarian engineering, and essential services planning.
The prolonged conflict has led to an almost total collapse of the WASH system, with severe repercussions on the availability of safe drinking water, wastewater treatment, public health, and environmental protection. Recent assessments document widespread destruction of water and sanitation infrastructures, a dramatic reduction in access to drinking water and a significant deterioration in environmental conditions.
The contribution developed by Acquedotto Pugliese outlines a synthetic yet operational framework of the current

conditions, proposing a structured approach for the gradual restoration of water and sanitation services. This approach is articulated into three phases - emergency, stabilization, and reconstruction - consistent with the Gaza Phoenix plan.
The recovery path of the WASH system in the Gaza Strip requires a coordinated set of targeted, progressive, and sustainable interventions. These measures include the securing of water resources and existing facilities during the emergency phase, the rehabilitation and optimization of damaged systems, along with reconstruction planning, during the stabilization phase, and the construction of new infrastructures alongside the implementation of advanced monitoring and management systems during the reconstruction phase.
Such interventions aim first to re-establish minimum sanitary safety conditions, and subsequently to build a more resilient, autonomous, and sustainable system than the pre-conflict one, through appropriate technical and technological solutions, local capacity building, and a long-term vision focused on resilience, sustainability, and self-management.

Current status of water and sanitation systems

Over the past year, the water supply and sanitation system in the Gaza Strip has experienced an almost complete collapse, with dramatic implications for public health, environmental quality, and the population's ability to sustain minimum living conditions.
The most recent data indicate that between 60% and 85% of water infrastructures have been damaged or destroyed (OCHA 2024–2025); the majority of the population receives substantially insufficient quantities of water for essential needs, with daily consumption ranging between 2–8 litres

per person, compared to pre-conflict levels of approximately 85 litres per person (UNEP 2024). Additionally, the water available is often of extremely poor quality.
Frequent blackout have further compromised the operation of pumping stations, wells, and treatment plants. Untreated wastewater is being discharged into the sea and infiltrating potentially groundwater-connected land, leading to a progressive risk of aquifer contamination and long-term environmental degradation (Abu Shomar 2024).
The analysis of existing water and sanitation networks reveals highly heterogeneous damage conditions: some areas retain partial operational capacities, while others are entirely deprived of services. Notably, 79% of WASH infrastructures are located in militarized or evacuation zones, while 91% of households have reported a significant deterioration in access to safe drinking water (GPF 2024). This spatial and functional variability necessitates a differentiated strategy that maximizes the functionality of existing assets, supplemented by mobile or temporary solutions where necessary.

Methodological approach and intervention strategy

The reconstruction of the water and sanitation sector does not merely represent a technical necessity but constitutes an essential prerequisite for restoring minimum conditions of safety, public health, and human dignity. Therefore, it is crucial to define a comprehensive strategy that encompasses the physical infrastructure, access to services, water quality, and environmental protection.
The proposed pathway integrates the principles of the Gaza Phoenix framework, adopting a time-layered methodology structured into three sequential yet interconnected phases:
1. Emergency phase (short term)

2. Stabilization and rehabilitation phase (medium term)
3. Reconstruction phase (long term)
These phases are described in detail in the following subsections.

Emergency phase (short term)

The first phase, referred to as the Emergency Phase, focuses on rapid response interventions designed to ensure population survival and immediately contain sanitary and environmental risks. The proposed actions are not intended to be structural; rather, they are conceived to be rapid, temporary, flexible, and easily adaptable to unstable logistical conditions.
In this short-term phase, the priority is to prevent and mitigate immediate risks, while ensuring minimum water supply and maintaining an essential level of service provision. It is therefore characterized by high operational intensity and low technological complexity.
A critical focus during this phase is on interventions in campsites and survival nodes, namely the areas where the population is effectively concentrated, thus ensuring adequate coverage and accessibility of available resources.
Additionally, this phase marks the beginning of a site assessment and preliminary survey of existing conditions, aimed at identifying the real needs of the population and supporting the planning of targeted interventions, transitioning from localized emergency issues to broader strategic challenges addressed in subsequent phases.

Water supply infrastructure
In the Emergency Phase, activities related to water infrastructure are primarily aimed at securing and maximizing the use of residual water sources and

infrastructures that remain operational, in order to ensure a minimum level of water availability.
To compensate for the interruption of distribution networks and the destruction of many facilities, small-scale desalination units and mobile water packaging systems are deployed. These solutions enable the production of drinking water directly on site overcoming the problem of non-functional external connections. In parallel, water trucking (tankers) becomes a fundamental mechanism for rapidly serving isolated areas or those completely lacking distribution infrastructure.
A key action involves localized leakage repair, focusing initially on primary transmission pipelines and, where feasible, on the reactivation of pumping stations powered by still functional electrical lines, so as to re-establish a minimal but vital flow of water.
In sites facing critical energy shortages, portable generators are distributed to guarantee the operation of essential water supply systems and ensure the continuity of basic services under emergency conditions.

Sanitation and wastewater management
In the sanitation sector, the strategy mirrors the approach adopted for water services: securing and utilizing what remains operational, while integrating the system with decentralized and context-appropriate emergency solutions.
In a context where no full wastewater treatment chain can be immediately restored, the partial reuse of existing networks and treatment facilities represents an essential bridging solution to ensure a minimum level of wastewater management.
In parallel, the deployment of mobile sanitations units, e.g. mobile toilets and chemical toilets, is necessary. Moreover, the realization of septic tanks and cesspits in unserved zones provides essential sanitation services to the population.

These facilities help to reduce the risk of uncontrolled discharges and environmental contamination.
Designated areas, primarily located adjacent to cesspits, are identified for the future establishment of natural wastewater treatment systems, e.g. phytoremediation systems. These sites will serve as strategic locations for sustainable, low-maintenance treatment solutions, helping to manage effluent volumes while minimizing environmental and public health risks. This solution represents a pragmatic and sustainable approach that can be rapidly implemented and is suitable for fragmented infrastructural contexts.
A critical component is the regular emptying and management of decentralized sanitation units, which is essential to contain the spread of diseases and to mitigate odours, an often underestimated but crucial element in public health protection and the habitability of emergency settlements.

Water and environmental quality monitoring
Regarding water and environmental monitoring, this phase prioritizes simplified monitoring tools and procedures, which can be effectively implemented even in the absence of full laboratory capabilities. The objective is to safeguard survival and prevent immediate health risks through fast, robust, and mobile monitoring solutions.
The mapping of water sources and preliminary classification of their quality represents the starting point for orienting subsequent interventions.
The installation of basic disinfection stations and regular monitoring of chlorine residual in distributed water are essential to prevent microbiological contamination and serve as the first steps towards fostering a quality control culture.
For wastewater, this preliminary phase includes the identification of suitable areas for future treatment plants,

ensuring an appropriate distance from potential potable water sources.
Simultaneously, systematic data collection on the quantity and quality of raw wastewater begins, providing essential information for properly shaping the technical planning for the next phase.

Stabilization and rehabilitation phase (medium term)

The second phase, referred to as the Stabilization Phase, marks the transition from emergency management to the re-establishment of minimum operational conditions of the WASH system. It represents a critical transitional stage, designed to prevent emergency arrangements from becoming permanent and to lay the technical, operational, and organizational foundations required for long-term reconstruction.
This phase aims to restore the minimum functional capacity of existing infrastructures and to create a stable operational framework. Technology begins to re-emerge as a central component, although applied through a pragmatic and context-sensitive approach.
The temporary solutions introduced during the emergency phase continue to be used, but are progressively optimized, standardized, and systematized through clear guidelines, structured maintenance, and monitoring protocols.
Throughout this medium-term phase, all essential activities initiated during the emergency, particularly within campsites and survival nodes, are preserved to guarantee continuity in the provision of basic water supply and sanitation services. In parallel, interventions are extended to slightly damaged sites, where infrastructure has sustained partial damage but can be restored through targeted and technically feasible repair operations.

A key innovation introduced during this phase is the implementation of Workshop Areas, which are dedicated facilities equipped for training, technical support, and community engagement. These areas represent the cornerstone of local capacity building, offering practical and immediately deployable skills, facilitating infrastructure maintenance, and fostering community autonomy. They also serve as preparatory platforms for the more complex and large-scale interventions planned for the reconstruction phase.

Overall, the stabilization phase combines infrastructural, organizational, and capacity-building components. The training of local personnel becomes a fundamental element: it enhances awareness of public health risks, strengthens operational and management capacities, and ensures that rehabilitated and newly developed infrastructure can be operated safely, efficiently, and sustainably in subsequent phases.

Based on the surveys and assessments conducted during the emergency phase, this stage also involves the planning and design of reconstruction interventions, ensuring that long-term efforts are based on a technically robust, context-appropriate, and operationally coherent foundation aligned with real population needs.

Water supply infrastructure

Interventions focus on the rehabilitation of both transmission and distribution pipelines, wherever damage is partial and restoration is technically feasible. This approach aims to progressively re-establish hydraulic continuity and functional connectivity across the network, enabling at least a minimum level of service provision.

A strategic priority is the recovery and reactivation of existing desalination plants. Their restoration not only increases the availability of drinking water, but also gradually

reduces reliance on mobile solutions and water trucking, shifting from emergency-based provision towards more stable and semi-autonomous production systems.
In parallel, efforts are directed towards the reactivation of pumping stations, frequently inoperative due to energy shortages or structural damage. The restoration of these facilities is critical to ensuring the minimum required pressure and enabling continuous water flow, particularly towards peripheral and structurally disadvantaged areas.
The small-scale desalination units, mobile water packaging systems and water trucking (tankers) continue to be employed.

Sanitation and wastewater management
The rehabilitation of damaged networks and treatment facilities aims to re-establish more controlled wastewater management cycles, thereby reducing sanitary and environmental risks.
Temporary solutions, such as mobile toilets and septic tanks, continue to be employed; however, they are now implemented in a more regulated and integrated manner, supported by periodic maintenance and standardized operational procedures.
The introduction of phytoremediation systems represents a significant step forward in sustainable wastewater management, enabling the treatment of a portion of effluent using low-cost, low-maintenance natural systems.
Finally, the remediation of contaminated areas is a crucial intervention to mitigate the environmental risks accumulated during the emergency phase.

Water and environmental quality monitoring
With regard to water and environmental quality monitoring, this phase represents a transition to a more technical and structured level of management. The establishment of a

network of laboratories, the development of standardized procedures to ensure water quality during the rehabilitation of networks, and the training of specialized personnel constitute the foundational elements of a modern, autonomous water quality control system.
During this phase, a stable organizational framework for water quality monitoring is established, and technical procedures are defined for both potabilization and desalination processes.
Regarding wastewater management, support processes are introduced to enable the operation of treatment plants, the implementation of laboratories to enhance analytical capacity for these facilities, and the definition of technical procedures for monitoring wastewater treatment processes.
The overarching objective of this phase is to facilitate the transition from emergency management to the structural recovery of the system, establishing the technical and operational foundations necessary for longer-term, sustainable reconstruction interventions.

Reconstruction phase (long term)

The third phase, referred to as the Reconstruction Phase, adopts a systemic and forward-looking perspective. The focus is no longer on repair and stabilization, but on the construction of a new WASH system that is more resilient, autonomous, and efficient.
During this phase, damaged water and sanitation infrastructures are rebuilt, new facilities are constructed, and technological innovation, digitalization, energy efficiency, and environmental sustainability are systematically implemented.
The deployment of advanced solutions and digital monitoring systems enables more effective network

management, ensuring continuity, reliability, and service quality.
Thus, this phase embodies a vision oriented towards resilience and sustainability, in which the water and sanitation system not only recovers but becomes stronger, more autonomous, and more stable than before.
While previous phases focused initially on small centres and then on progressively larger areas, interventions during this phase are aimed at the renewal and modernization of the entire regional urban context, establishing the foundation for long-term development and sustainable management of water resources.

Water supply infrastructure
The enhancement or construction of new desalination plants represents a strategic choice, given the fragility, overexploitation, and frequent salinization of the coastal aquifer.
Furthermore, the identification of new autonomous water sources constitutes a step towards the diversification of supply, thereby enhancing autonomy in water supply and reducing the system's vulnerability to future crises or supply interruptions.
The construction of new transmission and distribution infrastructures offers the opportunity to redesign networks that are more resilient and better integrated with the remaining functional portions of the existing system. This phase incorporates principles of redundancy and flexibility, enhancing the system's capacity to adapt to and withstand critical events.
The introduction of advanced monitoring and control systems, based on sensors, telemetry, and smart control platforms, marks the transition towards an evolved management model, enabling continuous monitoring of

water quality, flows, network pressures, and infrastructure condition.

Sanitation and wastewater management

In the wastewater and treatment sector, existing facilities are modernized, integrating more efficient and lower-energy technologies that are compatible with local conditions. At the same time, new treatment plants can be constructed, designed to accommodate anticipated population growth and equipped with advanced treatment systems.

The completion of primary and secondary networks enables the elimination of uncontrolled discharges and restores the continuity of the sewerage cycle.

Within this framework, the agricultural reuse of treated wastewater, managed through risk-based approaches, represents a strategic measure, both for the recovery of non-conventional water resources and for its contribution to food security and community resilience.

Water and environmental quality monitoring

In the monitoring sector, the transition to ISO 17025-certified laboratories consolidates analytical capacity and ensures the reliability of water quality controls. The integration of laboratory analyses with real-time sensor data enhances the ability to anticipate, prevent, and respond to contamination events.

The development of a marine and inland water monitoring programme is essential to assess long-term environmental impacts and to guide evidence-based policies and protection interventions.

During this phase, water quality resilience is strengthened through the implementation of a Water Safety Plan approach, which enables the management of risks throughout the entire water cycle, from source to point of use.

With regard to wastewater, the upgrade of treatment facilities with advanced technologies is supported, alongside the implementation of an integrated environmental quality assessment plan (covering marine, freshwater, and soil), combined with a risk-based approach to the agricultural reuse of treated wastewater, in accordance with international best practices.

Conclusions

The reconstruction of the water and sanitation system in the Gaza Strip constitutes a complex multi-layered process that requires an integrated and phased approach. Overall, the three phases outline a coherent and well-structured pathway that progressively addresses different levels of need: from immediate emergency response, through operational stabilization, to innovative long-term development. This represents a scalable and adaptable model, combining technical pragmatism, environmental sustainability, and the strengthening of local capacities.

The proposed actions - from restoring essential infrastructure, to deploying simple and reliable technologies, and ultimately implementing advanced monitoring and management systems - aim to reduce health risks, improve water quality, protect the environment, and ensure service continuity. Equally important are local workforce training, the dissemination of technical skills, and the adoption of standardized procedures, which are essential for building a system that can operate autonomously and sustainably.

Looking ahead, the reconstruction provides an opportunity to rethink the WASH sector according to the principles of resilience, sustainability, and equity. By strengthening local capacities, introducing appropriate technological innovations, and integrating physical infrastructure with

management systems, it is possible to transition from a survival-based model to one of stable long-term development, ultimately improving living conditions for the population, safeguarding the environment and ensuring autonomy.

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Empowering Gaza through solar energy: A scalable humanitarian framework for electricity and water security

Massimo La Scala*

Abstract

This paper presents a framework for providing rapid humanitarian relief of Gaza's critical electricity and water crises through solar energy deployment. With a population density exceeding 6,000 inhabitants per km² and approximately 90% of electricity infrastructure damaged post-2023, Gaza faces severe shortages affecting 2.2 million people. The study demonstrates that Gaza's abundant solar irradiation offers a viable solution through scalable photovoltaic microgrids.

A phased implementation strategy is proposed, beginning with mobile emergency systems and progressing to community-scale microgrids serving approximately 100 households each. These systems integrate solar generation (70-80 kWp per microgrid), battery storage, and solar-powered desalination to address both electricity and water needs simultaneously. The framework employs demand-side management through "electric springs" technology, using water desalination as a flexible load to optimize battery utilization. Preliminary estimates indicate that basic electricity and water needs could be met for a pre-war population through a feasible investment. This decentralized approach offers enhanced resilience, local maintenance

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capacity, and potential integration with future centralized infrastructure, while providing immediate humanitarian relief.
The modular nature of available microgrid technology makes it highly scalable, enabling the development of urban environments with elevated living standards once the emergency has passed.
This article is based on the author's presentation "Empowering Gaza: A Humanitarian Appeal for Power and Water Through a Scalable Solar Energy Vision" (Workshop "Framework Gaza Phoenix" organized by Politecnico di Bari, Bari, 16 July 2025). The rapid and severe evolution of the crisis in the area may have changed some data reported here as presented at the date of the meeting.

Keywords

Solar microgrids, Humanitarian infrastructure, Renewable energy communities

Gaza's humanitarian crisis: Infrastructure as a battleground

The Gaza Strip represents one of the most extreme cases of humanitarian distress in the contemporary world. Years of blockade, recurrent military operations, and structural underinvestment have progressively eroded basic infrastructures. Electricity and water systems—cornerstones of public health, economic activity, and human dignity—are no longer able to meet even minimal needs. The crisis is not episodic but systemic, deeply embedded in Gaza's demographic pressure and geopolitical isolation.

With a pre-war estimated population of 2.2 million people living in an area of only 365 km², Gaza's population density exceeded 6,000 inhabitants per square kilometre, ranking among the highest worldwide. Such density magnifies the consequences of infrastructure failure: when electricity stops, hospitals, water pumps, sewage treatment plants, and communication systems collapse simultaneously.



Figure 1 - Urban overview of Gaza strip (2025)

Table 1 - Demographic and energy context of the Gaza strip (2025)

Indicator	**Value**
Population (2025 estimate)	≈ 2.2 million
Area	365 km²
Population density	≈ 6,000 inhabitants/km²
Electricity access	< 45% of daily needs met
Daily power outages	12–20 hours/day
Average household consumption (2025)	≈ 50 kWh/month

The electricity system: Chronic deficit and war-induced collapse

Gaza's electricity system has long operated under chronic deficit. Prior to the latest conflict escalation, electricity supply relied on imports from Israel (approximately 120 MW) and Egypt (around 30 MW), supplemented by a local power plant nominally rated at 60 MW but rarely operating at full capacity. In the pre-war period 12-15 MW photovoltaic capacity was also available. Even in times of relative stability, demand consistently exceeded supply.

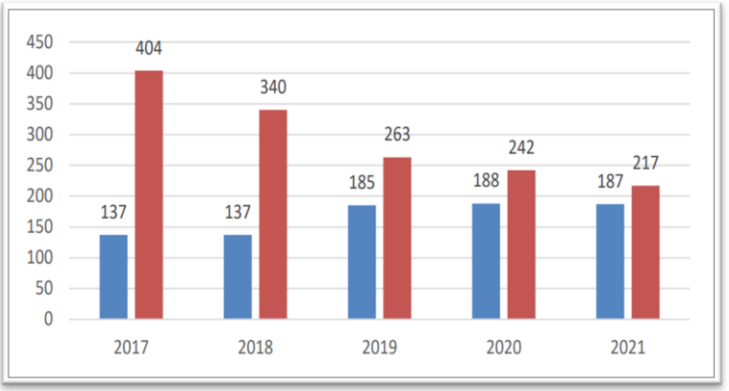


Figure 2 - Average daily electricity supply (blue) versus estimated demand gap (red) in Gaza (GEDCO data, 2017–2021).

In Figure 2, the persistent demand gap in the pre-war period highlights the structural inadequacy of the centralized electricity provision. Drawing on data from GEDCO (the local utility), it can be observed that the fuel entry ban worsened the electricity crisis in Gaza, in 2017 supply-demand gap can be estimated at ~ 75%, GEDCO supplied only 4 hours/day of electricity whereas the Energy demand exceeds 540 MW (peak at night). It can also be observed

that the demand and, consequently, the demand gap reduced in the period 2017-2021 but it can be likely due to an economy which deteriorated and a steadily increase of the utilization on Renewable Energy Resources (RES) during years.

Following October 2023, the situation deteriorated dramatically. According to UNDP estimates, approximately 90% of Gaza's electricity grid infrastructure has been damaged (2025). Fuel import restrictions further reduced the operational capacity of the Gaza Power Plant to less than eight hours per week, while supply through Egyptian lines was intermittently suspended.

Water insecurity and the energy–water nexus

Water scarcity in Gaza is inseparable from the electricity crisis. Water extraction, pumping, treatment, and desalination are all energy-intensive processes. Without reliable electricity, water systems fail, leading to widespread contamination and public health risks.

Gaza's water supply has been unstable for decades, with ongoing strain affecting water quality, reliability, and acceptability.

- In 2022, 76% of Gaza's water supply came from groundwater and surface water sources.
- That same year, Gaza produced only 9.6 million m^3 of desalinated water, with plans for significant increases through new central desalination plants.
- Only 4% of Gaza's population had access to safe, clean drinking water even before October 7, 2023.
- Average daily water consumption in 2022 was 85.7 liters per capita in Palestine, 86.4 l/c/d in the West Bank and 84.6 l/c/d in Gaza.

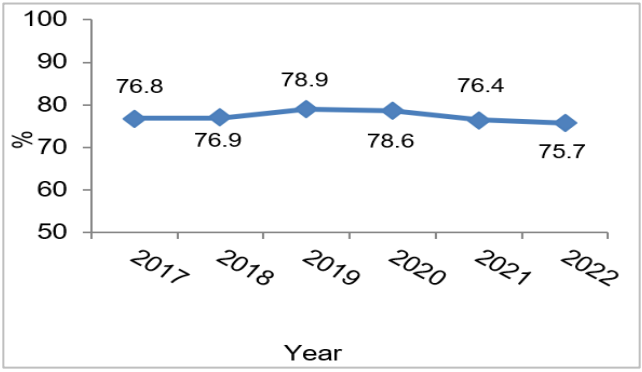


Figure 3 - Composition of Gaza's water supply prior to the conflict (2022). Groundwater and surface water percentage.

Even before the 2023 conflict, only 4% of Gaza's population had access to safely managed drinking water. Groundwater and surface water dominate, despite severe overexploitation and contamination.
Post-war assessments indicate that up to 95% of available water is now unfit for human consumption, while approximately 70% of water infrastructure has been damaged or destroyed.

Solar energy potential in Gaza

Despite widespread destruction, Gaza retains a critical natural resource: abundant solar energy. Average solar irradiation is approximately 5.5 kWh/m²/day, making photovoltaic (PV) generation a technically sound and geographically appropriate solution. The Specific Photovoltaic Power Output is 1833 kWh/kWp (Figure 4).

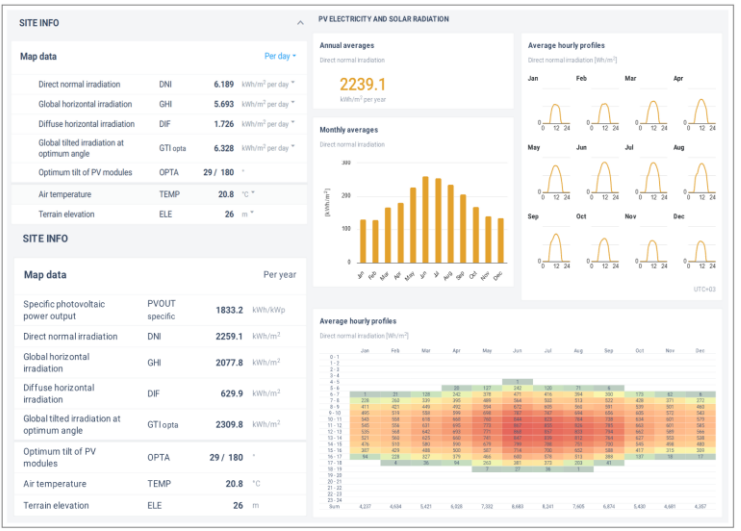


Figure 4 - Site photovoltaic electricity production and solar irradiation (source: https://globalsolaratlas.info)

The great availability of solar energy makes it possible to imagine widespread exploitation of photovoltaic energy, which integrated with storage systems and truck/disseminated generation units would make it possible to generate electricity throughout the day.

The distribution of generation sources throughout the territory would make it possible to create microgrids comprising small generation units, utilities and desalinators.

Land scarcity poses challenges, but Gaza's dense urban fabric offered before the war an extensive rooftop space. Estimates indicate that if only 5% of pre-war existing rooftops could be utilized, making available over 18 km² for PV deployment—sufficient to sustain the basic needs of the pre-war population.

Several solar projects, implemented before the conflict, demonstrated the feasibility of decentralized renewable

energy. In 2018, UNDP-supported installations in hospitals providing critical services and reducing the dependence on diesel generators.

Table 2. Solar photovoltaic installations in selected Gaza hospitals

Hospital	Installed PV Capacity (kWp)	Supplied Function
Beit Hanoun Hospital	20	Laboratory
Al-Aqsa Hospital	25	Laboratory
Najjar Hospital	20	Laboratory
Emirati RC Maternity Hospital	20	Laboratory

Microgrids: A scalable gradual deployment

Some short-term emergency solutions to alleviate electricity and water scarcity can be envisaged based on Solar Microgrids with "Energy Backpacks" for Refugee Camps,



Figure 5 - Some mobile photovoltaic systems to provide emergency power supply.

namely:

- Mobile microgrids, including small solar arrays that

charge backpack batteries and trolley-mounted solar generators, can be quickly deployed to high-need areas such as hospitals and shelters.

- Displaced families can carry power to their tents/camps.

To produce water, it is possible to install mobile and decentralized Water Supplies Solution for War-Torn Areas such as Trolley-mounted units which can be moved to high-need zones (hospitals, shelters, near refugee camps) or away from conflict hotspots.

Furthermore, due to restrictions on importing heavy machinery and fuel into Gaza, low-tech solutions based on evaporation or small solar power units offer a practical solution allowing community-owned maintenance, implementing modular designs and employing local abilities and competencies.

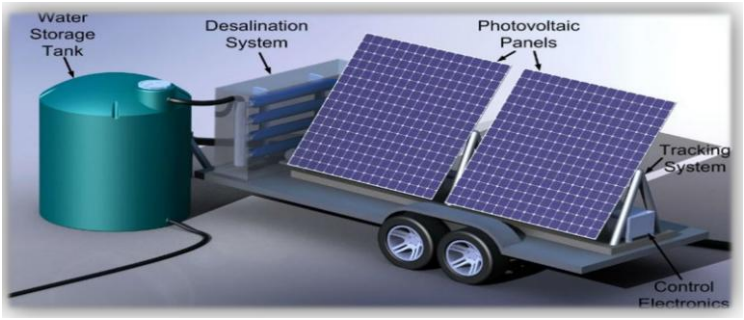


Figure 6 - Trolley-mounted solar desalination units

In the medium and long-term, a microgrid based solution can provide a gradual and scalable deployment plan of solar technology.

The application of Multiple Microgrids embedded in a distribution grid introduces the vision of a disseminated electricity production based on modular and scalable entities characterized by a high reliability, resilience and better decentralized maintenance.

In a recent project, financed by the Ministry of the University (PRIN 2022), the concept of multi-microgrid (MMG) as a structure composed by several MGs, distributed generation units, and controllable loads has been proposed for Europe as a new paradigm to develop urban clean electrification ensuring sustainability through RES, reliability through storage and flexible loads, resilience due to a modular and distributed infrastructures. It has been shown that the approach is effective when starting from scratch in urbanization, but it can also work envisioning a community of MMG embedded in an existing interconnected distribution system allowing the clean electrification of services such as illumination, heating/cooling, transportation, etc. Remote villages, small islands and humanitarian emergency areas can get effective solutions from this technology.

Beyond individual microgrids, interconnected MGs can form Renewable Energy Communities (RECs). Such configurations allow energy sharing, adaptive reconfiguration, and enhanced resilience also in the case of infrastructure damage. Each REC can support communities in need by adjusting its generation or ownership boundaries to redistribute power flows, either to compensate for lost generation or to integrate new areas. Optimal Network Reconfiguration (ONR) functions enable the system to find new topologies to reconnect loads and generation in case of faults or loss of lines and generation.

ONR goes beyond identifying reclosure paths.

In operation, it offers a complete network reconfiguration ensuring power balance satisfying security constraints. Using smaller, distributed generating units instead of large, centralized plants enhances system adaptability and resilience, allowing critical loads to be supplied by remaining operational units during outages. Furthermore, this approach can provide restoration and black start strategies

for interconnected systems after a blackout, increasing the overall resilience of the system. As an example, a MG controller can be designed to allow the shift from grid-connected to islanding mode, and conversely, without requiring a centralized control structure for reconfiguration. In planning ONR enhances system reliability also during the building phase of the infrastructure making it adaptive, modifying the energy paths as the construction proceeds. Each area can be viewed as a collection of microgrids forming Renewable Energy Communities (RECs), aimed at sharing energy for mutual support. These interconnected renewable energy systems (RES) can evolve as new structures are built or existing ones are enhanced, allowing the network to adapt and grow over time.

MG technology is ready, numerous control methodologies have been presented in the literature and even technical standards and guidelines are available at this time such as IEEE 2030, a standard and a Guideline for implementing smart grids, developing functions for the Microgrid controller, etc.

In these notes, a very preliminary assessment, without any claim of accuracy, is proposed in a humanitarian energy framework to provide first aid to Gaza during the power system reconstruction. The situation is in rapid development and more reliable data are needed for a more accurate feasibility study. However, the following preliminary example is introduced just to illustrate some ideas and stimulate a discussion on that issue.

It has been assumed, as an example, that modular solar microgrids serve approximately 100 households each. Of course, better optimization can be obtained considering more accurate and updated data and analyses will be available. These systems integrate photovoltaic generation, battery storage, and demand-side management with a solar capacity of about 40-50 kWp and 400-500 kWh storage to

ensure very basic needs (less than 2kWh per household, 60 kWh/month). In recent years, it should be considered that household consumption dropped from 200–300 kWh/month to 50 kWh/month according to the Palestinian Central Bureau of Statistics (PCBS), thus the assumption adopted here is about reconstituting a minimum level of quality of life ensuring very basic needs for humanitarian purposes. New updated data is necessary to improve this preliminary analysis after the military events of the last years.

Table 3. Vision of a possible first deployment of microgrids

Phase	Microgrids (100 homes each)	People Covered	% of Gaza (Population)	Total Cost
Phase 1 (Pilot)	200	~ 110,000	~ 5%	~ 40 M$
Phase 2 (Mid-scale)	800	~ 450,000	~ 20 %	~ 160 M$
Phase 3 (Wide rollout)	1900	~ 1,100,000	~ 50 %	~ 400 M$

It should be considered that total cost reflects market costs not considering difficulties due to the political and military crisis.

Nevertheless, with all the limitations of such very preliminary analysis, we can assess that not a very big amount of money is needed to provide basic needs and first help.

Of course, given the decentralized infrastructure the capacity and storage per microgrid can be gradually increased providing better comfort and supplying more advanced needs.

The infrastructure so built can successively be considered as a community of MGs embedded in an eventual interconnected power system after that the reconstruction is completed, providing more electrical services, capacity and reliability.

Finally, it should also be considered that in Europe the first mass deployment of photovoltaics is close to the end of the

20-year-old lifecycle and it can be replaced on the same surface with double the capacity possible at the time they were installed. This opens the possibility of a second life for the photovoltaic panels of the first generation which lost about 20 % of their initial efficiency but they can be still operated for years. They could be used for humanitarian purposes in the first phase of the reconstruction to supply energy to a large population in a short time, perhaps cutting costs. New regulations on the second-life of used PV plants for humanitarian purposed needs to be developed.

A synergy between photovoltaic resources and water: Solar-powered desalination and water security

Synergy can be obtained by the dual production of electricity and drinking water.

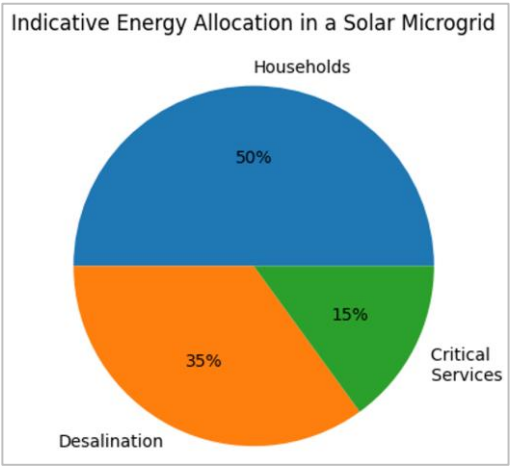


Figure 7 - Indicative allocation of electricity within a community-scale solar microgrid, balancing domestic consumption, water production, and critical services.

Let us consider an indicative allocation of energy needs which can be satisfied by a local solar microgrid.
Water desalination and distributed storage of water together with electrochemical storage and microgrid technology can provide a useful way to store energy (in the form of produced water) when there is an excess of RES production while ensuring flexibility and demand-response by curtailing desalinization when other critical services need to be supplied.
This approach can be useful to reduce the capacity of the electrochemical batteries (BESS -Battery Energy Storage System).
Why is this relevant?

- BESSs are quite expensive, so, their optimal sizing is crucial;
- in small islanded microgrids with limited generating capacity, regularly charging an oversized storage can be challenging,
- a frequent and regular charging/discharging of batteries can impact their lifespan
- and chemical risks and environmental concerns are connected to their final disposal.

A viable solution can be provided by Electric Springs applied to water desalination plants. In few words, a smart demand-side power management approach is assumed considering water production not as a critical load since it can be easily stored in tanks when solar power is in excess.
Critical loads may include Health care facilities, Hospitals, Data centers, Communication infrastructures whereas non critical ones may include, as said, Water desalinization, but also Induction cookers, heating systems, refrigerators, air conditioning, etc.

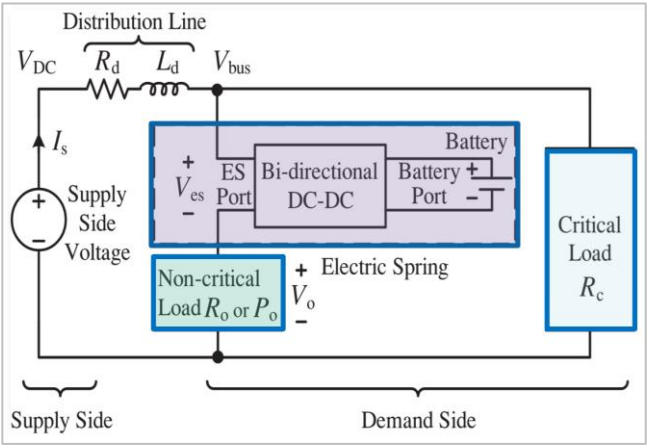


Figure 8 - Indicative scheme for an electric spring through power electronics

According to WHO guidelines, basic human needs require 7–20 liters of water per person per day, while the United Nations considers 50–100 liters essential for dignified living. Meeting even minimum requirements in Gaza necessitates large-scale desalination perhaps supported by renewable energy.

Small-scale Seawater Reverse Osmosis (SWRO) plants typically require 8–9 kWh/m³, while large-scale facilities can reduce consumption to approximately 3 kWh/m³ as demonstrated by some plants in the area, namely: Taweelah (Emirates), and Jubail 3A (Saudi Arabia the first PV powered large plant).

Solar-powered desalination plants integrated into microgrids through the electric spring approach can operate as dispatchable loads, enhancing overall system flexibility.

Let us make a very preliminary assessment. Meeting very basic water needs (20 liters/person/day) requires around 40,000 m³/day per a population as Gaza strip (pre-war).



Figure 9 - A pictorial representation of a seawater reverse osmosis desalinization plant.

Small-scale desalination plants can produce this volume using approximately 360 MWh/day. Energy demand can be met by about 70 MW peak power photovoltaic (PV) systems. 1/3 less is needed in the case of large-scale plants.
Even the first figure is possible with small and decentralized desalinization plants.
This peak power can be shared among the MGs associated to 100 households each serving about 500 persons with a basic need of 10 m^3/day of water which requires about extra 18 kWp per microgrid. Consequently, a MG with a capacity of about 70-80 kWp can provide basic electricity and water needs for about 100 households and, in emergency conditions, constitute the fundamental module for a decentralized production of both these essential goods.

Conclusions

Gaza's electricity and water crises illustrate how infrastructure has become a frontline humanitarian issue.

In these notes, an incitation to provide practical and easy-to-install solutions to provide immediate aid to critical areas under emergency conditions is proposed. Solar energy, abundant in Gaza area, offers a realistic, scalable, and resilient pathway to restore essential services.
Available microgrid technology, with its modularity, is prone to a scalability which can lead to the development of an urban environment characterized by high life standards when the emergency has got over.
Decentralized photovoltaic systems, microgrids, and solar-powered desalination cannot resolve a political conflict, but these technologies can provide rapid aid, create a cooperating community aware of energy and sustainability issues and start restoring hope.

Acknowledgement

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Sustainable seawater desalination in marine protected areas: Modelling and monitoring activity

Michele Mossa[*], Diana De Padova[*]

Abstract

This manuscript presents numerical simulations of the discharge from a desalination plant planned within a Marine Protected Area characterized by increasing freshwater demand. The modelling activity investigates the potential impacts of brine release on the coastal marine environment, with the aim of supporting environmentally sustainable design solutions. The proposed system adopts mitigation strategies based on the mixing of brine with treated wastewater, allowing the assessment of different dispersion scenarios under representative winter and summer hydrodynamic conditions. Results indicate that salinity variations remain limited and largely confined near the seabed, suggesting negligible effects on sensitive benthic habitats. The study highlights the role of green desalination solutions, supported by numerical modelling, as an effective approach to reconcile local water supply needs with the conservation of marine ecosystems in protected coastal areas.

Keywords

Marine protected area, green desalination, brackish water, sustainable water management

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Introduction

Climate change is profoundly disrupting historical precipitation patterns, altering the global distribution of water and reducing the reliability of traditional storage solutions such as dams, lakes, and underground reserves. These shifts are expected to intensify droughts and complicate the sustainable management of the world's freshwater resources, further destabilizing already imbalanced reservoirs and leading many regions to severe water shortages. Simultaneously, population growth, industrialization, and rising living standards are increasing water demand, while Earth's freshwater resources continue to dwindle.

Freshwater scarcity has thus emerged as one of the most pressing global challenges, particularly in arid and semi-arid regions with limited natural resources. According to Soni et al. (2025), approximately 66% of the global population experiences water shortage for at least one month each year, and many models forecast a sharp increase in freshwater scarcity in the near future due to longer drought periods, excessive freshwater withdrawals, and seawater intrusion that salinizes coastal aquifers.

To address these challenges, alternative and climate-independent water sources are essential for sustainable development. Desalination has become a practical and increasingly widespread solution to supplement traditional supplies, providing clean water in regions where natural sources are insufficient or overexploited. As an almost unlimited and climate-resilient resource, seawater desalination extends water availability beyond the constraints of the hydrological cycle, particularly benefiting

coastal communities. Reflecting this potential, unconventional water resources—chiefly seawater desalination—have been recognized as critical for achieving the United Nations Sustainable Development Goal 6 (SDG 6): "Ensure availability and sustainable management of water and sanitation for all" (Ayaz et al., 2022).

In the past few decades, the global capacity of plants has expanded exponentially, surpassing 19,000 facilities by 2020 and producing around 99 million cubic meters of freshwater per day (Jones et al., 2019). However, this growing reliance on desalination raises concerns regarding the environmental impacts of brine disposal on marine and coastal ecosystems. Nevertheless, this practice generates dense hypersaline plumes that settle and spread along the seabed, altering the physical and chemical characteristics of receiving waters. Such changes can degrade water quality, affect local fisheries, and harm benthic organisms adapted to stable salinity conditions (Lattemann & Höpner, 2008).

To mitigate these impacts, desalination plant and outfall designs must be tailored to the local marine environment through comprehensive preliminary studies that assess hydrodynamics, wave conditions, and water quality. Mathematical modeling is often employed to predict brine dispersion, optimize outfall configurations, and minimize environmental harm (Roberts et al.; 2010; Palomar & Losada, 2011). Proper planning and advanced design methodologies are therefore essential to reduce ecological risks while ensuring a sustainable water supply. The desalination industry faces the dual challenge of producing new freshwater resources without increasing pressure on marine ecosystems and contributing to groundwater conservation (Hoepner, 2019).

Recently, research has explored alternative intake sources, such as coastal springs with relatively low salinity levels that require minimal desalination (De Serio et al., 2025). This

innovative approach offers multiple advantages: it circumvents technical issues such as shell clogging, suspended solids from seasonal currents, and membrane fouling; it substantially reduces the environmental footprint of brine discharge. The resulting effluent has much lower salinity, lessening stress on marine organisms, preserving the natural salinity gradient crucial for coastal ecosystems, and improving local biodiversity and dilution capacity. Consequently, this approach aligns closely with sustainable marine management principles and the goals of the United Nations Sustainable Development Goal 6 (SDG 6).

This study evaluates the case of the Tremiti Islands Marine Protected Area, which is affected by chronic potable water scarcity. Periodic crises occur when the submarine pipeline linking the islands to the mainland water supply network experiences failures. During such events, freshwater must be transported by ship from the mainland, highlighting the critical need to develop local, self-sustaining, and climate-resilient freshwater production systems. The present work aims to assess the environmental implications of brine discharge from a potential desalination plant in the Tremiti Archipelago, seeking to balance the demand for alternative water sources with the preservation of marine and coastal ecosystems.

Materials and Methods

Study area

The focus of this study is the Tremiti Islands Archipelago, located in the Adriatic Sea off the northern coast of the Gargano Promontory (southern Italy), approximately 12.5 nautical miles from the nearest mainland point at Torre Mileto. This small archipelago consists of the islands San

Nicola, San Domino, Capraia, and the islet of Cretaccio. The islands are aligned along a northeast–southwest (NE–SW) axis and are separated from each other by only a few hundred meters.

Since 1989, the Tremiti Islands have been designated as a Marine Protected Area (MPA), within which three management zones have been established (Fig. 1).

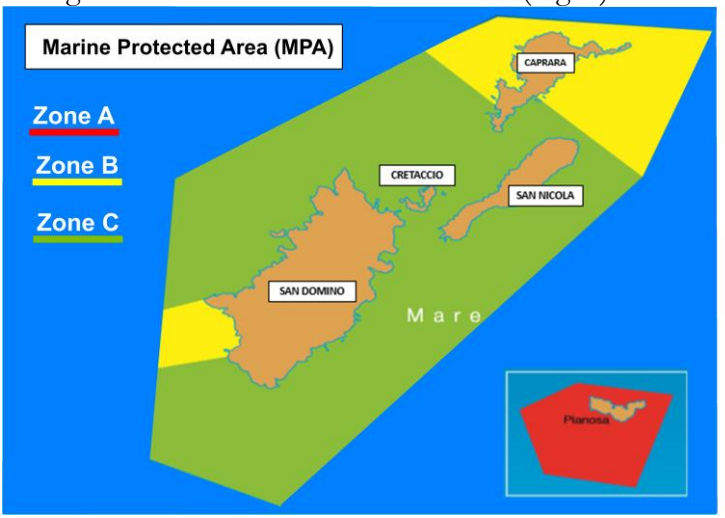


Figure 1 - Target area: Marine protected area.

The marine environment of the Tremiti Islands is considered one of the most ecologically valuable and scenic ecosystems of the Mediterranean Basin, often described as a true "underwater sanctuary." Scientific studies have identified 17 distinct habitat types and associated benthic assemblages that characterize the seafloor within the Marine Protected Area (Chimienti et al., 2020, 2021; De Padova et al., 2024).

From 2003 to 2016, the Tremiti Islands experienced a paradox: surrounded by the sea yet forced to rely on tanker ships for their water supply (Fonzi, 1984). For years, a direct connection to the mainland has been under discussion: an underwater pipeline approximately 22–25 kilometers long,

capable of supplying up to 2,000–3,000 cubic meters per day. This would be a stable, low-maintenance solution, but the risks of anchor damage, strong currents, and significant impact on the seabed have so far hindered any project. In Italy, islands have addressed this issue using two main models: underwater pipelines or desalination plants. The choice depends on distance, seabed conditions, and environmental constraints (Giacomelli & Baldi, 2023; Parada et al., 2023).

Today, the most feasible solution for the Tremiti Islands is represented by a modular reverse osmosis desalination plant on San Nicola Island, funded by the PNRR. It is a small plant with a capacity of 12 l/s, designed to serve only the archipelago's inhabitants. Funded under the PNRR "Green Islands" initiative, it is conceived as both a solution for local needs and a pilot model for other minor islands or isolated coastal communities.

Habitat mapping

The study of the seabed characteristics and benthic communities potentially affected by the discharge from the desalination plant was undertaken in the area of the existing wastewater treatment plant outfall. Six video transects were planned and conducted using the ROV Ageotec Perseo aboard the vessel Kiya (Fig. 2).

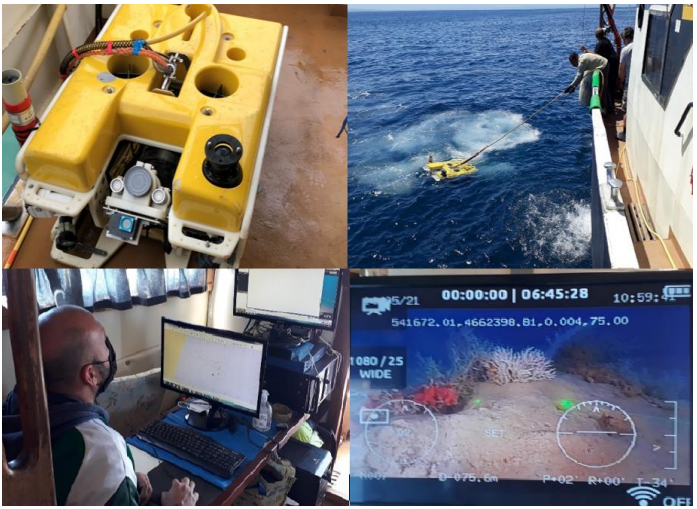


Figure 2 - Tools and instruments used.

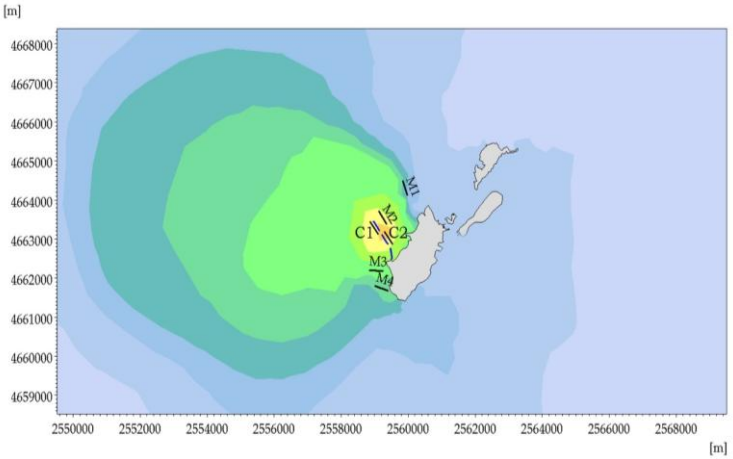


Figure 3 - Transects carried out for the study of the seabed (C1, C2, M1, M2, M3, M4) and the benthic communities that will be affected by the discharge from the desalination plant.

Two transects (C1 and C2) were aligned with the outfall, one offshore and one onshore, while the remaining four (M1–

M4) were executed on adjacent seabeds following a cross-shore pattern (Fig. 3).

Numerical model and implemented runs

The aim of the modeling activity carried out in this study was to analyze using the 3D numerical model MIKE 3 Flow Model FM provided by the Danish Hydraulic Institute (DHI, 2016), the wave and current regime, as well as the dispersion process of the waters discharged from the desalination plant's submarine outfall.
The MIKE 3 FM HD model is based on the numerical solution of three-dimensional incompressible Reynolds-averaged Navier–Stokes equations, subject to the assumptions of Boussinesq and of hydrostatic pressure. Consequently, it solves the conservation equations for mass, momentum, temperature, and salinity, as well as the turbulence closure equation. Using a sigma-type vertical coordinate system, it accounts for variations in the free surface, and the model employs an unstructured computational mesh to ensure maximum flexibility in representing complex geometries. In order to achieve fine resolution in the area of interest, allowing for the visualization of local circulation, a coarse mesh was used in the region of deep waters and appropriately refined near the coast of the Tremiti Islands for domain discretization. The nodes of this mesh represent the calculation points of the model. Vertical discretization in the model is carried out using the so-called sigma layers, which follow the terrain's variations, ensuring a constant number of calculation points along each vertical (Fig. 4).

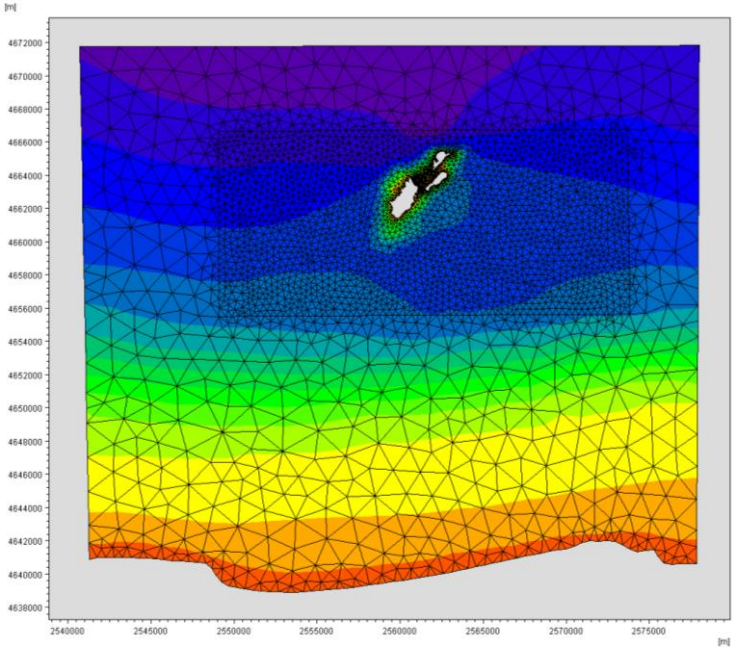


Fig. 4: Computation domain used for numerical simulations.

Simulations were executed by adopting a Smagorinsky coefficient (Cs), a seabed roughness and a wind drag coefficient (Cd) equal to 0.6, 0.1 m and 0.002 respectively, according to recent sensitivity analysis, and a wind drag coefficient Cd equal to 0.002, based on earlier studies (Armenio et al., 2016, 2017a, 2017b, 2018a, 2018b; 2019; De Padova et al., 2023, 2024).

Two seasonal mean circulations were generated, respectively, for winter and summer, to evaluate the diffusion process of groundwater under typical seasonal conditions and thus within more limited time intervals and with more distinct forcings. Specifically, the hydrodynamic module of the model was driven by three different inputs: a homogeneous and steady wind field, a semi-diurnal tidal motion and wave motion.

For the average winter condition, the input consisted of a wind field that was representative of the season, namely a wind coming from the NNO with an intensity ranging from 11 to 17 knots, estimated to be an average of 7 m/s. This homogeneous and steady wind field in space was imposed for the entire duration of the run (i.e., 7 days, ensuring a stationary condition is reached). This generates average current patterns, which can naturally be modified by intense but brief transient events, and then return to the representative average condition.
For the average summer condition, the input consisted of a wind field that was representative of the season, namely a wind coming from the ONO with an intensity ranging from 7 to 11 knots, estimated to be an average of 4.5 m/s.
The representative values of radiation stress for the average winter and summer conditions were the output of the MIKE 21 SW wave model. Specifically, the representative wave motion for the winter condition, as reported in the Regional Coastal Plan for Apulia, is defined by a direction of 336° NW.
The representative wave motion for the summer condition, as reported in the Regional Coastal Plan for Apulia, is defined by a direction of 333° NW.
The tide, considered to be generally invariant between winter and summer periods, was imposed as a variation in the free surface along the open boundary of the domain. It is of a semi-diurnal type, characterized by an amplitude of 0.15 m (height 0.30 m) and a period of 12 hours.
Two scenarios were analyzed under both average winter and summer conditions to evaluate the effectiveness of mixing the brine with the treated wastewater discharged through the existing outfall system at the outfall point (2559009.934E 4663240.072N) (Fig. 5).

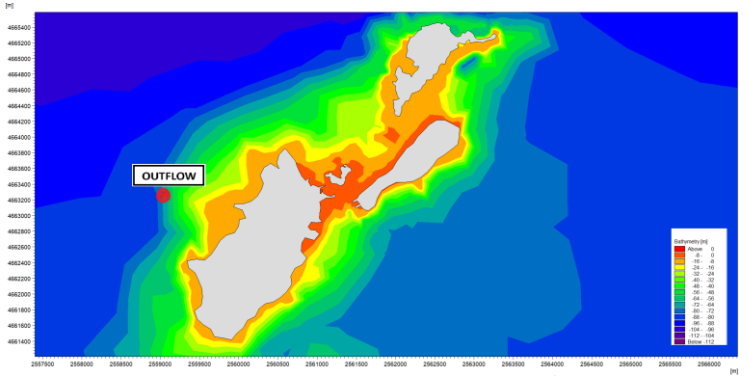


Figure 5 - Location of the outflow.

In the first configuration only the treated wastewater discharge was regarded, characterized by a salinity of approximately 0.05 PSU and a flow rate of 500 m³/h, for both the average winter and summer conditions (T1A and T1B).
In the second configuration (High Salinity), the discharge consisted of a mixture of brine and treated wastewater. For the winter condition (T2A), the mixed effluent was characterized by a salinity of 66.92 PSU and a flow rate of 50.00 m³/h; for the summer condition (T2B), the salinity was 55.68 PSU with a flow rate of 150.00 m³/h.

Results and discussions

Biological characterization of the seabed

The video surveys revealed a variety of seabed types and benthic assemblages along the investigated transects, ranging from sandy-muddy bottoms to well-developed coralligenous habitats. For the sake of brevity, only selected survey results are presented. For instance, along transect M4, starting at a

depth of -50 m, typical platform coralligenous bioconstructions were observed, richly colonized by the yellow gorgonian Eunicella cavolinii and the red gorgonian Paramuricea clavata, forming extensive facies comparable to true underwater gardens (Fig. 6).



Figure 6: Forests of yellow gorgonians Eunicella cavolinii and red gorgonians Paramuricea clavata.

Hydrodynamics

The simulated average winter surface circulation (at 1 m depth) shows a northward flow that branches into two main currents: one feeding a relatively strong upwelling between the islands of San Nicola and Caprara, and another directed southward between San Nicola and Cretaccio. The latter current intensifies south of Cretaccio, channeling between

San Domino and San Nicola, where the highest flow velocities are reached.
An intense downwelling flow is also observed along the northwestern coasts of San Domino Island, which, before veering southward, contributes to the formation of a counterclockwise eddy in the southwestern area of the island.
The bottom circulation pattern closely mirrors the surface flow structure, though with generally lower current magnitudes (Fig. 7).

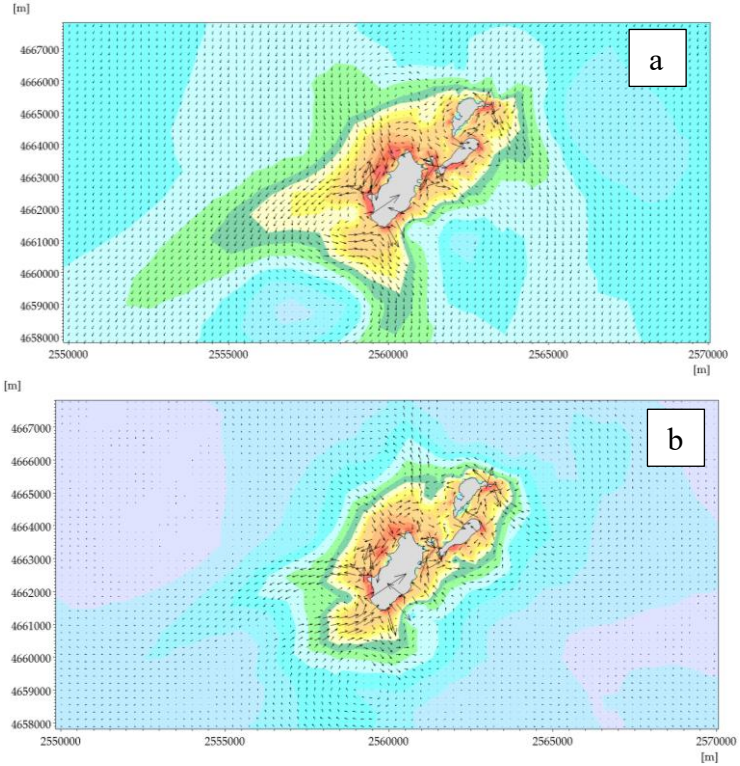


Figure 7 - Average winter current: surface(a) and bottom (b).

The summer circulation pattern is similar to that observed during the winter period; however, the currents generally exhibit lower intensity.
In particular, the average summer surface circulation (at 1 m depth) shows a branching of the northward flow, feeding a relatively strong upwelling between the islands of San Nicola and Caprara, and a weaker southward current between San Nicola and Cretaccio. As in the winter scenario, the coastal downwelling current along San Domino Island contributes to the formation of a large counterclockwise eddy, extending along the western and southern coasts of the island before gradually flowing southward.

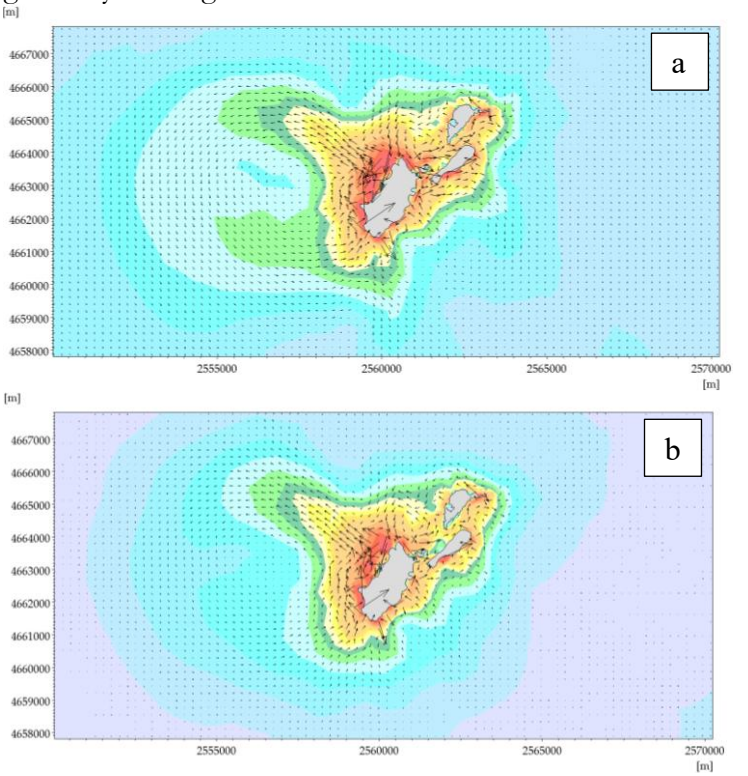


Figure 8: Average summer current: surface(a) and bottom(b)

The bottom circulation field displays a similar structure to that of the surface layer, though with generally lower current magnitudes (Fig. 8).

Plume spreading

T1: Configuration 1: T1A and T1B

The results obtained are presented below as follows:

- Map of minimum surface (Figure 9a) and bottom (Figure 9b) salinity values reached during the average winter condition at each point in the domain, along with the vertical salinity profile (Figure 9c) taken along the transect perpendicular to the flow for the same condition (T1A).
- Map of minimum surface (Figure 10a) and bottom (Figure 10b) salinity values reached during the average summer condition at each point in the domain, along with the vertical salinity profile (Figure 10c) taken along the transect perpendicular to the flow for the same condition (T1B).

It should be emphasized that in the visualization of the figures presented below, color scales have been used to make the transport and diffusion of the tracer visible, and therefore areas of plumes with salinity values close to 38 PSU, which is the salinity of seawater, are also visible.

For both winter and summer conditions, the analysis of the figures suggests that, both at the surface and at the bottom, the S plume moves away from the discharge point and is predictably transported by the current—towards the NW during winter conditions and towards the SW during summer conditions—spreading around the southwestern coast of San Domino Island; however, the mixing effect is limited, and the vertical profiles indicate that the plume remains confined to the area closest to the seabed, with a maximum reduction in $S \leq 0.001\%$.

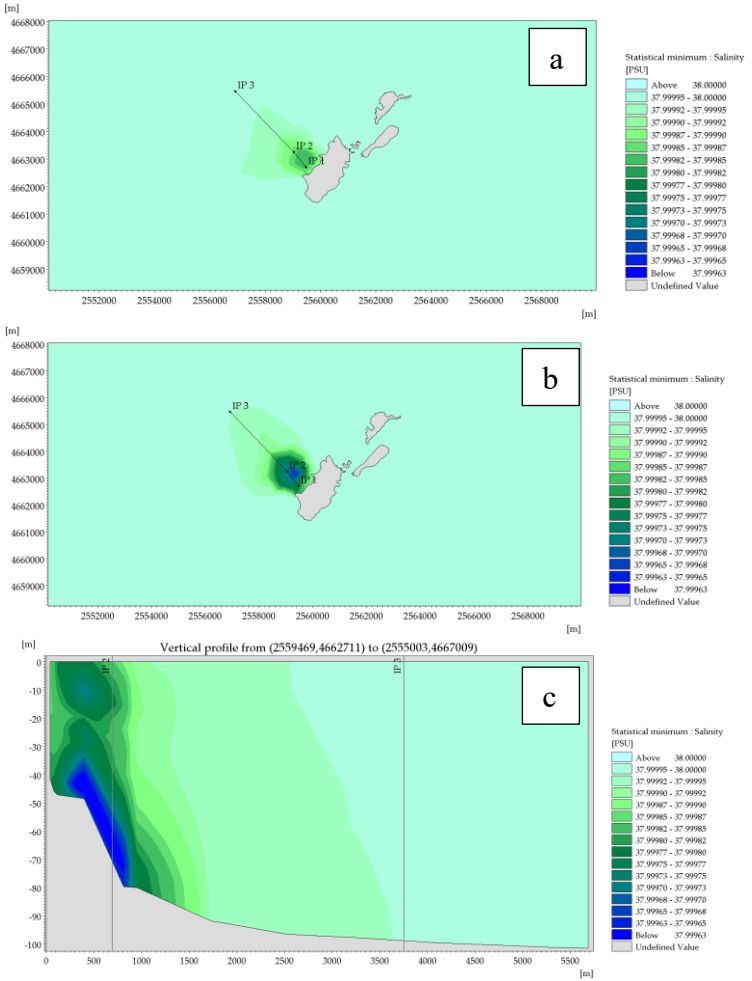


Figure 9 - Average Winter Condition: Salinity Minimum Map (a) at the surface; (b) at the bottom; (c) vertical profile of S along the transect perpendicular to the coastline.

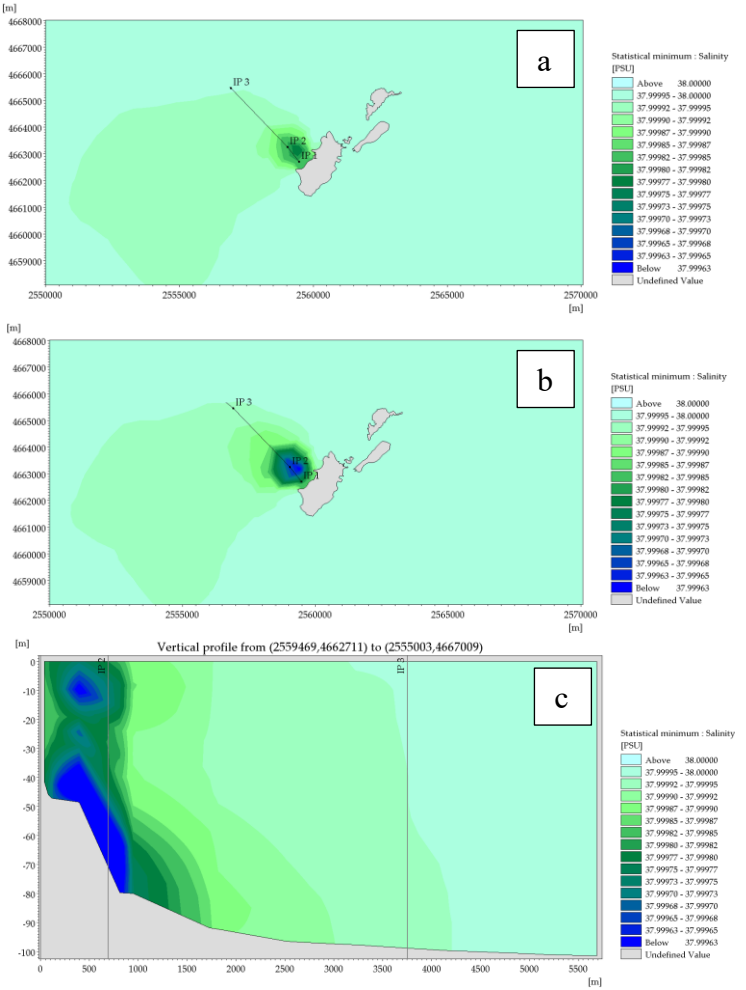


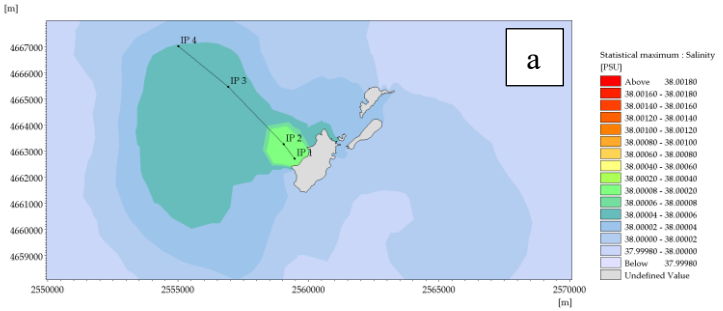
Figure 10- Average summer Condition: Salinity Minimum Map (a) at the surface; (b) at the bottom; (c) vertical profile of *S* along the transect perpendicular to the coastline.

Configuration 2: T2A and T2B

Also, for the second configuration, the results are organized as follows:

- Map of minimum surface (Figure 11a) and bottom (Figure 11b) salinity values reached during the average winter condition at each point in the domain, along with the vertical salinity profile (Figure 11c) taken along the transect perpendicular to the flow for the same condition (T2A).
- Map of minimum surface (Figure 12a) and bottom (Figure 12b) salinity values reached during the average summer condition at each point in the domain, along with the vertical salinity profile (Figure 12c) taken along the transect perpendicular to the flow for the same condition (T2B).

For both winter and summer conditions, the analysis of the figures suggests that the salinity plume spreads north-northwest at both the surface and bottom, then is carried by the current towards the southwest, affecting the western coast of San Domino Island. The mixing effect is limited in both cases, and the vertical profiles indicate that the plume remains confined near the seabed, with a maximum salinity increase of 0.001% in winter and 0.002% in summer.



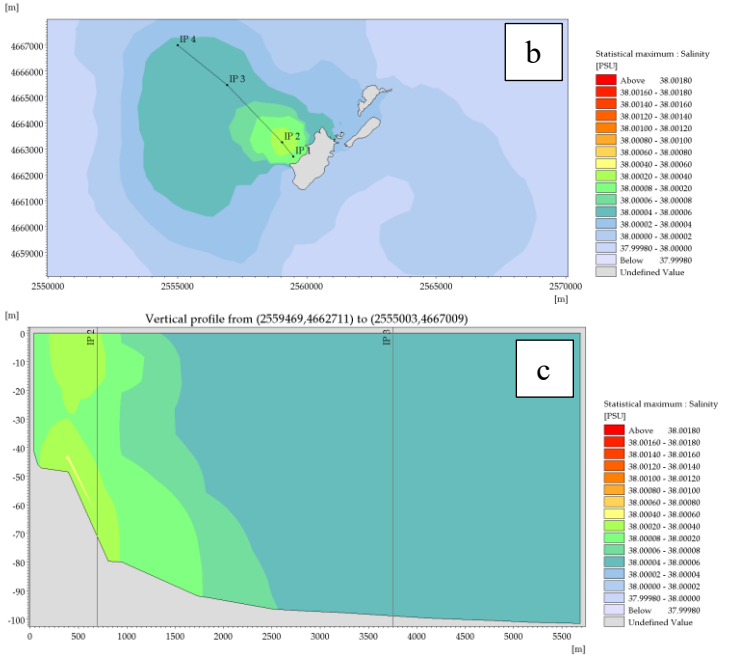
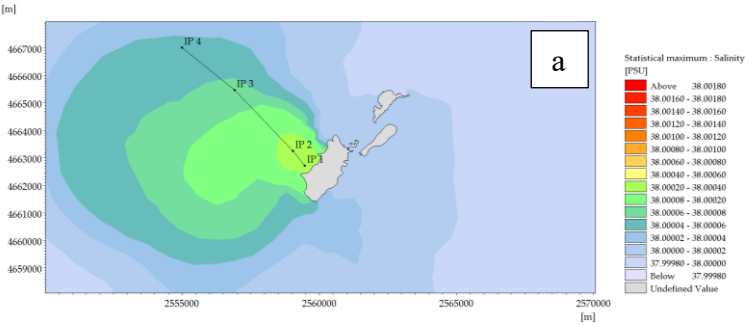


Figure 11 - Average Winter Condition: Salinity Minimum Map (a) at the surface; (b) at the bottom; (c) vertical profile of S along the transect perpendicular to the coastline.



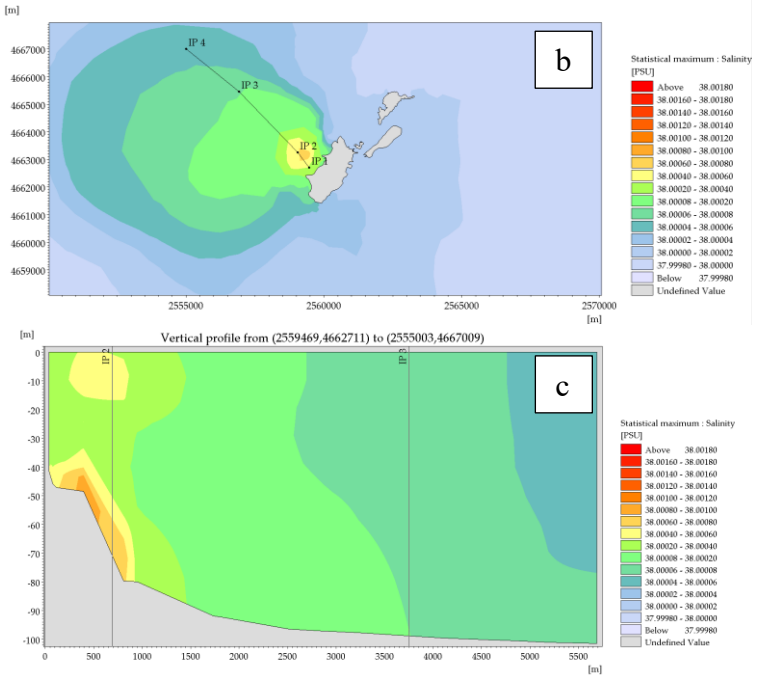


Figure 12 - Average summer Condition: Salinity Minimum Map (a) at the surface; (b) at the bottom; (c) vertical profile of S along the transect perpendicular to the coastline.

Conclusions

In this study, we analyzed the potential discharge configuration of an innovative desalination plant that plans to release its brine through the existing treated wastewater outfall pipeline, to limit possible alterations caused by increased water salinity.

The examination of the salinity dispersion maps for the design condition, both at the surface and near the bottom, under average winter and summer scenarios, showed that the salinity plume (S) spread toward the N–NW and was

generally transported southwest by the prevailing current, reaching the southwestern coast of San Domino Island. The plume remained largely confined near the seabed, with a maximum salinity increase of $S \leq 0.002\%$, indicating limited mixing.

The salinity increase was therefore restricted to the immediate vicinity of the planned brine diffuser, and its impact on benthic communities—as assessed through seabed video surveys—was regarded negligible. Importantly, the valuable coralligenous bioconstructions located northeast (transect M1) and southwest (transects M3 and M4) of the outfall remained entirely unaffected by the minor salinity changes associated with the desalination system.

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Strategies and processes for the recovery of Gaza's cultural landscape

Loredana Ficarelli[*], Giulia Annalinda Neglia[*]

Abstract

Years of protracted conflict in Gaza have devastated a region whose urban landscape was shaped over centuries by successive civilisations. The destruction has compromised the physical built environment and cultural heritage, severely damaging them and undermining social cohesion and the territory's deeply embedded symbolic values.

This paper first outlines a culturally sensitive reconstruction strategy for Gaza, drawing comparisons with previous cases and approaches to urban recovery and investigating the cultural significance of the different layers of heritage.

The second section presents a methodological framework of principles and challenges for rebuilding a cultural urban landscape that has been severely damaged or completely destroyed.

Finally, the paper concludes with targeted suggestions for rebuilding cultural urban landscapes, proposing actions and roles aimed at rehabilitating and restoring cultural and residential assets in crisis contexts. This ensures that recovery efforts respect and preserve the area's identity and characteristics.

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Keywords

Gaza, Cultural landscape, Urban landscape recovery, Area-based approach, Open spaces and healing gardens.

Preface: Beyond destruction, towards a project of collective rebirth

The devastation that has struck Gaza in recent years represents one of the gravest humanitarian emergencies of our time. Faced with such destruction, urban reconstruction cannot be approached as a mere technical process, but requires a broad vision, rooted in the history and social fabric of the city.

The issue, therefore, of reconstruction after a catastrophic event such as that in Gaza, compels both architecture and society to profound reflection: it is not merely a matter of repairing what has been destroyed, but of considering how the traumatic event influences identity, both personal and collective.

Each individual and every community attribute unique meanings to these events, which are intertwined with their histories and determine the modalities and outcomes of rebirth.

The only way to face the abyss that opens before us is through active and collective engagement. Architecture, aware of its own limits, is called to mobilise, directing its gaze towards a new perspective: recognising that the history of humanity and its dwellings is an integral part of the history of the planet.

The Academic Senate of the Polytechnic University of Bari, in June 2025, expressed its support for peace and the reconstruction of Gaza, confirming a firm condemnation of all ongoing wars, wherever they occur, as well as against all

forms of violence affecting civilians, minorities, and the most vulnerable segments of the population. It is a continuous commitment to spreading a culture of peace, dialogue, collaboration, and respect for human dignity—values that are indispensable for scientific, civil, and democratic progress.

In a global context marked by numerous conflicts, it is emphasised how the attention of public opinion and the international community is powerfully drawn to the dramatic situation in the Gaza Strip, made increasingly evident by news, direct testimonies, and reports from humanitarian organisations.

This "catastrophe" does not concern only the survivors, but mobilises a wider consciousness; we have all become participants in an involvement that goes beyond the boundaries of direct experience. We have internalised the event and recovered a radical twist of perspective, which consists, first and foremost, in suspending the obvious and cultivating the ability to see the world from a different viewpoint—a true "reversal" or "overturning," which does not necessarily carry the negative meaning we attribute to it today.

Thus, devastation/destruction represents a turning point, the interruption of continuity—a discontinuity that takes on decisive value because it puts an end to the previous order, a "leap" from one state to another, the breaking of a morphological and structural equilibrium which produces an irreversible mutation of form.

The "Gaza Phoenix" 2024 project and the "Resilient Horizons" strategy represent an important opportunity for a deep and collective reflection on the meaning of the "leap," intended as a moment of regeneration and redefinition of socio-cultural identity. These initiatives emphasise the need to avoid the risk of a "tabula rasa" which, under the banner of modernity and well-being, could lead to a mystification of

reality, instead of enhancing the memory and roots of the territory.
On the contrary, it is necessary to recognise and integrate the historical, social, and spatial roots that update the character of an ancient city built and destroyed over time. This perspective allows us to tackle the complexity of reconstruction in a gradual and sustainable way, avoiding top-down solutions and favouring instead a participatory and conscious process.
In this context, historical memory becomes a precious resource. Evaluating and appreciating different points of view—even those far from one's own background—enriches the creative process and strengthens the bond with the territory. Considering the territory, the place, as a source of information, supplemented by other sources, brings out new pathways for research: on the one hand, an analysis of landscape physiognomies for descriptive purposes; on the other, the study of representations, meanings, and values that different observers attribute to the place.
The choice to use local materials and to promote a technique nourished by humanism—far removed from both futurist totalisation and the media mythology of technology—represents a path towards more conscious dwelling, in harmony with nature and places.
"Nature becomes landscape for us only when we accept and seek it without purely utilitarian purposes" (Hellpach, 1960).
Starting from the complexity and multiplicity of meanings of the concept of reconstruction, the text advocates a point of reference for the construction of an architectural palimpsest, where image and reality intertwine to transcend traditional oppositions and identify new connections. New landscapes are determined by the relationship between the observer and the overall view—an experience involving environments, people, and culture, accessible through the gaze, the mind, and the knowledge of each individual.

In this view, reconstruction is interpreted as a representation of the territory itself, configured as a complex combination of elements and phenomena in functional relation, constituting an organic unity.

A central element of this strategy is the active involvement of local communities. Only through respect for social dynamics and the promotion of resilience, via the use of recycled materials and the reinterpretation of traditional architecture, can we hope to restore authentic urban life to Gaza. The aim is not only to rebuild buildings, but to rewrite a lesson on how to read the past to design the future, an architecture capable of dialogue with the new, often unknown, horizons of contemporaneity.

The guiding principles of this rebirth must include the safeguarding of memory, mitigation of environmental impact, respect for private property, and the development of sustainable infrastructures. Only in this way will it be possible to build the foundations for an equitable and lasting rebirth, capable of uniting digital experimentation and respect for tradition.

The reconstruction of Gaza represents an epochal challenge but also a unique opportunity to rethink the very meaning of architecture and dwelling. Supporting a courageous, innovative, and profoundly human vision is the first step in restoring new hope and a better future to the city.

The School of Architecture at the Polytechnic University of Bari, which was established and continues to grow thanks to the intuition of Prof. Claudio D'Amato, is based on a precise educational model, the result of considered choices and solid theoretical references. It adopts and enhances principles of settlement and recognition of the genius loci, integrating tradition with a contemporary vision.

This School is rooted in the clear and inalienable idea that Architecture is, above all, the Art of Building. This method is expressed through a profound relationship with History,

to be explored and reinterpreted with a critical eye, adopting the "Mediterranean landscape" as a privileged key to interpretation—an operational and concrete human habitat, characterised by complex and non-linear paths.

The choice of stone construction, among many possible options, becomes an essential necessity for coherently reading and defining the meanings, forms, and identities of such unique places.

In these lands, architecture becomes the expression of a process of structuring physical identity space, organically linked to the places that host it and taking on the unique character of the spirit of the place.

A deep and authentic connection with the territory, rooted in original traditions and the use of local materials. Architecture originates from the careful extraction and processing of elements from the earth, generating spaces of extraordinary quality where the trace left by the quarried stone becomes measure and memory. This measure of extraction transforms into a constructive rule, manifesting a true cult of the earth, which gives architectural spaces an unmistakable identity, the result of a way of operating intimately belonging to a culture.

The theory underlying this method is linked to the definition of organic architecture: capable of describing general principles in which all the individual parts exist in a relationship of reciprocal necessity, generating each time different, unique, and thus unrepeatable forms.

If architecture forgets Firmitas, as Vitruvius says, it loses its most extraordinary power. Architecture is a bridge between generations, across time and space, possessing the exceptional ability to unite the living and the dead—one of humanity's greatest achievements; if it does not endure, this dialogue is interrupted and its immortal function is lost.

An idea of Architecture that sits between art and practice, as the authentic expression of τέχνη—not pure technique, but technical and creative knowledge.
A constant search for a balance between innovation and tradition, where "innovation must rest on durable construction technique; experimenting with techniques that free us from the absolute freedom of reinforced concrete and iron means bringing architecture back under the control of functionality and beauty, achieving the perfect Vitruvian synthesis". Just as reading architecture can give the pleasure of the text, designing means joining this debate, embracing the idea of an organism where the space is unitary but neither exclusive nor dogmatic. The past becomes a travelling companion, and logic together with history contribute to redefining the vision of the representative space of our time. Shared responsibility is needed, capable of turning tragedy into an opportunity for growth and rethinking how we inhabit and live together.
Representing a sudden change in an arrangement leads us to reflect on origins in search of a new possible equilibrium; at the same time, it compels us to lay bare the open wound, giving voice, with intensity, to the experience of a bitterness that erupts suddenly and from which escape seems impossible, highlighting the gap between those who limit themselves to analysing causes, meanings, and possible explanations—perhaps in an attempt to provide rational justifications or answers—but what matters are the effects: destruction should not be met with knowledge, but with being. A collective being.

Introduction

The destruction in the Gaza Strip has unleashed an unprecedented humanitarian catastrophe, displacing a vast

portion of the population and dismantling the region's living traditions, social networks, and cultural continuity. Within the area, entire urban areas have been reduced to rubble, erasing not only homes but also the intangible heritage embedded in the urban fabric—spaces of collective memory, identity, and everyday life.

The situation remains extremely complex and fragile today. Basic services and infrastructure are almost entirely absent, creating conditions of extreme vulnerability. Water, electricity, and sanitation systems have collapsed.

Compounding these challenges, the severe damage to Gaza's urban landscape also endangers the most significant aspects of its architectural and cultural identity. The state of monuments and remaining residential traditional buildings and urban areas, many of which are severely damaged, are critical: historic quarters, traditional housing and public spaces have been devastated, as has the entire urban fabric. This has left behind a fragmented environment that urgently requires recovery in terms of its social, architectural and economic fabric.

This is particularly important for an area with origins dating back to ancient times, when Gaza was a strategic port and trade hub developed along caravan routes linking Egypt, the Levant, and Arabia. Over the centuries, Gaza flourished, leaving behind a legacy of vernacular and monumental architecture. The Great Mosque, now in ruins and standing on the site of an ancient Philistine temple that was later used as a Byzantine church before being converted in the early Islamic era, symbolises this layered history by embodying transformations across religious and political contexts. Traditional Ottoman courtyard houses, known as "ahwash", with their stone masonry, vaulted rooms and shaded gardens, demonstrate how architectural form can be integrated with environmental sustainability and cultural norms. Gaza's historic urban fabric therefore embodies

millennia of layered civilisation, including Philistine, Roman-Byzantine, Mamluk and Ottoman influences. Ensembles of courtyard houses, mosques, churches, markets, madrasas and khans (such as Qasr al-Basha, the Great Omari Mosque and St. Porphyrius Church) still punctuate the urban landscape, as do archaeological strata.

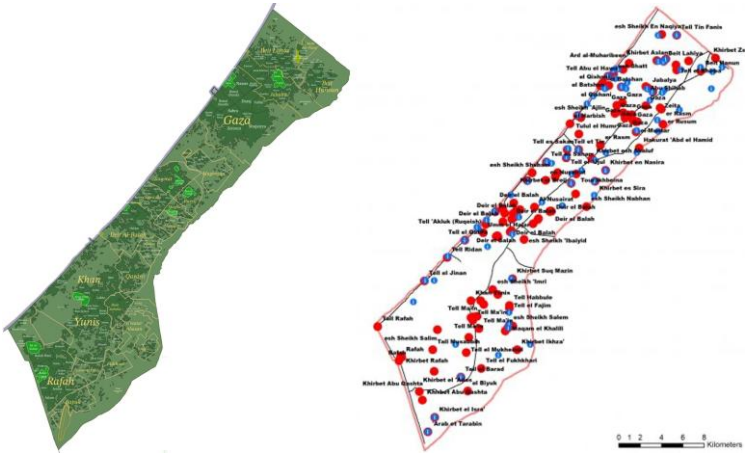


Figure 1 - Distribution of settled areas and archaeological sites in the Gaza Strip.

Today, this heritage is under severe threat due to widespread destruction and displacement. The loss of monuments, traditional housing and public spaces endangers not only the city's architectural integrity, but also the intangible cultural values embedded in its spatial organisation. Therefore, preserving and reconstructing Gaza's historic urban landscape, alongside with its overall reconstruction, is crucial for safeguarding its identity, ensuring cultural continuity, and enabling the community to return and rebuild in harmony with its past.

In this context, clear recovery guidelines alongside a reconstruction masterplan are essential to facilitate urban rebuilding. Reconstruction would therefore present not only a technical challenge, but also a cultural imperative, as the aim would be to restore Gaza's rich and layered heritage, which defines the sense of place and belonging in the area.
A culturally sensitive reconstruction strategy must respect the stratification of urban history, restore key architectural typologies and revive the social and economic functions of historic neighbourhoods. It should also return homes and residential districts to local inhabitants. By doing so, Gaza can reclaim its role as a living cultural organism in which heritage and modernity coexist to create a sustainable and resilient urban future.
Therefore, the recovery of Gaza must go beyond physical rebuilding. A holistic approach is required that integrates cultural heritage preservation, urban resilience and sustainable development. The reconstruction process should seek to rebuild the urban fabric of residential areas, respecting traditional layouts and reviving the cultural landscapes that have historically shaped Gaza's identity. Only through this kind of approach can the city reclaim its role as a living organism, ensuring that its memory, diversity and uniqueness are not lost to history.

Rebuilding cultural urban landscapes: Principles and challenges for Gaza

Reconstructing a damaged historic environment requires a pluralistic approach that prioritizes cultural continuity, tradition, and the restoration of collective memory (UNESCO, 2011; Bandarin & van Oers, 2012, Marcinkowska & Zalasinska 2019).

In historic areas, reconstruction should be conceived as a process, not merely a technical intervention. It must aim to preserve both explicit and implicit attributes of heritage, encompassing the built environment, social structures, and the functional uses of buildings. This is essential to avoid phenomena such as gentrification or the gradual erosion of authenticity caused by replacing damaged structures with inappropriate building typologies and urban/landscape morphologies (ICOMOS, 2016).

In the case of Gaza, the challenge lies in maintaining the overall remaining features of authenticity, while integrating participatory processes and acknowledging cultural, ecological, and economic transformations driven by prolonged conflict (UN-Habitat, 2023).

Future recovery should be envisioned as a complex, multidisciplinary process, requiring the development of methodological and site-specific guidelines to address the layered nature of Gaza's urban and social landscape. Actions should emphasize the sense of place, ensuring continuity and consistency with the surviving historic urban fabric, in line with international charters (UNESCO, 2011). Reconstruction strategies should focus on "building back better" (UNISDR, 2017) while safeguarding authenticity, linking tangible and intangible heritage through cultural spaces, fostering reconciliation, and promoting understanding of cultural expressions and places of significance (UNESCO, 2011).

Whitin this framework, community involvement is critical: the active engagement of inhabitants in decision-making processes ensures that reconstruction reflects local identity and social needs. Moreover, recovery efforts should aim to create safer, greener, and more sustainable cities, integrating cultural heritage into urban resilience strategies and supporting a heritage-based economy that contributes to

long-term sustainability (UN-Habitat, 2023; World Bank, 2022).

Implementation process

Recognising that an urban landscape is the result of the complex interplay of physical, cultural and natural values, encompassing the natural and built environment, open spaces, gardens, visual relationships and cultural practices, Gaza's reconstruction must be approached within a comprehensive sustainable development framework.

The challenge extends beyond the mere physical restoration of stones, monuments, and iconic landmarks. Rather, the recovery process requires an integrated strategy that considers all the diverse urban layers (e.g. monuments and landmarks, archaeology, public buildings, open spaces, courtyard houses) and aims to rebuild them using differentiated objectives and methodologies.

Planning strategies must be developed to ensure continuity between reconstruction efforts and the existing urban fabric. This involves focusing on the holistic reconstruction of the historic urban landscape, including clusters of traditional courtyard houses, monuments and public buildings, archaeological remains and the layout of open spaces. The goal is to "build back better" by preserving and enhancing the tangible (natural and built) and intangible cultural characteristics that have historically shaped—and continue to shape—the identity of Gaza's urban landscape (UNESCO, 2011).

Reconstruction should therefore be viewed as an opportunity to address pre-existing vulnerabilities, improve building and urban conditions, and remediate problematic situations. This approach requires integrated strategies that respect cultural continuity while promoting resilience and

sustainability. This ensures that the city's heritage becomes a foundation for future development.

Reconstruction: Consciousness or amnesia?

Long-term reconstruction can erase the memory of war (Violi, 2017). However, in the aftermath of urbicide — the deliberate destruction of the urban fabric (Coward, 2009) — reconstruction is never neutral. It involves choices that shape collective memory (Halbwachs, 1980), identity and the city's future, not merely future use, new functions or targets to be addressed.

Moreover, post-traumatic contexts often generate aspirations for renewal and modernisation, which can lead to the adoption of globalised urban models, particularly when foreign actors exert significant influence. In the conflict between universal civilisation and national culture (Ricoeur, 1961; Frampton, 1983), globalised architecture often triumphs while historical typologies, which are repositories of accumulated layers of meaning, are marginalised or obliterated.

Past experiences of reconstruction have been characterised by several key approaches to rebuilding devastated urban areas. Some have aimed to restore the city's former appearance, recreating its historical form and spatial continuity, as in the case of Warsaw (Bugalsky & Lawrence 2023). Others have focused on rebuilding emblematic buildings as symbols of resilience and cultural heritage, as with the reconstruction of the Mostar Bridge, which became a powerful symbol of reconciliation (Hadzimuhamedovic & Bouchenaki, 2018). Alternatively, reconstruction can be linked to political processes of conservation, transforming the narrative of memory into a narrative of identity. An example of this is Beirut, where the rapid and controversial

reconstruction prevented not only archaeological excavations, but also efforts to highlight the local identity by enhancing the traces of the historic built environment (Rowe & Sarkis, 1998). In the future, Aleppo could hopefully demonstrate how an area-based (UN-Habitat, 2023) regeneration approach involving courtyard houses, markets, streets and mixed-use ensembles could restore morphological continuity to a devastated urban landscape, prioritising civic spaces as places of dialogue to foster social cohesion in a fractured community (Neglia, 2020).

In the case of Gaza, this dilemma is particularly urgent. The need for rapid reconstruction, coupled with severe economic constraints and ongoing political instability, increases the risk of rebuilding efforts defaulting to standardised, globalised models. While such approaches are expedient, they often disregard the unique cultural identity and historical depth of the place. If reconstruction becomes merely a technical exercise that smooths over the scars of conflict and obliterates the richness of heritage, it will compromise the very possibility of cultural resilience and collective memory.

Conversely, prioritizing the recognition and safeguarding of fragile and vulnerable sites can transform reconstruction into a vehicle for continuity rather than rupture. Pilot projects focusing on emblematic buildings and open spaces as "anchor points for memory", complemented by neighbourhood-scale fabric rehabilitation, would help maintain symbolic coherence within the urban landscape. These interventions would restore physical structures and reaffirm the cultural narratives embedded in them, thereby reinforcing a sense of identity and belonging.

Furthermore, these principles could inform the development of context-sensitive housing prototypes, the revitalisation of local markets and the design of public spaces that integrate memory into their spatial logic while meeting contemporary

performance standards. By embedding cultural meaning within functional upgrades, reconstruction can transcend mere physical repair and become a catalyst for social recovery and long-term resilience.

Rebuilding cultural urban landscapes: Actions and roles

In order to achieve these goals, the local community must be at the heart of the reconstruction process. Recovery cannot be imposed from outside; it must emerge from participatory mechanisms that empower residents to shape their own urban environment. This approach ensures that reconstruction is technically effective, socially legitimate and culturally meaningful.

For this reason, the international community must play a critical role—not as distant decision-makers, but as enablers and partners. Support should extend beyond financial aid to include structured programmes of training, capacity building and technical assistance. Such initiatives could bolster local expertise in heritage conservation and enhancement, sustainable construction techniques, architectural, urban and landscape design, while fostering collaborative platforms where knowledge is shared and adapted to Gaza's unique context.

Support throughout the process is also vital: mentoring local professionals, facilitating community workshops and promoting inclusive governance models will help ensure that reconstruction becomes a catalyst for resilience rather than dependency.

By investing in human capital and participatory frameworks, local and international communities can transform rebuilding efforts into a long-term strategy for cultural continuity and social recovery by providing the following

actions in accordance with Sustainable Development Goals (UN, 2015) and recovery frameworks (UN-Habitat, 2021).

Community empowerment through digital documentation and damage assessment.

The action aims to activate the role of the international community by promoting the use of digital technologies to document cultural heritage and foster an understanding of its value. Technologies such as 3D scanning, GIS mapping and immersive platforms offer innovative tools for recording, analysing and disseminating information about heritage assets, ensuring their preservation for future generations. Beyond the technical dimension, the initiative emphasises the importance of raising awareness of the intrinsic value of local heritage and fostering a deeper understanding of its historical, social and cultural significance. Support is needed to strengthen the connection between local and international stakeholders in the documentation and preservation of urban sites, integrating local narratives and traditions into global heritage discourses. Ultimately, this action contributes to the development of resilient cultural ecosystems where urban sites are documented and preserved through a combination of local expertise and international support. In doing so, it reinforces the notion that cultural heritage is a common good whose protection requires collective responsibility and innovative strategies.

Community empowerment through connection between local and international academia.

The proposed action aims to strengthen the connection between local and international academic communities, fostering a deeper, shared understanding of the cultural, historical and social value of local heritage. The initiative emphasises the importance of knowledge exchange and capacity building as fundamental tools for heritage recovery. By encouraging collaborative research, joint educational programmes and interdisciplinary dialogue, the initiative aims to establish robust international academic networks that serve as platforms for disseminating best practices, innovative methodologies and digital solutions for heritage documentation and management. These networks facilitate scholarly cooperation and local empowerment, enabling communities to access global expertise while preserving their agency and cultural identity. Thus, academic collaboration becomes a strategic resource for reinforcing local resilience, promoting sustainable development, and ensures that local narratives and traditional knowledge systems are incorporated into global academic discourse. This synergy between local and international academia contributes to the creation of a participatory framework for urban landscape recovery, in which research and education act as catalysts for community-based practices. Ultimately, the initiative seeks to establish a transnational academic ecosystem that promotes the safeguarding of cultural heritage as a shared responsibility, in line with the Sustainable Development Goals 11.4 (Protect the Worlds Cultural and Natural Heritage).

Community empowerment through connection between local and international experts.

The proposed action is designed to activate and strengthen the role of local communities in preserving heritage and

promoting urban sustainability. This is achieved by raising awareness of, and promoting knowledge of, the cultural, historical and social value of both tangible and intangible heritage, which is an essential component of collective identity and social cohesion. In line with Sustainable Development Goal 11 (Make cities and human settlements inclusive, safe, resilient and sustainable) the initiative recognises that heritage conservation is a strategic driver for sustainable urban development as well as a cultural imperative.

Empowering local communities requires the creation of participatory frameworks that integrate bottom-up initiatives originating from citizens and local stakeholders with top-down strategies developed by institutions and policymakers. This multi-level approach ensures heritage management is inclusive and responsive to local needs, while also benefiting from institutional support and global expertise. Furthermore, the initiative promotes inter-scalar strategies, connecting neighbourhood-level interventions with city-wide and international policies. This fosters coherence between local practices and global agendas (UNESCO 2011).

Through a combination of awareness-raising activities, capacity-building programmes and digital tools for documentation and dissemination, the initiative aims to empower local communities to become active custodians of their heritage. This participatory model strengthens cultural identity and enhances resilience against socio-economic and environmental challenges. Ultimately, this approach contributes to the creation of sustainable urban ecosystems in which heritage preservation and community empowerment reinforce each other, ensuring that cultural assets become a resource for inclusive growth and long-term sustainability.

Community empowerment through the knowledge of urban landscape and forms.

The proposed action is designed to empower and activate the role of local communities by raising awareness of the cultural, historical and social significance of tangible and intangible heritage. Strengthening this knowledge base is essential for fostering a sense of identity and belonging, thereby supporting the sustainable development of urban environments. Ultimately, this aligns with the principles of SDG 11 (Making cities and human settlements inclusive, safe, resilient and sustainable).
To achieve this, targeted support is required for developing and applying strategies to recover and revitalise traditional residential areas and open spaces for urban landscape restoration. These techniques offer a systematic way of understanding the spatial and structural features of historic urban areas, enabling interventions that honour local identity while meeting modern requirements. Integrating heritage-sensitive design strategies with modern urban landscape contributes (e.g. healing gardens) to preserving cultural continuity, enhancing social cohesion, and promoting sustainable urban regeneration.

Community empowerment through the awareness of urban values and forms.

This action is designed to activate and strengthen the role of local communities by fostering an in-depth awareness of the cultural, historical and social value of tangible and intangible heritage. Such awareness is fundamental to sustainable urban development and aligns with key global objectives, particularly SDG 11 (Making cities and human settlements

inclusive, safe, resilient and sustainable), and SDG 5 (Achieving gender equality and empower all women and girls).
The initiative emphasises the importance of community engagement as a means of heritage preservation and a driver of social inclusion and gender equity. By promoting participatory processes, this approach ensures that diverse voices, especially those of women and marginalised groups, are integrated into decision-making, thereby reinforcing democratic governance and social cohesion.
To translate these principles into practice, specialised support is needed to define and implement innovative design techniques for the regeneration of public spaces and the revitalisation of urban communities through urban landscape restoration. This involves rethinking public spaces as multifunctional environments that encourage interaction, cultural expression, and ecological resilience. Urban Landscape Restoration is a holistic strategy that combines environmental sustainability, cultural continuity, and social empowerment, not merely a physical intervention. Drawing on interdisciplinary methodologies such as urban design, landscape architecture, and community planning, it regenerates degraded areas, restores ecological balance, and creates inclusive spaces that reflect local identity.
Ultimately, this action contributes to the creation of cities that are environmentally sustainable, socially vibrant, and equitable, where heritage becomes a living resource for innovation and community well-being.

Thinking out of the box: Cultural landscapes as healing gardens

This action aims to strengthen the connection between local and international communities in the recovery and

reconstruction of historic urban sites by leveraging advanced approaches and solutions to urban open spaces design. The initiative is grounded in the principles of SDG 11 (Promoting inclusive, safe, resilient and sustainable cities and communities) and SDG 5 (Achieving gender equality and the empowerment of all women and girls), particularly Target 5.b (Enhancing the use of enabling technologies, especially information and communication technologies).

Building on this vision, the initiative embraces the concept of cultural landscapes as "healing gardens", positioning restored urban spaces as therapeutic and inclusive settings that nurture social well-being and ecological balance, as well as being functional environments. The concept of healing gardens stems from environmental psychology and landscape architecture, emphasising the restorative power of nature and culturally significant spaces in alleviating stress, promoting mental health and strengthening community bonds.

In the context of historic urban sites, cultural landscapes serve as living archives of collective memory, identity and tradition. By reimagining these landscapes as healing gardens, the project takes a multidimensional approach, integrating heritage conservation, ecological restoration and social empowerment. This involves:

- Designing green and open spaces that incorporate native vegetation and traditional spatial patterns to reinforce cultural continuity and improve environmental resilience;
- Creating inclusive environments where women, children and vulnerable groups can safely gather, interact and participate in cultural activities, thus aligning with SDG 5 and SDG 11 objectives.

Healing gardens within cultural landscapes thus become catalysts for urban regeneration, offering spaces that heal both the physical environment and the social fabric. These gardens promote biodiversity, mitigate urban heat islands

and provide psychological relief. They also serve as platforms for cultural expression and intergenerational dialogue. This holistic approach transforms restoration into an ecologically and socially inclusive recovery process where technology and tradition converge to shape sustainable futures.
By combining innovation with community engagement, this initiative aims to establish a heritage restoration model that is socially equitable, environmentally sustainable and culturally respectful. It views urban landscape recovery as a catalyst for empowerment, inclusion and resilience in urban landscapes.

Conclusions

Rebuilding Gaza is not merely a technical challenge; it is a cultural and social imperative that demands a holistic and inclusive vision. The devastation of its residential areas and historic urban fabric has erased spaces of memory and identity, threatening the continuity of traditions that have shaped the city for millennia.
Reconstruction must therefore embrace an integrated approach that combines heritage conservation, urban resilience, and sustainable development, ensuring that recovery does not default to standardized global models that obliterate local character. Instead, strategies should prioritize authenticity, participatory processes, and context-sensitive design, linking tangible and intangible heritage to foster social cohesion and cultural continuity.
International cooperation will play a crucial role, not only through financial support or top-down processes but by enabling knowledge exchange, capacity building, and innovative methodologies that empower local communities. By embedding cultural meaning within functional

upgrades—such as housing prototypes, revitalized markets, and inclusive public spaces and green areas —reconstruction can become a catalyst for healing and resilience rather than rupture.

Gaza's recovery offers an opportunity to transform post-conflict reconstruction into a model of sustainable urban regeneration, where memory and modernity coexist. In doing so, the city can reclaim its identity as a living cultural organism and lay the foundation for a future that is equitable, resilient, and deeply rooted in its heritage.

Authorship credits

LF: Preface; GAN: All other sections.

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Urban ecosystem services in the planning and design of urban green infrastructure for sustainable cities

Antonio Leone[*]

Abstract

Green Infrastructure (GI) represents a network of natural and engineered ecological systems, located at the landscape scale and fully integrated with the built environment. GI provides a wide range of Urban Ecosystem Services (UES) and can enhance the resilience of urban systems to different categories of risk (e.g., hydrological risk and climate change). In particular, two main components of GI are presented and discussed: Non-Urbanized Areas (NUA) and Nature Based Solutions (NBS). NUAs include cultivated land, abandoned agricultural land, grasslands, woodlands and shrubs, often located at the edges of peri-urban cities, and they provide all main categories of ecosystem services. NBSs are techniques developed to control pollution, runoff and, in general, ensure sustainable urban water management, such as green roofs, permeable surfaces, constructed wetlands, retention basins, infiltration basins and filter drains. Ecosystem-service-aware GI planning and design, based on these components, can integrate human activities and the environment, considering both ecological and cultural/social aspects. A methodology for characterizing NUAs is presented as a planning support tool intended to improve current land-use patterns, with the aim of increasing

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the overall supply of ecosystem services in highly dispersed urban contexts. The capacity of GI to control urban stormwater is then discussed through a modelling approach applied to a compact district in the city of Bari.

Keywords

Urban ecosystem services, Green infrastructure, Nature-based solutions

Introduction

Cities grow and shrink, modifying their structure. Common features of urban growth include impervious surfaces, urban sprawl, traffic congestion (Schewenius et al., 2014) and new forms of "peripheralization" of rural areas (Larondelle & Haase, 2013). Conversely, urban shrinkage leads to the creation of empty or under-used urban areas, demolitions, abandoned industrial sites and de-densification (Haase et al., 2014a). All these processes can influence the functioning of an urban system. Every change in land use may alter system equilibrium, with consequences for resilience and system functionality (Pelorosso et al., 2011; 2015).

From an environmental perspective, unregulated development or shrinkage may significantly impact climate, stormwater control, biodiversity, and air and water quality. From a social perspective, several consequences may emerge regarding social capital, segregation, and quality of life.

Planners and designers can limit negative socio-ecological impacts by integrating nature into the city (McPhearson et al., 2014). Nature in cities is fundamental for sustainability. Humans rely on nature to meet primary needs, such as food and drinking water. Nature mitigates negative pressures of

an oversized Western society, improves the aesthetic appearance of cities, and green/blue areas reduce the urban heat island effect and flood risks. These areas provide multiple environmental and socio-cultural functions and form part of Urban Green Infrastructure (UGI). UGI improves wellbeing, public health, and provides economic benefits, which can be analyzed through Urban Ecosystem Services (UES) in particular the potential to mitigate the alteration of the hydrological cycle (Leone, Grassini and Balena, 2022). Land-use changes, conversion associated with shrinkage, or residual non-urbanized areas between new settlements offer potential to enhance and expand UGI. Green and permeable elements such as green roofs and trees can also be introduced in compact districts.

Achieving optimal UGI organization is challenging. Sustainability can be enhanced by increasing system complexity, mimicking ecological systems (Ho, 2013; Leone et al., 2017). In cities, this is achieved by considering UGI multifunctionality and spatial organization. UGI should maximize non-dissipative flows and minimize dissipative ones, reducing entropy production. Sustainable UGI depends on designs that reuse system waste and minimize external energy, materials and labor.

A green area may have minor or negative effects if poorly placed. A park in an inaccessible area may not meet needs and requires maintenance resources. The same park could be highly valuable if designed for stormwater management, reducing combined sewer overflows and protecting receiving water bodies. Proper spatial and temporal analysis of environmental and social processes is essential, often requiring GIS and modelling techniques.

This article presents Non-Urbanized Areas (NUAs) and Nature Based Solutions (NBSs) in the context of UES.

Urban green infrastructure (UGI) and urban ecosystem services (UES)

Green Infrastructure describes natural landscape features such as forests, wetlands and waterways. The Landscape Institute (2013) defines UGI as including both green and blue areas inside and outside the city, from country parks and lakes to urban features like green roofs and street trees. UGI supports urban development, nature conservation and public health, providing numerous ecosystem services.

Like built infrastructures, GI provides essential ecosystem services such as air purification, water filtration and cooling, nutrient cycling, soil generation, pollination, climate regulation, carbon sequestration, storm and flood protection, and maintenance of hydrological regimes. Natural lands also provide goods like forest products, wildlife and recreation, serve as habitats, and contribute to the quality of life.

Different methodological approaches exist to assess UES, including monetary and non-monetary evaluation, biophysical models, empirical methods, GIS-based spatial modelling, lookup tables and interviews. The choice depends on available data, resources and project goals.

In this paper, UGI is defined as a network of natural and engineered ecological systems fully integrated with the built environment. It includes NUAs and NBSs, planned at the landscape scale, capable of providing diverse UES and increasing urban resilience.

It also demonstrate the feasibility of land used based to prevent the hydraulic risk by urban planning.

New scenarios for non-urbanized areas (NUA)

NUAs are vegetated areas within urban and peri-urban contexts (La Rosa et al., 2014). They include abandoned industrial areas, agricultural lands, parks, urban gardens, woodlands, vacant lots, cemeteries, sports fields and open spaces. Planners may redesign NUAs to maximize ecosystem services and improve socio-environmental quality.

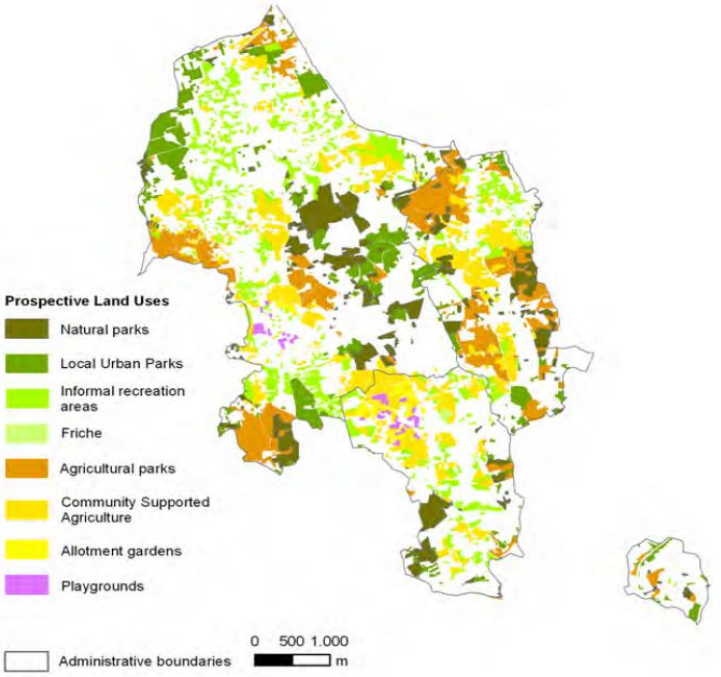


Figure 1 – Example of a new scenario of Land Uses for NUAs

NUAs often act as habitats for flora and fauna. Connectivity between NUAs must be preserved to maintain biodiversity. Due to their vegetation, NUAs reduce heat island effects and stormwater runoff.

A five-step methodology by La Rosa and Privitera (2013) characterizes NUAs:

1. Land-cover mapping
2. Ecological fragmentation index
3. Proximity index
4. Suitability matrix for land-use options
5. Compatibility analysis

This method was tested in three municipalities of the Catania metropolitan area.

Modelling approach for nature-based solutions (NBSs)

Urban regeneration and development can be supported through NBSs designed to manage runoff, pollution and urban water sustainably. NBSs include green roofs, permeable surfaces, constructed wetlands, retention and infiltration basins, and filter drains. Literature sometimes refers to them as SUDS.

NBSs provide ecosystem services even when not explicitly designed for them, such as habitat creation and cooling effects. Multifunctional NBSs can support transitions toward more resilient socio-ecological systems.

Spatial impact evaluation of NBSs requires analysing the territorial context, hydraulic load from adjacent lots, effects on downstream sewer networks, and interactions with other system components. Environmental modelling is an essential planning support tool.

The US-EPA SWMM model simulates stormwater runoff in single events or long-term simulations. It supports scenario evaluation and UES-related indicators.

An example in Bari involved identifying critical sewer nodes, testing different NBS configurations (e.g., 3 to 9 ha of green roofs), and computing an index based on reductions in runoff peak flows.

Conclusions

Cities must become more resilient and sustainable by:
– Increasing system complexity and interactions between natural and human components;
– Reducing ecological footprint;
– Evaluating cultural and social impacts.
Planning should be based on ecosystem-service-aware UGI design. This article presented UGI as a network of natural and engineered ecological systems providing diverse UES and improving urban resilience. NUAs and NBSs were discussed in detail.

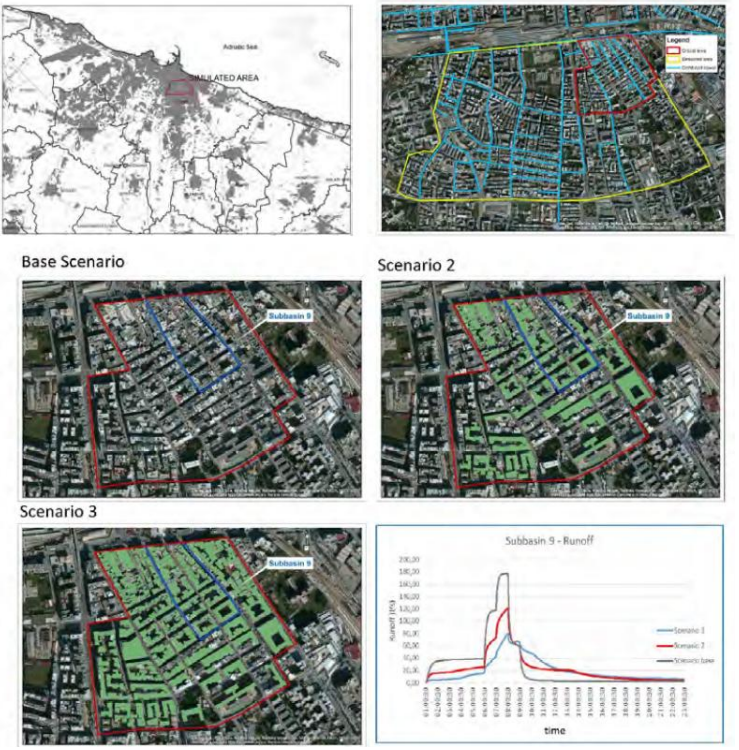


Figure 2 - Scenarios

A methodology for NUA characterization was outlined, as well as a modelling approach for urban stormwater management using NBSs.
The article promotes moving beyond linear engineering approaches toward circular economy principles and territorial engineering, where local resources and closed cycles enhance the socio-ecological functionality of urban systems.
The feasibility of the method is also confirmed by comparing the required 15 hectares of green space (see the graph in fig. 2) with the green urban planning standard, which, according to Italian legislation (D.I. 1444/1968) is equal to 9 sqm/inhabitant.
In fact, the neighborhood examined has approximately 17,000 inhabitants, thus requiring quite precisely 15 hectares of green spaces.
The traditional, structural, solution leads to the restructuring of the sewers, estimated at cost of 30 million euros. The integrated land-use-based approach leads to an integrated green space of 15 hectares.

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Early considerations for a transport system in the Gaza Strip: A short-term, sustainable mobility proposal

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Abstract

This paper presents early considerations for a short-term, sustainable transport strategy for the Gaza Strip, developed using the Dar Al Omran – Rasem Badran Master Plan as a long-term spatial framework. Given the urgent need for rapid, low-cost mobility solutions that can support reconstruction while ensuring social inclusion, the proposed system integrates multiple modes, including Bus Rapid Transit (BRT), community taxis, active mobility infrastructure, and shared mobility services. Five key mobility hubs—Beit Hanoun, Gaza City, Deir al-Balah, Khan Yunis, and Rafah—serve as structural anchors for a scalable network. Two alternative BRT configurations are examined. These options are complemented by feeder services, cycling facilities, and innovative shared mobility solutions such as cargo bikes and drone-enabled deliveries. The proposal emphasizes the importance of coordinated land use–transport integration to ensure that mobility interventions respond to community needs and adapt as new data becomes available. Overall, the proposal offers a pragmatic path from immediate recovery to long-term, resilient urban mobility development in the Gaza Strip.

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Keywords

Sustainable mobility, Bus rapid transit, Mobility hubs

Introduction

Effective reconstruction requires transport systems that can quickly restore mobility, support social inclusion, and lay the foundations for long-term urban development. In this context, the Dar Al Omran – Rasem Badran Gaza Master Plan (Dar Al Omran – Rasem Badran, 2025) provides a strategic vision for the reconstruction of the Gaza Strip, outlining major infrastructural and connectivity goals. Building upon this framework, this paper presents early considerations for a short-term, sustainable transport proposal that can be implemented rapidly and at relatively low cost while remaining compatible with the medium- long-term spatial plan. The proposal focuses on sustainable modes, equity, and scalable interventions that can evolve into more advanced mobility systems over time.
Given the current lack of detailed mobility data, the analysis presented here is intentionally preliminary. The recommendations emphasize flexible and incremental strategies to be refined as new information on travel patterns, land use, and community needs becomes available.

Rationale and approach

The Master Plan by Dar Al Omran – Rasem Badran provides a long-term vision for mobility and spatial development in the Gaza Strip. Its primary transport components include:

1. Expansion of roadway infrastructure to strengthen internal and regional connectivity.
2. Development of a regional railway along the eastern side of the Strip for passenger and freight movement.
3. Reactivation of the former airport in the southeastern area.
4. Introduction of a coastal water-taxi service linking major cities from north to south.

These strategies articulate a high-capacity, multi-modal system envisioned for full reconstruction and regional integration. However, many of these infrastructures require substantial investments and medium-long implementation timelines. Consequently, immediate mobility needs must be addressed through pragmatic, low-cost, and scalable solutions that preserve compatibility with future expansions. Short-term reconstruction contexts face constraints in funding, time, materials, and institutional capacity. The proposal presented here is guided by four principles:

- Ensure trips within Gaza and connections with the West Bank: prioritizing public transport, cycling, and shared mobility to reduce congestion, emissions, and infrastructure costs.
- Accelerated implementation: deploying systems that can be operational within 1–2 years and require minimal specialized construction.
- Social inclusion: ensuring equitable access to opportunities, by expanding affordable and reliable transport options.
- Economic development: enabling labor mobility, supporting reconstruction logistics, and fostering local entrepreneurship.

Early stage planning also requires understanding local mobility habits, community preferences, and the spatial distribution of households and services. As these data are

not yet available at scale, the proposal adopts modular and adaptable design principles.

Proposed short-term mobility system

Mobility hubs as structural anchors

Five primary mobility hubs—Beit Hanoun, Gaza City, Deir al-Balah, Khan Yunis, and Rafah—are proposed as the backbone of the system, aligned with major population centers and access points. These hubs function as intermodal nodes integrating:

- Bus Rapid Transit (BRT) services
- Community taxis
- Active mobility infrastructure
- Shared mobility services
- Urban delivery logistics

Hubs enable efficient network organization, community accessibility, and phased expansion as future data becomes available.

Bus rapid transit (BRT)

A BRT network represents the core public transport solution due to its low capital cost, high capacity, and rapid implementation (Lambas et al. 2017). The system features protected lanes, high passenger capacity, traffic signal priority, sheltered stations with real-time information, and accessibility for passengers with reduced mobility.

Two alternative configurations are considered for the initial deployment of the Bus Rapid Transit system. Option 1 (Figure 1) envisions a network composed of two distinct

lines, each serving complementary segments of the Strip. The Red Line would connect Beit Hanoun in the north to Deir al-Balah in the central region, while the Green Line would extend southward from Deir al-Balah to Rafah. Together, the two lines would operate through a system of 13 stations, comprising the five main terminal hubs and eight secondary stations strategically placed along the corridor. With 10-minute headways, corresponding to six buses per hour, the system would ensure frequent and reliable service throughout the day. Commercial speeds are expected to range between 20 and 25 km/h, enabling efficient movement even in constrained urban conditions. To broaden coverage beyond the main corridor, a set of feeder buses would connect key residential and activity nodes to the BRT stations, thus forming an integrated network. This configuration offers a balanced geographic distribution of services and high operational frequency, making it particularly suitable for the early stabilization phase of the reconstruction process. Option 2 (Figure 2) proposes a more streamlined configuration centred on a single, continuous north–south line. This line would traverse the entire length of the Strip, connecting all five terminal hubs through a sequence of approximately 40 stations. A distinctive feature of this option is its cargo-hitching capability, in which articulated buses tow modular trailers that can accommodate both passengers and freight. This dual-purpose system would support not only personal mobility but also small-scale logistics during the reconstruction period. The line would operate with 15-minute headways—about four buses per hour in each direction—supported by a fleet of approximately 50 articulated vehicles equipped with trailers. This option emphasizes continuity, logistical efficiency, and ease of deployment across the entire corridor.

Both options meet urgent mobility needs with low emissions, limited construction disturbance, and scalability toward future tramway or metro systems.



Figure 1 – BRT proposal - Option 1 (basemap from the Master Plan by Dar Al Omran – Rasem Badran)

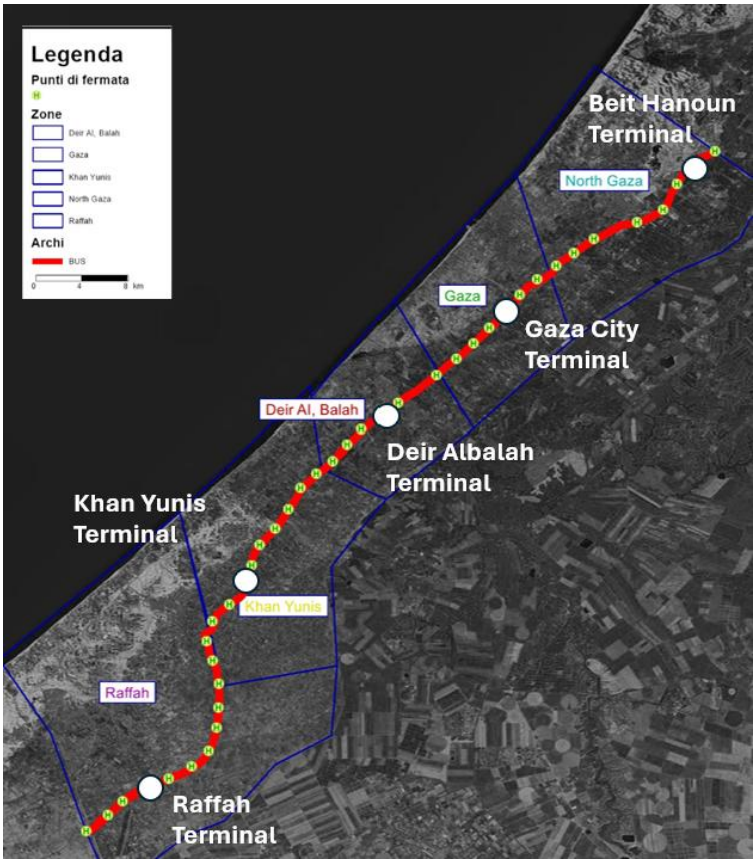


Figure 2 – BRT proposal - Option 2 (Basempap ESRI)

Community taxi system

In parallel with the BRT network, a community taxi system would play a complementary role by extending mobility into residential areas and neighbourhoods not directly served by the main corridor. Operated locally by residents, these services would offer flexible, demand-responsive connections from BRT stations to surrounding districts. Beyond improving physical accessibility, the model carries

significant social and economic benefits. It can provide affordable mobility for users who may not have access to private vehicles, while simultaneously creating employment opportunities and fostering small-scale entrepreneurship among local drivers. Because routes can be adapted to the unique spatial patterns and social dynamics of each neighbourhood, community taxis also help reinforce social interaction and cohesion. This system is particularly valuable in fragmented urban settings, where fixed-route services alone may be unable to accommodate the fine-grained mobility needs of dispersed communities.

Cycling infrastructure

To strengthen sustainable transport options, we propose to introduce a continuous and legible cycling network designed to promote active mobility as a viable everyday mode. Segregated cycle tracks along major arterial roads would provide safe, predictable corridors for longer trips, while shared, traffic-calmed environments in residential areas would encourage cycling within local streets. Complementary infrastructure—such as bike parking and racks at terminals, public facilities, and commercial areas—would support routine use and reduce barriers to multimodal travel. Ensuring seamless first- and last-mile connections to BRT stations further integrates cycling into the wider mobility ecosystem. As a low-cost and rapidly deployable mode, cycling offers health and environmental benefits while expanding mobility opportunities for populations that may be underserved by motorized transport, or experiencing fuels shortage.

Shared Mobility and Urban Deliveries

Finally, we propose a suite of shared mobility solutions intended to diversify available modes and support flexible, user-oriented travel. Bike-sharing systems at major transit hubs would facilitate short trips and last-mile movements also for those who cannot afford a private vehicle, while cargo bike rentals would provide an efficient option for small-scale deliveries, especially within dense urban neighbourhoods. Scooter-sharing services at key nodes would offer additional lightweight and accessible personal mobility. For freight logistics, we envision the development of vertiports for drone operations both at major hubs (Marinelli et al., 2025) and at the southern airport site, enabling rapid, low-impact transport of essential goods in short time and allowing to reach the most remote regions, also in case of infrastructure disruption.

Conclusions: Toward a coordinated mobility–land use strategy

Beyond immediate reconstruction, the proposed system contributes to a broader urban strategy centred on coordinated land-use planning, equity, and community-driven development. Integrating transport and land use ensures that residential areas, services, and economic hubs remain well connected, reducing spatial inequality. The participatory dimension of the solutions (such as community taxis and shared services) helps align transport interventions with daily movement needs and local mobility cultures. Together, these innovations contribute not only to improved accessibility of the region but also to the establishment of a "Living Lab" environment in which experimental and advanced mobility technologies can be tested and refined to meet local reconstruction needs.

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Managing uncertainties in the implementation of Gaza Phoenix recovery framework

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Abstract

The paper proposes a model for the implementation of reconstruction projects in the Gaza region as outlined in the Gaza Phoenix Recovery Framework. The model includes creating alternative scenarios and mapping uncertainties against the backdrop of these scenarios adopting a participatory approach, which is consistent with a fundamental principle underlying the GPRF. The paper outlines operational guidelines for preparing scenarios and assessing uncertainties, assigning the GPRF multidisciplinary team the role to facilitate, give voice to and support the population's perspective on the reconstruction of the Gaza region.

Keywords

Project implementation options, Uncertainty mapping, Scenarios, Strategies, Gaza Phoenix Recovery Framework.

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Introduction

Cities grow and shrink, modifying their structure. Common features of urban growth include impervious surfaces, urban sprawl, traffic congestion (Schewenius et al., 2014) and new forms of "peripheralization" of rural areas (Larondelle & Haase, 2013). Conversely, urban shrinkage leads to the creation of empty or under-used urban areas, demolitions, abandoned industrial sites and de-densification (Haase et al., 2014a). All these processes can influence the functioning of an urban system. Every change in land use may alter system equilibrium, with consequences for resilience and system functionality (Pelorosso et al., 2011; 2015).

From an environmental perspective, unregulated development or shrinkage may significantly impact climate, stormwater control, biodiversity, and air and water quality. From a social perspective, several consequences may emerge regarding social capital, segregation, and quality of life.

Planners and designers can limit negative socio-ecological impacts by integrating nature into the city (McPhearson et al., 2014). Nature in cities is fundamental for sustainability. Humans rely on nature to meet primary needs, such as food and drinking water. Nature mitigates negative pressures of an oversized Western society, improves the aesthetic appearance of cities, and green/blue areas reduce the urban heat island effect and flood risks. These areas provide multiple environmental and socio-cultural functions and form part of Urban Green Infrastructure (UGI). UGI improves wellbeing, public health, and provides economic benefits, which can be analyzed through Urban Ecosystem Services (UES) in particular the potential to mitigate the alteration of the hydrological cycle (Leone, Grassini and Balena, 2022). Land-use changes, conversion associated with shrinkage, or residual non-urbanized areas between new settlements offer potential to enhance and expand UGI.

Green and permeable elements such as green roofs and trees can also be introduced in compact districts.
Achieving optimal UGI organization is challenging. Sustainability can be enhanced by increasing system complexity, mimicking ecological systems (Ho, 2013; Leone et al., 2017). In cities, this is achieved by considering UGI multifunctionality and spatial organization. UGI should maximize non-dissipative flows and minimize dissipative ones, reducing entropy production. Sustainable UGI depends on designs that reuse system waste and minimize external energy, materials and labor.
A green area may have minor or negative effects if poorly placed. A park in an inaccessible area may not meet needs and requires maintenance resources. The same park could be highly valuable if designed for stormwater management, reducing combined sewer overflows and protecting receiving water bodies. Proper spatial and temporal analysis of environmental and social processes is essential, often requiring GIS and modelling techniques.
This article presents Non-Urbanized Areas (NUAs) and Nature Based Solutions (NBSs) in the context of UES.

Methodological note

Scenarios provide images of the future that usually has a long-time horizon, longer than the "long-term phase" proposed in the GPRF and the Road Map. Scenarios are relatively undetailed images of alternative probable and/or desirable futures. Their main purpose is to provide background and context for decisions, which in our case are already outlined in the GPRF. The scenarios also increase our understanding of the present situation and the various uncertainties that define it. In this way scenarios enable us to

develop alternative strategies for the implementation of the GPRF.
Uncertainties can be demarcated according to life domains such as political, economic, and social and technological spheres. Alternatively, they can be classified according to the strategic approach which, for example, the implementors of the GPRF select bearing in mind the uncertainties. According to this approach uncertainties are categorized in relation to 1) the working environment, broadly defined in terms of political, economic and social and technological milieus (UE), 2) decisions made by other public or private agencies (UR), 3) guiding values prevailing in Palestine generally and in particular in Gaza (UV).

Operational guidelines

In the following texts we outline operational guidelines for preparing alternative scenarios and evaluating uncertainties in the implementation of GPRF
The approach consists of five-steps. They can be carried out in brain-storming workshops where participants are physically present or participate virtually. We advocate a participatory approach that is also a fundamental principle underlying the GPRF which states that "The future of Gaza can only be in the hands of its people.…experts should empower the community's vision, not dictate it".
The role of the GPRF's multidisciplinary team should be to facilitate, voice and advocate the people's view on reconstruction of the Gaza region.

STEP 1 - Catalysts and obstacles

Catalysts are incentives or stimulants that may enable the implementation of the GPRF. They can be political or economic or social and can be re-classified according to the strategic choice approach: UE – UR – UV. For example, here is a list of catalysts:

- **Political catalysts**: GPRF receives considerable support from key international organizations, NGOs in Gaza are supportive of the Road Map.
- **Economic catalysts**: Appreciable agreement among donor agencies regarding the financing the reconstruction according to the Phoenix Roadmap. Local entrepreneurs' strong belief in mobilizing local labor for the reconstruction projects.
- **Social catalyst**: GPRF has been instrumental in mobilizing considerable support from Gaza's five municipalities. NGOs willing to provide technical support for the reconstruction projects.

In the same way a list of obstacles, in other words, stumbling blocks or deterrents, that may disable the implementation of the GPRF, needs to be prepared. For example, here is a list of obstacles:

- **Political obstacles**: Reconstruction of Gaza is constantly inhibited by constant external inference. Long delays in the supply of necessary building resources.
- **Economic obstacles**: Constant disruptions of the banking system in Gaza cause delays in the flow of foreign reconstruction aid. International donor agencies are in disagreement with providing necessary funds owing to domestic political dissentions.
- **Social obstacle**: Long period of colonization and intermittent military conflicts have resulted in dismay in Gaza society. Clan-based dissentions have been exacerbated by "divide-and rule" policies of the colonial

authorities.

STEP 2 - Identical, mutually supportive and mutually exclusive statements

Catalysts and obstacles are identified and rearranged into three categories:

- **Identical proposals**: there are only differences in the way proposals are expressed.
- **Mutually supportive proposals**: they create similar sense of shared success or failure. They reinforce each other in the same policy area.
- **Mutually exclusive proposals**: they cannot exist or happen together at the same time.

An example of identical statements:

- *In 2030 Gaza municipalities* participating *in the GPF receive full support from key international organizations and NGOs*
- *In* late *2020s Gaza municipalities participating in the GPF receive support from international organizations and NGOs*

An example of mutually supportive statements:

- *GPRF has been instrumental in mobilizing Gaza's population for the reconstruction projects.*
- *There is a considerable agreement among international and national donors regarding reconstruction aid in accordance with Gaza Phoenix Roadmap.*

An example of mutually exclusive proposals,

- *Implementation of the reconstruction of Gaza is inhibited by constant external interferences.*
- *Gaza Region receives uninterrupted aid from international donor agencies.*

STEP 3 - Deriving alternative scenarios

Following the preparation of the above statements or proposals, the participants need to discuss and rearrange the statements, in order to develop two or more alternative scenarios. Based on our understanding of the situation in Gaza, we feel that it may be necessary to have three scenarios, for example:

- Scenario 1 - Relatively trouble-free implementation of the GPRF.
- Scenario 2 - Incremental and partial achievement of the GPRF.
- Scenario 3 – Stalemate: Waiting in the wings.

Scenario 1: Hopeful future with very few political, economic and social obstacles. Gaza able to live at peace with neighboring countries.

Scenario 2: "Stop-go development" implies that for almost every step Gaza society takes in order to live in peace with its neighbors, there are external interferences that thwart reconstruction attempts.

Scenario 3: Gloomy future implies that it is almost nearly impossible to implement the GPRF in foreseeable future mainly because of external interventions but the Gaza society hopes of the possibilities to achieve reconstruction goals once conditions improve radically.

STEP 4 - Mapping uncertainties

Understanding the preconditions for achieving the objectives of the GPRF in a carefully thought-out step-by-step process in crucial stages of the Phoenix Roadmap.

- **Uncertainties about working environment (UE)**: Factors that would facilitate or hinder Gaza's efforts for reconstruction. For example, 1. A durable peace between

Israel and Palestine is difficult to achieve. 2. External donor agencies no longer fulfill their promises for financing the reconstruction projects.

- **Uncertainties about related decisions (UR)**: Factors that have historically defined Gaza region's geopolitical, social and economic status. For example, 1. Decisions taken by neighboring regions are contrary to the wishes of the Gaza society. 2. Constant failures of understanding between Gaza and other Palestinian regions.
- **Uncertainties concerning guiding values (UV)**: Societies that have experienced long-term colonial occupation with all kinds of pressive regimes develop frame of mind that is detrimental to political, economic and social self-reliance. De-colonizing the mind takes time. The implementation of the GPRF has an implicit assumption of mass mobilization of the society. For example, 1. The clan-based values may prove to be countervailing to the desires implicit in mass-mobilization efforts. 2. Colonial occupation has created a sense of defeatism that may hinder entrepreneurial initiatives

STEP 5 - Strategies for achieving the objectives of the Gaza Phoenix Recovery Framework

The causal approach that we have discussed above can be simply stated as following:

Alternative scenarios → Uncertainty maps → Strategies → The roadmap for the reconstruction of Gaza

Once the participants in the above outlined process have achieved a consensus about the scenarios and uncertainty map, they have the final task of developing strategies in order to implement building projects as outlined in GPRF.

Strategies are vital for ensuring the implementation of development projects in face of uncertainties.
We illustrate the relationship between the four elements in strategic decision making with the help of one example from each scenario and corresponding set of uncertainties and necessary strategies to manage these uncertainties.

Table 1 - Illustrative relationship among strategic decision-making elements

Scenario	Set of uncertainties	Strategies
Relatively trouble-free implementation of the GPRF	Donor agencies' willingness to finance the reconstruction of Gaza on a piecemeal basis in order to ensure optimal use of their money	"Rolling" evaluation of the construction projects in order to ensure transparency and uninterrupted flow of foreign aid
Incremental and partial achievement of the GPRF	Decisions taken by neighboring regions are contrary to the goals of the GPRF, leading to unstable supply of building material	Mobilizing supportive network of national and international organizations to exercise constant pressure in order to minimize chicanery
Stalemate: "Waiting in the wings"	The clan-based values may prove to be a major obstruction in order mobilize efforts for self-reliant actions in order to improve the living conditions of people living in improvised settlements	Developing a framework of neighborhood mobilization efforts in order to reduce clan-based obstacles

Concluding reflections

In this paper, we have outlined a procedural model for increasing robustness for the implementation of programs and projects outlined the GPRF. Our model advocates that the GPRF is anchored in a knowledge base provided in alternative scenarios enabling the participants to map out of uncertainties and to derive strategies in order to assuage uncertainties, and thereby ensure a sustainable achievement of the reconstruction of the Gaza region.

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Towards advancements of a knowledge-based economy: Suggestions from the Gaza Phoenix strategic plan

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Abstract

Knowledge-based economies appear to have strong relations with tradition and identities in social organizations. Complex settlements coming from varieties of language and stories and of special relations between human agents and space are knowledge-based fabrics for intensive knowledge-based economies. This paper explores the potential for Gaza's reconstruction through an endogenous development strategy rooted in regional science research, focusing on traditional sectors, youth engagement, symbolic places, and human capital development as pillars for building a resilient knowledge-intensive economy.

Keywords

Knowledge-based economies, Regional development, Endogenous growth, Youth engagement, Human capital, Gaza reconstruction

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Introduction

Intensive knowledge-based economies are current protagonists of intensive growth. Knowledge-based economies appear to have strong relations with tradition and identities in social organizations. Cities as concentrated settlement spaces of agents and knowledge production are now seen in critical relation with empty spaces as producers of ideas. Complex settlements coming from varieties of language and stories and of special relations between human agents and space are knowledge-based fabrics for intensive knowledge-based economies. Ontological models can be useful to reason on these dilemmas and to avoid abandonment of important social organizations of space at the crossroad of concentration and dispersion in knowledge production.

Intensive knowledge-based economies

Intensive knowledge-based economies are credited today with growth rates much higher than what happens for others. We refer here to economies performed by agents and multi-agents who for some reason are able to do things or activate production processes that are uncommon in the markets because of their creativity complexity.
The assumption above is of course in line with the mainstream classic and neo-classic economic theory: goods that are uncommon because of their difficult generation or conservation are priced much more than those that are abundant because of their easy life. Intensive knowledge-based economies in the vein of our discourse can relate to both 'internal' and 'external' features of their space-based systems (Borri et al. 1996; Lichfield et al. 1998). Of course, our discourse refers to static-discrete or dynamic-continuous

constitutive situations. Intensive and uncommon bases of knowledge are in general created by specialization, which means by the recurrent and resolute use in a specific way by agents and/or multi-agents of cognitive resources that are easily available to them because of their local (i.e. in the agent's and/or multi-agent's circle) abundancy (Friedmann 1987). The multi-agent production of a well-tailored knowledge-based mixed trade economy by the Lubeck circle or industrialists-merchants in the Baltic sea corridor environment could be modeled in abstract way as the type of a dynamic-continuous specialization in a multi-good market fabric: a situation whose persistence-of-existence today with the society living there is probably unclear. The multi-agent production of a well-tailored olive oil soap-based economy by the Palestinian circle of peasants-industrialists-merchants along the Mediterranean coast could be modeled in abstract way as the type of a static-discrete specialization in an individual good regional space market: a situation still existent.

Both the Baltic coast and the Mediterranean coast in the Middle East with their cities need cognitive and commercial corridors: the sea with its ports cannot but be complemented by land - a problem which is technical and political. Concentrated and/or disperse spaces where knowledge is cultivated, with their typical scenes (schools, labs, communities, etc.), are potential powerful generators of knowledge-based productions.

Ontologies of knowledge interaction

Memories of interaction with the environment are fundamental pieces of knowledge for living agents who continuously create images of the reality in which they are functioning, by senses as detectors and brain as a central

machine for elaboration of its physical and virtual interaction sceneries, in which the non-living agents are also fundamental (Anderson, 1983). All this exists in fertile and also fragile situations where specialization-construction and generalization-abstraction of the interaction among agents by reinforcement mechanisms (Anderson) is the key of an ambiguous 'door' which is also essential transient between 'life and death'. Where there are limitations to interaction capacities hierarchies are introduced as generalization-abstraction mechanisms to reduce the amount of interactions: now artificial machines with increasingly massive repositories of memories and speed of computation seem to promise the elimination of the fallacies of hierarchization.

Sceneries

Cities are natural and artificial spaces-sceneries crowded of objects and processes which are illusory places where powerful knowledge and intelligence creation machines are located. Cities and now increasingly megacities are plenty of objects and processes and interactions and repetitions so that they seem to be able to cultivate knowledge and intelligence without particular efforts even if they structurally lack of the death side of reality which is the existence and functioning in isolation. Spaces without cities able to put a living agent in direct contact with its generation ground are probably more fundamental means for cultivating deep knowledge and intelligence being far from massive artificial sets with their inclination to construction. Spaces with or without settlements can present impressive sceneries of integration between human beings and nature still fully operational for contemporary life: impressive because of their impressive histories and identities with their impressive

remains and still operational agentivities, impressive because of their sustainable coexistence with the 'natural' environment. Here, we define the above sketchly described spaces of human life as Sustainable Settlements. Sustainable Settlements today are not abundant because of human behaviors characterized by a detachment between humanity fundamentals and context fundamentals and can be cultivated as powerful agentivities for sustainable economies.

Sustainable settlements and knowledge-based economies

Fostering traditions and local identities in urban and regions and nets and poles of innovative knowledge exchange and production based on those traditions as keys of advanced and resilient knowledge-based economies. Keeping dialogues between spatial concentration and spatial dispersion as models of sustainable settlements and as generators of knowledge innovations. In Bengaluru the Indian Institute of Technology, as a multiagent innovative knowledge production pole, hosts intriguing dialogues among agents coming from the traditional villages of the surrounding rural India of the Karnataka region and agents living in a forefront research and teaching pole of world: I remember students in mathematics and informatics arguing defense there in favour of empty spaces against the proliferation of cities and megacities. Suggestions coming from the splendid visibility of the stars in the night presumably foster emotions and curiosities and from these the spreading of abstract cognitive abilities: think of the Newton confessions on the point regarding what happened to him when working to his Principia Mathematica, early XVII century.

In the Bengaluru IIT, credited as the best in the Indian circle of five, the Ganesh God can be near to these extremely skilled cognitive agents, to help them in their crises from daily life failures. Rana Dasgupta (2014) in his Capital: The Eruption of Delhi, in analyzing the recent economic booming of the city, end of XXI century, makes evident how this megacity is coming back to the Gods of its constitutive environment by correcting the errors made by the British planners in the XIX century in the enlargement and reconstruction of the original system of villages because of their fighting again the spirits of the place. The concept of an innovative milieu is well established in applied economics and regional science (Camagni, 1985, 1995; Camagni, Capello, 2005): it postulates the importance of networking of socioeconomic agentivities and of learning activities and learning organizations (Schon, 1983; Schon, Rein, 1994). Now individual and multiple agents, natural and/or artificial, with their indispensable relations, populate the scene of new types of knowledge-based economy.

Rationale integration in knowledge-based social processes

In the current vein of studies on natural and artificial intelligence knowledge-based processes in both individual and multiple agentivities are credited with complex and frequently powerful problem solving abilities when they integrate different rationales, let's say for example calculus and emotion (Minsky 2006). For future situations of advanced knowledge-based economies in a variety of sophisticated technological domains the careful conservation of cultures, computational and emotional creativities and interaction abilities, languages, organizations, productions, traditions, to cite only of a few of the resource

set offered by cities and regions still not destroyed by routine simulation models.

Rebuilding the public space

The post-war economic reconstruction of Gaza could be grounded in a comprehensive and ambitious infrastructure plan. Immediate priority the rebuilding of essential public and private facilities, including social housing, schools, healthcare centers, and civic spaces, to restore the conditions necessary for a dignified and functional daily life for all the inhabitants.

Tradition pillars for the endogenous development strategy

A revitalized regional economy should draw upon and reinvigorate the area's traditional productive sectors: namely, the maritime economy, commerce, and agriculture. These sectors should constitute the foundational pillars for reducing the region's alarming unemployment rate and represent the core drivers of an export-oriented development model based on endogenous resources. However, sustainable economic recovery requires more than sectoral investment: it necessitates the articulation of a long-term endogenous development strategy that combines robust public investment with dynamic private sector initiatives.

Recent regional science studies show that local economies rebuilt on endogenous foundations are more resilient when rooted in the historical competencies of their territories. According to Urban Science, traditional sectors can evolve into a "smart heritage economy", capable of integrating

ancestral knowledge with contemporary technologies. The International Journal of Cultural Economics reaches similar conclusions, recognizing traditional productions as strategic assets for attracting cultural investment and triggering high-quality economic regeneration. AISRe research highlights that strengthening rooted competences—from fisheries to light manufacturing—helps consolidate community ties and territorial cohesion, prerequisites for reactivating development spirals. For Gaza, this means transforming traditional sectors into knowledge platforms that connect local expertise, productive innovation, and regional logistics networks.

Focusing on youth

At the center of this vision, we propose the creation of an innovative territorial milieu: an enabling environment that fosters social cohesion, knowledge creation, and sustainable opportunity, particularly for the younger generations. The youth of Gaza have borne the brunt of the war's devastation and trauma. Thus, a cornerstone of the recovery strategy must be the implementation of a comprehensive program of mental health and psycho**-**social support to address the profound psychological wounds inflicted upon this generation.

Recent literature shows that young people represent the strategic core of reconstruction in territories affected by deep crises. Urban Science identifies that territories investing in learning spaces generate "youth-driven innovation cycles", crucial in post-conflict contexts. The International Journal of Cultural Economics notes that youth engagement in cultural, creative, and community processes significantly increases resilience and long-term productivity. AISRe studies further demonstrate that young people, when

equipped with relational capital and educational opportunities, act as "multiplying agents" in building cooperative territorial networks. For Gaza, this requires integrated programs of psychological support, advanced training, entrepreneurial incubation, and civic participation, designed to activate the transformative potential of the new generation.

The fundamental role of symbolic places

We also propose the establishment of a symbolic «Place of Peace and Memory»: an open and inclusive public space dedicated not to revenge but to remembrance, reconciliation, and renewal. This site should serve as a powerful emblem of Gaza's resilience and its aspiration for a peaceful future in the broader Middle East. In tandem a robust strategy for institutional development is required, aimed at strengthening democratic governance, civic engagement, and local leadership. The consolidation of transparent and participatory local institutions is essential to ensuring long-term peace, legitimacy, and social stability.
Regional science gives increasing weight to symbolic places as catalysts of social cohesion in reconstructed territories. Urban Science indicates that public spaces designed as cognitive infrastructures facilitate reconciliation and collective learning, activating "place-based healing" dynamics. The International Journal of Cultural Economics shows that memorials and civic spaces can function both as cultural and economic devices, stimulating creative microenterprises and reinforcing community identity. AISRe research stresses that these spaces gain strategic value when integrated into inclusive, transparent, multilevel governance processes. For Gaza, developing a "Place of Peace and Memory" and a system of participatory local institutions

would provide a foundational infrastructure for anchoring reconstruction to a renewed social contract.

Human capital, education, and innovation: Pillars of endogenous growth

The most strategic investment for Gaza's future lies in the domain of human capital. This knowledge-based development approach is essential to curbing the brain drain and cultivating a new generation of local leaders, entrepreneurs, and scholars capable of steering Gaza toward a resilient and prosperous future. In this regard, we strongly advocate for the launch of a comprehensive scholarship program to support thousands of young Gazans with full access to higher education, both locally and abroad. Such an initiative would represent not only an investment in the region's economic regeneration but also a profound commitment to peace-building and inter-generational justice. Priority must be given to the reconstruction and modernization of the educational system, including: rehabilitation and expansion of primary and secondary schools, universities, and research centers; investment in teacher training, curricula development, and the provision of adequate learning materials and infrastructure; establishment of innovation hubs, technological incubators, and international academic partnerships; promotion of gender equality and universal access to education.

Recent regional science literature agrees that endogenous growth in post-crisis territories depends on the quality of educational institutions and the ability to generate advanced human capital. Urban Science demonstrates that territories investing in schools, universities, and research centers develop "knowledge-intensive recovery paths". The International Journal of Cultural Economics highlights the

role of cultural and creative industries as bridges connecting education, talent attraction, and productive diversification. AISRe studies confirm that regions capable of linking vocational training, businesses, public administration, and civil society consolidate collaborative ecosystems generating high-value development. For Gaza, this means building an integrated educational infrastructure—schools, universities, research centers—supported by scholarship programs, innovation hubs, and international partnerships to reduce brain drain and cultivate a new generation of professionals and researchers.

Recent regional science research shows that territorial reconstruction succeeds only when the spatial dimension of development integrates with the cognitive one. Studies published in Urban Science indicate that territories hit by acute crises can reactivate growth trajectories only if physical reconstruction is accompanied by the creation of new "knowledge nodes" capable of attracting skilled human capital and generating collective learning. Similarly, work in the International Journal of Cultural Economics highlights the role of local identities as intangible assets that, when recognized and enhanced, strengthen socio-economic resilience and the capacity of territories to absorb innovation. Recent AISRe contributions confirm that the quality of interactions among communities, institutions, and productive spaces is crucial for transforming fragile areas into development ecosystems. For Gaza, this means designing reconstruction not only as infrastructure rebuilding but as the creation of an open and collaborative cognitive milieu able to sustain a knowledge-intensive economy.

Conclusions

Rehabilitation and/or reconstruction of built spaces of urban and regional spaces as occasions to promote insights on complex spatio- and socio-environmental equilibria and dialogues created by culture, tradition, and history building and to create on them sustainable economies and settlements and sophisticated knowledge fundamentals and ontologies in the vein of the uncommon legacies social and environmental legacies

Fostering cognitive poles based on both existing and new situations as tools and ways of strength for the new socio-environmental challenge

Investing in youth and in new integrated rationales made of calculus and vision, of computation and emotion in intensive knowledge-based sustainable settlements

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Gaza's reconstruction or Gaza's redevelopment?

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Abstract

This paper reconsiders post-war recovery strategies for the Gaza Strip, arguing that a narrow focus on "reconstruction" is insufficient to address the territory's structural economic fragilities. It advances a broader framework of "redevelopment," grounded in the observation that Gaza's pre-war socio-economic conditions were shaped by long-standing constraints, market fragmentation, and limited policy space. Drawing on Amartya Sen's conception of development as freedom, the analysis links sustainable recovery to the expansion of economic and institutional capabilities. The paper examines the limits of standard growth models in contexts of severe destruction of physical and human capital and outlines a redevelopment approach aligned with the UN Sustainable Development Goals, with particular emphasis on health, education, and human capital formation. It concludes that while external assistance is an important component of recovery, long-term stability and development depend on addressing the structural conditions that have historically undermined Gaza's productive capacity.

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Keywords

Gaza, Redevelopment, Post-war recovery, Human capital, Sustainable development

Introduction

After more than two years of Israel's genocidal campaign in Gaza that saw Israel drop more than 200,000 tons of explosives on a small area of less than 365 square km that destroyed over 92 percent of homes, hospitals, schools, universities and infrastructure, which a UN expert dubbed as homicide, and killed over 70,000 Palestinians so far (there are credible accounts that this number underestimates those killed, starved to death and remain under the rubbles, which could top 350,000)(Khatib et al. 2024) the majority of them are children, women and elderly; there is now renewed discussion of the urgent need to reconstruct the Strip. The core issues about the reconstruction program revolve around the cost of the program, who would pay for it? How long it would take to complete? And is it feasible under occupation?

Missing from the discussion is a crucial question; does it make sense to reconstruct the past? Is it meaningful to avoid the crucial question of whether the need is for reconstruction or the redevelopment of Gaza?

The starting point of this paper is simple; Israel's illegal occupation of Palestinians' land is irreconcilable with their development. It is inconceivable to believe that the Palestinians can re-initiate their development, which is now after Amratya Sen (1999) is synonymous with freedom. Thus, ending the occupation and liberating the Palestinians from the shackles of colonialism should precede

reconstruction. It follows that reconstruction has to be coupled with redevelopment and the latter with freedom.

The Israeli occupation has presented a pervasive obstacle to Palestinian human development, human security and progress, geographically since it affects the entire Near East region, temporally as it extends over decades and developmentally as it distorts, disfigures and reverses developmental processes. Its costs go beyond loss of life, livelihood and assets. Nothing stifles the quest for development more than subjecting people to foreign occupation that robs them their freedom, which constrains their choices, and expropriates their resources. Israel's occupation has cast a pall across the political, social and economic life of the entire region. Occupation narrowed the national policy space, distorted national priorities, drained scarce resources, diverted investments into unproductive uses, fostered uncertainties, smoked opportunities and derailed political and human development. Palestinian development has been disfigured by occupation. The logical program is not about reconstruction. Rather it is about redevelopment and reconstitution.

If this disfiguration by occupation is not sufficient to derail Palestinian development then consider the negative effects of violence, upheavals, unrest, sanctions, closures and embargoes. It is no wonder that Palestinian development has been constrained as markets shrank, productivity declined, assets withered away, brains were drained, opportunities disappeared, frustrations mounted and inaction prevailed. These factors alone could explain by themselves why Palestinian development has been aborted. There are to be sure more complicating factors that need to be addressed to liberate Palestinian development from the stranglehold of these debilitating factors, but ending the occupation and creating a sovereign state will kick start a new dynamic

towards a more inclusive, just and meaningful development and peace.

In 1967, Israel occupied the West Bank and Gaza Strip and integrated their markets into its own. The size of the Israeli economy at that time was around ten times that of the Palestinian economy, its sectoral diversification was much greater and the manufacturing sector's share in GDP was more than four times larger. These differences in size and structure made the relation between the two economies as one between a large, advanced and rich economy and a small, underdeveloped and poor economy. Both the theoretical analysis and empirical studies suggest that the dynamics of such a relation always generate two opposing forces that disproportionately affect the smaller economy and shape its development. Favorable repercussions include an increased demand for the products of the small economy, possible diffusion of technology and knowledge, as well as other spread effects, resulting from the geographical proximity of the small economy to a large market. These effects typically lead to subcontracting, joint ventures and coordination in tourism and other services. Yet there are to be sure some unfavorable repercussions arise from the disappearance of many industries in the small economy, its confinement to producing labor intensive and low - skilled goods, and the emigration of a sizable segment of its labor force to the neighboring economy, as well as to other countries. These effects are known in the literature as backwash effects or polarization effects. They arise from the capability of efficient, large - scale industries in the advanced economy to out - compete inefficient, small - scale industries in the less advanced economy, and to attract both their labor and capital (Krugman and Obstfeld, 1994).

From the perspective of the small economy, therefore, the crucial question is the net balance between the two opposing dynamic impacts-- To what extent do they help its own

development, and to what extent do they reinforce underdevelopment? Among the factors that determine the relative strength of these two forces is the degree of integration between the two sides, which can be easily ascertained by considering trade. Further measures of integration between the two economies, such as allowing free movement of labor and capital, would significantly reduce the export of goods from the small to the large economy as the export of labor services would have been substituted for the export of goods. In other words, free trade and free mobility of factors would gradually wipe out trade based on comparative advantage and confine it to trade based on absolute advantage, resulting in the small economy exporting low - skilled goods and importing high - skilled goods, thus 'locking in' its poverty[1]. The small economy would be relegated to the status of a backward region in an otherwise advanced country, as is the case of the South in Italy Central Appalachia in United States and the maritime provinces of Canada.

If integration between two countries is allowed to proceed at a slower pace whereby the poor economy is able to exploit its own resources, free trade between the two sides without a common external tariff and free mobility of factors of production may allow producers in the small economy to expand production. This would be the result of taking

[1] The advanced economy is generally more productive in the majority of sectors. The small economy will be able to export to the large economy goods that have no absolute advantage in production provided it has smaller productivity disadvantages and its labor accepts wages lower than those prevailing in the large economy. Free mobility of labor would induce labor to move from the low - wage small economy's industries to the high - wage large economy's industries, gradually wiping - out the former and expanding the latter. In the long - run, no industry will survive in the small economy unless it enjoys an absolute advantage over its counterpart in the large economy, and that means a predominance of low - skilled industries.

advantage of scale economies and enhancing a comparative advantage favorable to development. In short, a slow pace of integration with the larger and more advanced economy, and a speedy integration and unification of the disparate parts of the Palestinian economy allowing it to develop its critical mass and avail itself of the economics of specialization, scale and scope while safeguarding sovereignty over resources and trade could improve the comparative advantage of the small economy by tapping into the spread effects. However, as is the current situation of Palestine and Israel under the occupation regime, the hasty/imposed integration, entailed usurping domestic resources, restricting freedom of movement, supressing historical economic relationships, fragmenting markets, dissecting regions, separating neighbours, continuous closures, fiscal repression and pulverization of the policy space. These negative dynamics have combined to destroy any comparative advantage that may have existed or could have emerged through the working of the polarization effects (Kubursi & Naqib, 2008).

This discussion is a necessary introductory cautionary note about the nature and the structure of the redevelopment program, and why it should go beyond reconstruction, cements and mortars. The past structures and the nature of what emerged under occupation is precisely what the new redevelopment program should avoid and should strive to change and guard against repeating and reconstructing the past.

The emphasis in this paper is narrow and focused on the objectives, nature, structure, path and processes that would define the redevelopment program and differentiates it from a reconstruction program. The context of the new program involves addressing and unshackling the constraints and shortcomings imposed by the occupation in the last three decades. The reclaiming of the geographical and policy space

is at the core of this socioeconomic project of independence and redevelopment.
In what follows we will discuss the time frame, its distinguishing features, and a model that quantifies the resources needed to achieve its objectives.

The time frame

The dire humanitarian crisis in Gaza cannot be ignored. Dealing with it and meeting the humanitarian needs of medicine and food take precedence over all other issues. But even here the lessons of history are clean. Humanitarian assistance should always be coupled with developmental objectives; the two are not separable. Humanitarian assistance can be delivered with local employment targets, use of local resources, training local workers and other measures that link this assistance with broader developmental objectives.
Viewed within this perspective a logical time path can be organized that prioritizes addressing humanitarian needs, rebuilding living quarters and infrastructure is initiated but without divorcing these actions from long-term objectives of revitalising developmental goals and targets.
In the short-term the response to the dire needs and targeting recovery prevails, whereas in the mid-term rebuilding and reconstruction take precedence over other considerations, but in both terms the long-term objective of development, independence, empowerment, reconstitution, and exercising their rights to self-determination are safeguarded.

Critical issues

As simple and natural these considerations are, there are a few critical issues to address.

Donors' agendas vs. domestic agendas

First, foremost is the issue of ensuring that national and domestic agendas should take precedence over donors' agendas. Donors often prefer the use of their surplus resources which may not be appropriate or the best to address the needs of the affected people. In many documented cases donors' tend to prefer rebuilding the past and not the best use of resources; they may seek photo-ops over the best design that may cost more and take longer to build or even create competitive capabilities to the exports of the donors.

NGOs and not Government

There is a general preference for donors' to depend on the mobilization of Non-Governmental Organizations (NGOs) over governmental bodies to assume the responsibility for managing aid. This preference of NGOs is rationalized on the basis that governmental bodies in the global south are more prone to corruption or cronyism. While this may be the case in some areas, care must be exercised to evaluate objectively the governmental bodies' record of performance, but it is necessary to recognize that there are few issues that limit the efficacy and effectiveness of NOGs such as dispersing and fragmenting the developmental effort, the limited accountability of the NGOs to local people, the limited resources available to NGOs and the divergence of

the objectives of NGOs from the national developmental program.***Financial vs. in-kind assistance***

Financial aid leaves the recipients in a much better position to earmark the funds to the best use. In-kind aid limits this option and ties the hands of the recipients to use the donations in the best use. As alluded to above some of the in kind donations are simply surplus resources that the donors want to get rid of and not what is needed by recipients.

Needs vs. Wants

Often needs deviate from wants. Donors need to be careful to meet needs and not wants, but this creates a problem. Who should decide whether a request for help is about a need or a want? The issue is raised here as a precautionary note not to address wants instead of critical needs despite all of the problems that this differentiation may raise.

Growth vs. development

Perhaps the most critical issue and concern is the pitfall of opting for growth targets instead of combining them with developmental targets. The distinction between the two is fundamental and care must be exercised to avoid confusing one for the other. The two need to be combined where there however a natural tendency to opt for growth targets, as they are simpler and easy to measure and monitor. Below we offer a few considerations to help in avoiding this confusion.

Economic growth refers to an increase in the total output of goods and services in an economy over time, typically

measured by the Gross Domestic Product (GDP), whereas Economic development encompasses a broader range of factors, including improvements in quality of life, human well-being, social progress, equity, Freedom, environmental sustainability, and an inclusive economy.

Economic growth is primarily concerned with the perspective of the economy as a whole, focusing on aggregate measures, whereas, economic development takes a more holistic approach, considering the well-being of individuals, human rights, communities, and the environment. Of course, economic growth can occur without significant improvements in social and environmental conditions. On the other hand, economic development emphasizes sustainable growth that balances economic progress with social equity and environmental conservation.

It is often the case that economic growth does not necessarily ensure equitable distribution of wealth. This is why economic development places greater emphasis on reducing income inequality and improving living standards for all segments of society. There are numerous cases where economic growth has led to regional disparities, with some areas benefiting more than others. Economic development aims to address regional imbalances and promotes balanced growth across different regions.

Economic growth may not prioritize environmental sustainability and can lead to negative externalities such as pollution, resource depletion and water shortages. Invariably, economic development integrates environmental considerations and aims for sustainable practices that minimize environmental impact.

Redevelopment: Going beyond GDP and taking advantage of the opportunity not to reconstruct the past

Development economists have rejected the over emphasis of GDP or GDP per capita as measures of development success. Early on they have opted to evaluate alternative indices that offer broader perspectives on what constitutes or measures development success. One of the most commonly used measures is the Human Development Index.

The Human Development Index (HDI)

This index combines GDP with two other indicators. The index integrates an indicator of health (life expectancy) and another indicator of education (years of schooling and expected years of schooling). In this way GDP growth is complemented with health and education measures.

This grew out of dis-satisfaction with the singularity of measuring development success by GDP growth where there are many examples of economies that scored very highly on GDP growth but failed miserably on measures of health and education. Measures that go beyond GDP growth were found to be more desirable as they are more accurate of measuring development success.

The Human Development Index (HDI) formula is the geometric mean of three normalized indices: health, education, and income. It is calculated by taking the cube root of the product of these three indices:[2]

HDI=Square Root of ($IHealth \times IEducation \times IIncome$)

Each of these sub-indices is a normalized measure that ranges from 0 to 1. Where,

[2] https://hdr.undp.org/data-center/human-development-index#/indicies/HDI

- Health Index (*IHealth*).This index is based on life expectancy at birth. The formula used is (LE−20)/(85−20), where LE is the life expectancy at birth. The minimum value is 20 and the maximum is 85.
- Education Index ($IEducation$): This index combines two indicators:
  - **Mean Years of Schooling Index (MYSI):** Average number of years of schooling for adults aged 25 and older.
  - **Expected Years of Schooling Index (EYSI):** Total number of years of schooling a child of school-entry age can expect to receive.
- Income Index ($IIncome$): This index is based on Gross National Income (GNI) per capita, adjusted for purchasing power parity (PPP). The formula uses the natural logarithm to account for the diminishing returns of income on human development:

$IIncome = (ln(GNIpc) - ln(100)) / (ln(75{,}000) - ln(100))$.

The GNIpc is capped at $75,000 because of diminishing returns on human development, and the minimum is set at $100.

The Genuine Progress Index[3]

Recently, even the HDI measure was found to be short of measuring true (genuine) development at it fails to consider human welfare or wellbeing. This is why a new measure known as the Genuine Progress Indicator (GPI) was developed just to fill this gap. The GPI adjusts the GDP indicator for income distribution, environmental degradation, and non-market activities. It offers a more

[3] https://en.wikipedia.org/wiki/Genuine_progress_indicator

accurate reflection of a nation's true progress by incorporating the wellbeing of the citizens.
The GPI is a metric that has been suggested to replace, or supplement, Gross Domestic Product (GDP). The GPI is designed to take fuller account of the well-being of a nation, only a part of which pertains to the size of the nation's economy, by incorporating environmental and social factors which are not measured by GDP. For instance, some models of GPI decrease in value when the poverty rate increases. The GPI separates the concept of societal progress from economic growth.
The calculation of GPI presented in the simplified form is the following:

$$GPI = A + B - C - D + I, \text{ where:}$$

A is income weighted private consumption
B is value of non-market services generating welfare
C is private defensive cost of natural deterioration
D is cost of deterioration of nature and natural resources
I is increase in capital stock and balance of international trade.

Still even the GPI was criticised for not incorporating happiness or wellbeing, which are the ultimate objectives of development or economic activity in general. A new index was formulated to measure this Well-being and Happiness Index: Measures of happiness, life satisfaction, and well-being provide valuable insights into people's subjective experiences, which GDP cannot capture.

The Sustainable Development Goals (SDGs)[4]

[4] https://unstats.un.org/sdgs

The Sustainable Development Goals (SDGs), also known as the Global Goals, were adopted by the United Nations in 2015 as a universal call to action to end poverty, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity.

These 17 special set of indicators are used to evaluate development progress where a number of domains are integrated to arrive at a comprehensive accounting of development progress where development is seen as a holistic concept and program of action that goes far beyond GDP and growth. The 17 SDGs are integrated—they recognize that action in one area will affect outcomes in others, and that development must balance social, economic and environmental sustainability.

Countries have committed to prioritize progress for those who're furthest behind. The SDGs are designed to end poverty, hunger, AIDS, and discrimination against women and girls.

The United Nations' SDGs offer a comprehensive framework that goes beyond economic growth to address every developmental issue and challenge. A list of these goals or indicators includes the following:

Goal 1. End poverty in all its forms everywhere.

Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture.

Goal 3. Ensure healthy lives and promote well-being for all at all ages.

Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Goal 5. Achieve gender equality and empower all women and girls.

Goal 6. Ensure availability and sustainable management of water and sanitation for all.

Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all.
Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.
Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.
Goal 10. Reduce inequality within and among countries.
Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable.
Goal 12. Ensure sustainable consumption and production patterns.
Goal 13. Take urgent action to combat climate change and its impacts.
Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development.
Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.
Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.
Goal 17. Strengthen the means of implementation and revitalize the global partnership for sustainable development.
The SDGs could be used in their entirety to evaluate progress and the extent of achievements of the Gaza redevelopment program. Each one of these goals defines and uses a quantitative metric that could be employed to evaluate and bench mark the development progress or lack of it, and to fine tune the redevelopment program and its performance to realize its targets. As mentioned earlier, each metric is part of the indivisible whole and any failure in any

part could spell the failure of the entire program. Today, these metrics are used by the UN to evaluate progress and lack of it of every member country and regions.

A Simple Growth Model – What is needed to spur growth? How much? And at the same time assuring development success

It is one thing to define and structure the redevelopment program and another matter to estimate what it costs and who will pay for it. In what follows we draw on a simple growth model developed by Harrod-Domar (HD). Actually, the model was developed independently by Roy F. Harrod in 1939[5], and Evsey Domar in 1946[6], although a similar model had been proposed by Gustav Cassel in 1924[7].

The Harrod-Domar model is basically a Keynesian economic growth model that suggests a country's growth rate is directly dependent on its savings rate and inversely related to its capital-output ratio. It posits that economic growth is a function of capital accumulation being the short side of the market and therefore less available than labour, such that higher savings leading to higher growth. It is also a function of capital labour ratio a proxy for the average productivity of capital such that a higher capital-output ratio (less efficient capital) leading to slower growth. The model's core equation is that the growth rate of output is equal to the savings rate divided by the capital-output ratio as will be explained below. This model will be used here to estimate the target growth rate and the requisite surplus needed (domestic savings and foreign grants) to realize it.

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5 https://en.wikipedia.org/wiki/Roy_Harrod
6 https://en.wikipedia.org/wiki/Evsey_Domar
7 https://en.wikipedia.org/wiki/Gustav_Cassel

Let us begin by defining the equations of motion and their interpretation:
Define first, Per Capita Income
1) y = GDP/Population

2) Growth in per capita income is then dy/y = dLn (GDP/Population)

Where dy = dLn GDP – dLn Pop

3) Or equivalently dy = (dGDP/GDP – dPop/Pop)

It follows that the first term is GDP Growth Rate and the second term is the Population Growth Rate. Therefore, If GDP is growing at 5% and Population (pop) is growing at 2%, Per Capita income will grow at 3% using relationship 3 above.
The other part of the HD growth equation is the production function which defines output as a function of labour and capital. We use a specific simple production function known as the Leontief production function expressed as follows:
The Leontief Production Function

4) Y = Min (L/l, K/k)

Where Min, stands for the minimum of the two arguments of the function in 4.

As an example of this production function we represent an atom of water H2O as the minimum of Oxygen (O) given its coefficient of one atom of oxygen per one atom of water and Hydrogen (H), given its coefficient of 2 atoms of hydrogen per one atom of water.

5) H2O = Min (O/1,H/2)

So if we have 50 atoms of Oxygen, 20 atoms of Hydrogen, the maximum output of water is 20 atoms of water H2O= 20.

Let us now define output Y in terms of capital K and Labour L. Translating these in terms of their contribution to output in the same way we translated Oxygen and Hydrogen contribution to water, we get the following definitions:

6) $Y=K/k$

Assuming that capital is the short side of the market and where k is the inverse of the average capital productivity, or the units of capital K per unit of Output Y.

Or alternatively

7) $k = K/Y$

Which, denotes the Capital –Output Ratio

It follows from 7 if k is constant that:

8) $dK = kdY$

Defining Investment as change in capital

9) $I = dK = kdY$
Defining the Saving Function as follows:

9) $S = sY$

Where s is the average or marginal propensity to save, we get relationship 10:

10) $dS = sdY$

In the absence of trade an economy is said to be in equilibrium (a state where there is incentive to deviate from), if $S = I$. If this not true and $S > I$, then leakages will exceed investment, inventories will build up and businesses have less incentive to invest, output would decline. The opposite is true if $I > S$. Inventories would be depleted and businesses would expand out to replenish them.

This being the case the equilibrium level of output is then determined by:

11) $I = S$ or

12) $dK = kdY = sY$

Equation 12 defines a simple relationship that determines the rate of growth of output (income) as the ratio of s to k, as in 13.

13) $dY/Y = s/k$

It follows that an economy with an average saving propensity of 21% and a capital output ratio of 3, will achieve a rate of growth of output of 7%. If the population is growing at 3%, the per capita income y will grow at the rate 4% per year.
We ae now in a position to use these equations to determine the needed level of foreign savings (grants) that would be needed to assure Gaza of a rate of growth in per capita income, in the recovery period, equal to what it had achieved in the years that followed Oslo agreements or to match the rate of growth of the Jordanian economy. The implicit

assumption is that we need to augment domestic savings in Gaza with that amount that would allow Gaza to achieve rates of growth that it was able to achieve under less constrained times. Once this level is augmented in the early recovery period following the destructive genocide, Gaza could achieve the target rate of growth of per capita income. There are many estimates of the requisite magnitude of the compensation Gaza needs to reclaim and reconstruct the damaged infrastructure of housing and other assets. A credible estimate puts this value at $57 billion[8]. This is the value of reconstruction capital, but the magnitude of annual grants to shore up savings to the required level that achieve the target rate of growth of real per capita income, is a different value. The foreign saving grants are additional to the capital needed to rehabilitate and reconstruct the damaged infrastructure. These subsidies are only needed as long as the domestic Gazan savings, which are now negative, were to recover their past levels.

It is a simple calculation that can identify the level of temporary help required. First, we need to determine the level of the target per capita income growth. This is typically fixed at the rate achieved by Jordan given the many similarities between the two economies. Second, the rate of domestic savings achieved in the years post Oslo where there was some relative normalcy could guide the determination of this level. Third, the difference between the expected saving rate and the required rate for achieving a level of per capita income growth similar to that of Jordan, could be used to determine the level of needed help on annual basis, until such time as the domestic saving rate can be relied upon to supply the needed funds to maintain the target level of growth.

[8] Palestine Economic Policy Research Institute (MAS), 2024.

A simple back of the envelop calculation puts this value at $450 million, but of course if we adjust this amount for inflation it would be around $800 million in current prices.
Another serious issue is the question of who should compensate Gaza and Palestine for all the destruction and depravation Israel visited upon them. To be sure Israel should bear the brunt of this responsibility. First, Israel has rendered the Gaza Strip unlivable. It has killed thousands and wounded hundreds of thousand Palestinians and aid workers. Those who destroy should be asked first to pay for their crimes and the havoc they had created. They should be responsible, and accountable for their crimes and infractions of international law and international humanitarian law. They should not be exonerated of any legal or financial responsibility to rebuild what they wantonly destroyed. This should be a paramount consideration otherwise Israel will repeat her crimes.. If the burdens of Israel's rampage and destruction are shifted to Arabs, US and European parties, there is no guarantee that it would not continue its barbaric wars in the region. So far no penalties have been exacted ion Israel for a number of wars, let alone the Nakbeh and the theft of Palestine.
Second, Israel, by any standard, is an advanced and relatively rich state with a per capita income similar to that of the US and many advanced economies, especially when the Palestinians who account for 20% of the population are disregarded and relegated to the status of second class citizens. The Israelis have not been held responsible for any of their crimes against the Palestinians or their neighbours. No wonder that they have been rampaging with impunity and would continue to act that way unless they are held accountable for their crimes and asked to pay for the damages they create. Raising the transaction costs of their destruction could be a good way and a necessary incentive

to prevent them from repeating their inhuman and illegal war campaigns.

A Note on the (Loss) of Human Development

A further issue worthy to explore is the current loss of human development to the growth and development trajectory in the context above. We will do this by using the generalised Solow-Swan growth framework. This neoclassical model provides the baseline for how economies accumulate wealth and why, under specific conditions of total infrastructure loss.

The Solow-Swan Framework: Foundations and Mechanics

The Solow-Swan model, formulated individually by Robert Solow (1956) and Trevor Swan (1956), transformed modern macroeconomics by providing a mathematical structure for long-run economic growth. Prior to this, the Harrod-Domar model, as suggested above, argued that slight deviations in savings or investment could lead to chronic unemployment or hyperinflation. Solow and Swan resolved this by introducing factor substitution, allowing the ratio of capital to labour to adjust according to market conditions, thus creating a stable path toward a steady-state. The model's starting point is the aggregate production function, which describes how an economy transforms inputs into total output (Y). The most prevalent form is the Cobb-Douglas production function, such that:

$$(14)\ Y_{(t)} = K_{(t)}^{\alpha}\left(A_{(t)}\right)\left(L_{(t)}\right)^{1-\alpha}$$

In this framework, K represents physical capital (infrastructure, machinery, housing), L represents the labour

force, and A represents 'knowledge' or the effectiveness of labour, often referred to as labour-augmenting technology. The parameter alpha represents the share of income attributed to capital. A fundamental assumption of this function is constant returns to scale; however, it also assumes diminishing marginal productivity. This implies that while adding more capital increases output, the incremental gain from each new unit of capital eventually decreases as the economy becomes 'capital-saturated' (Solow, 1956).

The Solow-Swan model assumes a closed economy where a constant fraction (s) of total income is saved and reinvested (I = sY). Capital changes over time based on the rate of new investment minus the rate of depreciation. To understand per capita wealth, the variables are converted into effective worker: k = K/AL and y = Y/AL. The evolution of the economy is governed by the fundamental differential equation:

(15) $\dot{k} = sf(k) - (n + g + \delta)k$

Here, sf(k) represents actual investment. The term (n + g + δ) represents break-even investment. In other words it is the amount required to keep the capital-per-worker ratio constant despite population growth (n), technological progress (g), and physical infrastructures (δ). The economy reaches a steady state (k*) when $\dot{k}=0$, meaning actual investment exactly covers the break-even requirements. At this point, capital per worker and output per worker stop growing unless there is a change in g.

The most profound conclusion of the Solow-Swan framework is that physical capital accumulation alone cannot drive indefinite growth. Because of diminishing returns, an economy eventually reaches a point where all savings are exhausted simply by maintaining existing assets. Therefore, the only way to achieve sustained, long-term increases in the

standard of living is through exogenous technological progress, otherwise defines as the 'Solow Residual' (Solow, 1957). A final key element of the framework is convergence. The model predicts that if two countries have the same savings rate and population growth, the poorer country (with less capital) will grow faster because its marginal product of capital is higher. This 'catch-up' effect suggests that developing regions should naturally experience rapid growth until they reach the steady-state level of advanced nations.

To include this framework to the Gaza context, we first need to highlight its potential drawbacks by summarising the main conclusions from recent literature on the topic. First, the standard model treats technological progress (g) as an external 'black box' that arrives independently of the environment under study. Recent research (Dykas et al., 2023) argues that in conflict zones, technology is endogenously destroyed. When there exists an almost total loss of educational and research institutions, the mechanisms for 'learning by doing' (Arrow, 1962) collapse. The model fails to account for a negative g, where the 'effectiveness of labour' (A) is actively reversed by the loss of intellectual capital; second, while the augmented Solow Model (Mankiw et al, 1992) adds human capital (H), recent literature (Dinerstein et al., 2022) highlights that H is subject to catastrophic depreciation during total shocks. In Gaza, the killing of several Palestinians and the total interruption of schooling represent 'negative accumulation'. This is not just a lack of growth; it is a deterioration of the labour force's quality, creating a permanent drag on productivity that a linear model cannot capture. Also, the production function for health and education sectors is fundamentally different from the (re)construction of physical capital.

Recovering the 'knowledge' variable (A) takes generations, whereas physical K can be rebuilt in years; by aggregating them, the model overestimates the speed of institutional

recovery. Finally, recent research on 'Institutions-Augmented' models (Tebaldi & Giorgio, 2013) demonstrates that without sovereignty and a 'national policy space', mechanical inputs of L and K cannot be effectively converted into output (Y). The Solow-Swan model assumes a functioning market and property rights, conditions which result 'pulverized' under occupation. Without sovereignty, the economy remains trapped in a 'bad equilibrium' or Poverty Trap, regardless of external capital injections (World Bank, 2023).

What to do in light of the above considered limitations and growth perspectives under the UN SDGs?

The recovery of Gaza must move beyond neoclassical 'reconstruction', by embracing SDGs emphasising an endogenization of human capital where Labour (L) must be weighted by health and education indicators. Following the augmented Solow model (Mankiw et al., 1992), redevelopment should prioritize restoring the 'returns to experience' by rebuilding the medical and educational sectors first, treating human capital as the primary 'domestic savings' of the nation (SDGs 3 and 4). Additionally, to solve the 'exogenous T' drawback, technology must be shored up through global partnerships. This involves the immediate restoration of digital and intellectual connectivity to prevent a permanent 'brain drain' of the survivors and to restart endogenous innovation (SDG 17). Finally, as identified by the pioneering work by Sen (1999) and updated in recent literature by the Palestine Institute for Economics and Peace (2024) and Acemoglu and Johnson (2024), peace and sovereignty act as the ultimate multipliers for the production function.

SDG 16 (Peace, Justice, and Strong Institutions) is the prerequisite for the model to exit its current poverty trap and transition toward a stable, independent steady state equilibrium.

As a result, the loss of human development in Gaza is a structural disfiguration of the production function. A successful redevelopment strategy should consider to augment the mechanical Solow-Swan variables with the outlined approach, treating sovereignty and human rights as the essential 'Technology' needed to rebuild the Palestinian future.

The Economic Costs of Genocide

In a newly released report, *From Economy of Occupation to Economy of Genocide*[9], UN Special Rapporteur on the situation of human rights in the Palestinian territories occupied since 1967, Francesca Albanese, has argued that there are many partners to Israel in carrying her crimes against the people of Gaza and other Palestinians. She single and highlighted the role of many corporations that have been aiding Israel's occupation and profiting from the genocidal campaign.
These are business entities that had previously enabled and profited from Palestinian elimination and erasure within the economy of occupation, instead of disengaging they are now involved in the economy of genocide.
Albanese focuses on eight key sectors in her report, naming over 145 entities that are implicated in human rights violations and international crimes in the occupied Palestinian territory (oPt).
The Eight Sectors include the Following:
1- The military sector: The business of destruction and elimination.

[9] https://www.un.org/unispal/document/a-hrc-59-23-from-economy-of-occupation-to-economy-of-genocide-report-special-rapporteur-francesca-albanese-palestine-2025/

2- The security and surveillance sector: Surveillance and circularity, the dark side of the "Start-up Nation".
3- The construction sector: Civilian guise, heavy machinery in service of settler-colonial destruction.
4- The housing sector: Building homes on stolen land.
5- The natural resource sector: The grip on natural resources, the incubator of conditions of life calculated to destroy.
6- The agricultural and tourism sector: Trading the fruits of illegality.
7- The financial sector: Financing the violations.
8- The post-secondary education sector: Knowledge production and violation legitimization.
The ICJ decisions place on corporate entities a prima facie responsibility to not engage and/or to withdraw totally and unconditionally from any associated dealings, and to ensure that any engagement with Palestinians enables their self-determination.
Both criminal and civil laws in various jurisdictions can be invoked to hold corporate entities or their executives accountable for violations of human rights and/or crimes under international law.
She concludes with a damning indictment of the corporate machine which has willingly stood with Israel through years of involvement and profiteering from the occupation genocide.
These corporations often enable Israel's violations in the oPt – they are not separate from Israel's crimes, but a key party in their commission.
What is lamentable is that there has never been a demand for compensation from Israel for all of its crimes, theft, destruction and violence.
Using Israeli claims against Germany in the Weidergutmachen Claim, Hadawi and Kubursi (1988) suggested that the following could be part of the claim:

- Loss of Life
- Injury
- Psychological Suffering
- Property and Asset Losses
- Income Loss
- Opportunity Loss, etc.

The enduring ideological, political and economic engine of racial capitalism has transformed Israel's displacement-replacement economy of occupation into an economy of genocide. This is where the acts of one ultimately contribute to a whole economy that drives supplies and enables this genocide.

Corporate relations with Israel must cease until the occupation and apartheid end, and reparations are paid. The corporate sector, including its executives, must be held to account, as a necessary step towards ending the genocide and disassembling the global system of racialized capitalism that underpins it. They should be held accountable and asked to compensate the Palestinians for the crimes and destruction the genocidal campaign had imposed on them. This is another source of legitimate funds that the Palestinians should ask for in their quest to reclaim their lives and property. It is only fair that those that benefited from the genocide should pay for dealing with its aftermath and consequences.

Summary and Conclusions

The genocidal campaign in Gaza that Israel initiated after October 7, 2023 is continuing unabated despite Israel agreeing to a cease fire brokered by president Trump and a few Arab governments. The bombing continues daily and few aid deliveries are made to alleviate hunger and disease caused by the war. This destruction is additional to the level

visited on the people of Gaza over more than two years that saw Israel drop more than 200,000 tons of explosives on a small area of less than 365 square km that destroyed over 92 percent of homes, hospitals, schools, universities and infrastructure, which a UN expert dubbed as homicide, and killed over 70,000 Palestinians so far (there are credible accounts that this number underestimates those killed, starved to death and remain under the rubbles, which could top 350) the majority of them are children, women and elderly; there is now renewed discussion of the urgent need to reconstruct the Strip.

There is now muted discussion of a reconstruction plan that would start once the guns lay silent, although the details of this plan are not clear or concrete.

Throughout the discussion we raised a few questions and cautions about the Gaza reconstruction plan being simply a partial attempt to rebuild the past with no definite road map or a time table of how it would be implemented, who would pay for it, and how feasible is it if the Palestinians are not granted their independence and their right to self-determination. In the current negotiations and discussions about Gaza, there is nowhere any mention of Israel's responsibilities to shoulder any part of the cost of reconstruction or any attempt to hold it accountable for all its crimes against humanity and its infractions of international law.

We asserted in this paper that what is needed prior to the reconstruction program is the recognition of the fact that Israel's illegal occupation of Palestinians' land is irreconcilable with their development. It is inconceivable to believe that the Palestinians can re-initiate their development, which is now after Sen (1999) seminal work is synonymous with freedom. Thus, ending the occupation and liberating the Palestinians from the shackles of colonialism should precede reconstruction and should be the core

principle of any peace plan. It follows that the reconstruction plan has to be coupled with a redevelopment plan and the latter with freedom, if reconstruction plan is to work and to bring about a better and sustainable peaceful Near East.

There are many estimates floating around of the requisite magnitude of the compensation Gaza needs to reclaim and reconstruct the damaged infrastructure of housing and other assets. One credible estimate, we mentioned puts this value at $57 billion[10]. This is the value of the reconstruction capital needed to accomplish restoring the housing and basic infrastructure to its past state before the war in current prices, if and when Israel leaves the needed materials flowing easily into the Strip. We drew a distinction between the needed capital for reconstruction and the the magnitude of annual grants needed to shore up domestic savings to the required level that would achieve the target rate of growth of real per capita income. Outside help is needed in the form of annual foreign saving grants to augment domestic savings to the level needed to rehabilitate and reconstruct the damaged infrastructure. These annual subsidies are only needed as long as the domestic Gazan savings, which are now negative, were to recover to their past levels.

We argued that it is a simple calculation that could identify the level of temporary help required. First, we need to determine the level of the target per capita income growth. This is could typically be fixed at the rate achieved by Jordan given the many similarities between the two economies. Second, the rate of domestic savings achieved in the years post Oslo where there was some relative normalcy could guide the determination of this level. Third, the difference between the expected saving rate and the required rate for achieving a level of per capita income growth similar to that of Jordan, could be used to determine the level of needed

[10] Palestine Economic Policy Research Institute (MAS), 2024.

help on annual basis, until such time the domestic saving rate can be relied upon to supply the needed funds to maintain the target level of growth. We estimated this amount to be around $800 million in current prices. This is not a huge amount and better yet it would be a temporary help until domestic Gazan savings recover to their levels in 1994.
We expanded the analysis to incorporate the loss of human development on long-term growth and development and the economics of genocide where we include other parties aiding the genocide and profiting from it. The issue is to make it difficult and costly for any party to sustain the genocide and to bring these parties to the preview of international law.

Authorship credit

AK: All sections except the subsection "A Note on the (Loss) of Human Development".
CDL and DB: Subsection "A Note on the (Loss) of Human Development".

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Rebuilding agriculture in Gaza: Experiences and perspectives

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Abstract

The agricultural sector in the Gaza Strip - once a cornerstone of local food security, livelihoods, and economic stability - has suffered unprecedented destruction since the outbreak of the 2023 conflict. Satellite assessments by FAO and UNOSAT indicate that more than 80% of cultivable land and a majority of agricultural infrastructure, including greenhouses and irrigation wells, have been severely damaged. Livestock and fisheries have experienced drastic losses, profoundly affecting rural livelihoods and food availability.

This paper analyses the extent of damage to land, infrastructure, and production systems, highlights key socio-economic and environmental impacts, and reviews estimated losses exceeding USD 2 billion. Despite a recent ceasefire, major constraints persist, including limited access to land, widespread debris, compromised water systems, and underfunded recovery appeals.

A two-phase recovery strategy is proposed: an emergency response focused on stabilising livelihoods and restoring minimal production capacity, followed by a transition toward sustainable, resilient agriculture through household-

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level production, water-efficient technologies, capacity building, and revitalisation of cooperatives.
The findings underscore the need for coordinated international support and locally driven solutions to rebuild Gaza's agro-food system and restore the foundations for long-term resilience.

Keywords

Agricultural reconstruction, Food security, Water-efficient technologies

Introduction

Before the conflict, agriculture represented a fundamental pillar for food security, livelihoods, and the economy of the Gaza Strip.

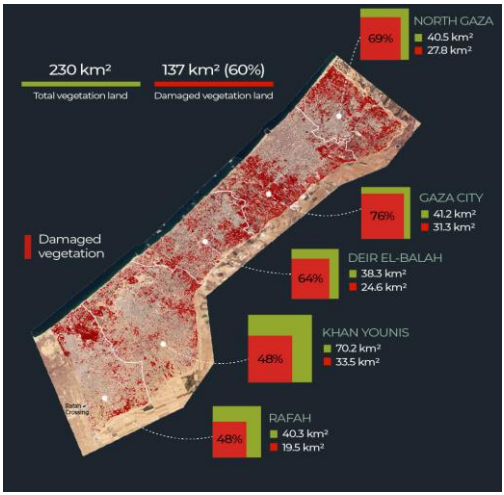


Figure 1 – Damages on agriculture (Al Jazeera 2024)

With the conflict that began in October 2023, the local agricultural sector has been severely affected: the scale of damage to land, agricultural infrastructure, livestock, and livelihoods makes an in-depth analysis and a recovery strategy urgently needed.
This paper aims to document the losses, analyse the socio-economic and environmental impact, and propose an action plan for a gradual and sustainable recovery.

Impact analysis: Scale of destruction

Damage to soil and agricultural infrastructure

A recent satellite-based assessment by FAO and UNOSAT estimates that, as of April 2025, more than 80% of Gaza's cultivable land has been damaged, amounting to 12,537 hectares out of a total 15,053, while only about 4.6%, equivalent to 688 hectares (FAO 2025a), remains available for cultivation. Damage to greenhouses is similarly severe, with approximately 71.2% reported as destroyed. The condition of agricultural wells, which are essential for irrigation, is also critical: the latest figures indicate that around 82.8% of irrigation wells are no longer functional.
Further updates from 2025 confirm that the situation has continued to deteriorate. An October assessment reports that damage to cultivable land has reached 87% (FAO 2025b), with greenhouse and well destruction following the same trend.
Taken together, these data demonstrate a drastic reduction in usable agricultural land, severely compromising local production capacity and overall self-sufficiency.

Damage to livestock and fisheries

Before the conflict, agricultural, livestock, and fish production provided livelihoods for an estimated 560,000 people. Current FAO assessments describe extremely severe losses in the livestock sector, with cattle numbers falling by approximately 96% and poultry (FAO 2025c) reduced to only about 1% of pre-conflict levels. The fisheries sector has also experienced an almost complete collapse. These losses extend far beyond production capacity: they directly affect food availability, household income, and the overall resilience of rural communities.

Socio-Economic and environmental impacts

The destruction of agricultural and livestock infrastructure has destabilised the livelihoods of hundreds of thousands of people, in a context where agriculture previously accounted for roughly 10% of Gaza's economy. Damage to water infrastructure has further intensified an already critical water crisis, severely limiting irrigation and obstructing both food security and the recovery of agricultural activities. In addition, soil degradation and contamination - stemming from bombardment, debris, potential explosive remnants, and the prolonged deterioration of water networks - pose long-term threats to soil fertility and have rendered many areas uncultivable. Recent satellite analyses continue to document a progressive decline in land quality, confirming the scale and persistence of the devastation.

Economic assessment of losses

According to FAO/UNOSAT data, losses in Gaza's agricultural sector amount to over USD 2 billion (direct damages + derived losses: about USD 835 million in damages and USD 1.3 billion in losses), while reconstruction and rehabilitation needs are estimated at around USD 4.2 billion.

These figures confirm the scale indicated in the initial document, although some figures (e.g., extreme livestock or poultry losses) are more cautiously presented in official sources compared to the original text. For instance, although FAO reports drastic losses, precise percentages such as "99% poultry loss" are not uniformly confirmed across all reports, reflecting the difficulty of obtaining accurate estimates in a rapidly evolving conflict context.

Obstacles to recovery and limitations

The current context presents deep obstacles to any meaningful recovery. Large portions of the territory remain inaccessible due to security concerns (FAO 2025b), debris, unexploded ordnance, and structural hazards; even under the recent ceasefire, only a limited share of damaged land can actually be rehabilitated. Water infrastructure is critically impaired, with most agricultural wells no longer functioning, a situation that severely restricts irrigation and makes immediate water-related interventions indispensable. The social and economic landscape has also been deeply disrupted, as the loss of livelihoods, population displacement, the breakdown of agricultural value chains, and the scarcity of essential inputs such as seeds, tools, and fertilizers continue to undermine both production and resilience. At the same time, a substantial gap persists

between needs and available resources: FAO's appeals for reconstruction remain underfunded, while the magnitude of the destruction far exceeds current operational capacities.

Proposed recovery strategy: A two-phase model

In light of the scale of the crisis and the evident constraints, a gradual strategy is proposed in two phases model.

- *Phase 1 – Emergency (0–3 months)*

The objective of this phase is to stabilise livelihoods and lay the groundwork for agricultural recovery. Key actions include the distribution of basic agricultural kits, comprising seeds, manual tools, and micro-irrigation systems, to enable small-scale subsistence farming. Urgent measures are also required to restore water infrastructure, including reactivating wells, repairing existing networks, and potentially installing rainwater harvesting systems or small pumping units. Support for livestock and fisheries is essential, involving the provision of work animals where feasible and fishing kits, such as small boats and nets, to reactivate complementary livelihood activities. Finally, cultivable areas must be cleared through debris removal, identification and disposal of unexploded ordnance, and preparation of safe land for productive agricultural use

- *Phase 2 – Transition and sustainable reconstruction (beyond 3 months)*

The objective of this phase is to rebuild a resilient and sustainable agricultural system capable of adapting to water scarcity and infrastructure challenges. Strategic actions include promoting small-scale family farming and home gardening with short-cycle crops and high-yield vegetables to ensure both food security and income for households. Resilient and water-efficient techniques are to be adopted, such as micro-irrigation, rainwater harvesting and storage,

the potential use of soilless or hydroponic systems, and cultivation of drought-resistant crops. Training and capacity-building programmes will be implemented to strengthen sustainable agricultural practices, including composting, crop associations, and efficient resource management. Agricultural cooperatives and community networks will be revitalised to facilitate resource sharing, improve market access, and enable collective management of reconstruction efforts. Finally, the fisheries and livestock sectors will be gradually restored through the rebuilding of minor infrastructure, small ports, and landing sites, alongside the promotion of sustainable fishing practices.

Conclusions and recommendations

The destruction of Gaza's agro-food system is extensive, with the loss of cultivable land, agricultural infrastructure, water systems, and livestock rendering short-term food self-sufficiency nearly impossible. An effective response must combine immediate emergency interventions with a long-term strategy focused on sustainable and resilient reconstruction. The proposed two-phase model addresses current needs and aligns with international cooperation frameworks. Promoting local capacities, cooperative structures, community engagement, technical training, and agricultural practices tailored to the new water and infrastructure constraints is essential. In addition, international mobilisation is critical to secure adequate funding, ensure transparency, and provide effective monitoring and coordination with both local and global actors.

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Preventing genocide in Gaza©

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What is happening in Gaza can be considered tantamount not only to war crimes and crimes against humanity, but even more pertinently, to attempted genocide



A Palestinian man carries the body of a child into a van holding the corpses of people killed in overnight Israeli

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airstrikes on the grounds of Gaza City's Al-Ahli Arab Hospital. Photo: AFP

Genocide is not a term that should be used lightly. It can all too easily become a political slogan, a term to weaponise against an opponent, or – so characteristic of our times – part of a culture of cultivating extremes and irreconcilable opposites.

Genocide is the most notorious of the atrocity crimes in international criminal law, which also include war crimes and crimes against humanity. It should solely be used when the acts committed fall within its very restrictive definition, as per the Convention on the Prevention and Punishment of the Crime of Genocide of 1948.

It is therefore only after careful consideration and deliberation that we, as scholars of international law and international relations, argue that what is currently happening in Gaza can be considered tantamount not only to war crimes and crimes against humanity but, even more pertinently, to attempted genocide.

This, in fact, is the subject of current proceedings before the International Court of Justice, the primary judicial organ of the United Nations.

According to the Genocide Convention 1948 (to which Malta, together with another 152 states, is party) two elements are necessary for a genocide to be present: the attempted eradication of a people, in whole or in part, on the one hand, and the intent to do so, on the other.

The attempted eradication can take various forms, from the prevention of births and removal of children from the group, to systematic violence, causing of deaths and active killings. The intent element means that the state must clearly display that it wishes to eliminate a group.

At present in Gaza, both the actions and the intent can be reasonably suspected: the refusal to admit humanitarian aid while cognisant and warned about the situation of famine in

the territory, as proclaimed by competent institutions. A group of 11 UN experts already in July 2024 had declared that famine had spread throughout Gaza.

Moreover, the fact that, in its interim order of January 2024, the International Court of Justice referred to "the catastrophic humanitarian situation in the Gaza Strip" is in itself revealing. Since then, we have seen further proclamations of members of the Israeli government and a series of actions that seem to indicate that there is both intent and measures tantamount to the definition of genocide in the 1948 convention.

"Eradicating Hamas as an armed opponent is a licit military target. Destroying the Palestinians in the process is not. It is genocide"

The public conscience regarding genocide often focuses on concentration camps, gas chambers or forced marches of starving and sick men, women and children in inhospitable conditions, as were the case in the Holocaust and the Armenian genocide.

But genocides in history – unfortunately not as uncommon as we might think – have involved different tools of killing and different methods of ensuring that a population does not survive: in Rwanda, bladed weapons were mainly used to kill Tutsis and moderate Hutus; in Congo, under King Leopold, genocide involved slavery and forced labour in unspeakably harsh conditions, combined with corporal punishments leading to deaths; and in Cambodia, under Pol Pot, starvation, forced labour and direct killings were combined to take the lives of "undesirable" parts of the population. So each genocide has some unique elements.

We also sometimes think that a genocide must kill an entire people – but while this is, of course, the intent, this rarely succeeds, fortunately: the genocide will stop before everyone belonging to the group is eradicated. The Genocide Convention itself recognises that one of the modes in which genocide may be committed is "deliberately inflicting on the

group conditions of life calculated to bring about its physical destruction in whole or in part [emphasis added by authors]."

The Genocide Convention is clear on the responsibility of states in the face of genocide: states have the obligation to prevent and punish genocide. Furthermore, according to the International Court of Justice, states have a corresponding duty to act in this regard "at the instant that the state learns of, or should have normally learned of, the existence of a serious risk that genocide will be committed" (Bosnia and Herzegovina v Serbia and Montenegro, 2007). The first step in this regard is to recognise the situation in Gaza as genocide.

We, thus, call on all the authorities concerned to see and treat the situation in Gaza for what it is: babies, children, women and the elderly are dying because of an intentional policy on the part of the Israeli government.

In a situation where neither Israel nor the dictatorial Hamas show any humanity, it is up to outside states to do so. Eradicating Hamas as an armed opponent is a licit military target. Destroying the Palestinians in the process is not. It is genocide.

INSTITUTIONAL REMARKS

Institutional remarks at *Domus Sapientiae* Hall, Polytechnic University of Bari

Loredana Ficarelli[*]

Good afternoon everyone, and welcome.
I bring greetings from the community of the Polytechnic University of Bari, which is hosting in this place, in this Department, an initiative of great importance, attended by the Apulia Region with its President, the Church of Bari, and the Municipality of Bari. We can now begin this second part of the day, devoted to the reconstruction of Gaza.
We see the reconstruction of Gaza as both a moment and an experience that gives life to words and actions emerging from the Academy, the University, and education more broadly. We firmly believe that research and teaching must be free: free from external pressures, free to choose their partners, and free to contribute to all States on the international stage, for the benefit of the entire world. This is evident—and I say this on a personal note, with emotion. Professor Borri and I wanted this day because we wished to give life and future to what words alone sometimes fail to achieve: giving voice to our inner responsibility.
We chose our inner voice; we chose the voice of all.
For this reason, without taking too much of your time, I would like to read a few excerpts from the declaration of the Academic Senate of the Polytechnic University of Bari, approved at its most recent meeting, in support of peace and

[*] Vice-Rector of Polytechnic University of Bari

the reconstruction of Gaza. The Academic Senate has firmly condemned all wars currently underway and has reiterated its commitment to peace, condemning all forms of violence that strike civilians, minorities, and vulnerable people. It reaffirms its dedication to promoting a culture of peace, dialogue, cooperation, and respect for human dignity, considering scientific, civil, and democratic progress as fundamental and non-negotiable values.

The conflict we are all aware of, which has affected the international community since October 7, 2023, following Hamas' initiative that caused thousands of deaths, has led to a disaster—indeed, to repeated disasters.

As recalled by the President of the Italian Republic, starving an entire people—from children to the elderly—is inhuman. Universities, as communities devoted to the development of knowledge and critical thinking, have the moral duty to promote peace, human dignity, and the rejection of all forms of violence and oppression.

We hope that an immediate truce may be achieved through a strong, coordinated international diplomatic initiative.

We believe in dialogue rather than force. This condition is necessary so that the Gaza Strip—and all conflicts currently active across our planet—may be freed from war and from terrorist organizations, and so that international organizations may act to bring peace, cooperation, and rights.

The Academic Senate has also expressed full support for the initiative launched by professors of the Polytechnic University of Bari who freely chose to participate in peace initiatives together with scholars from other Italian and international universities, offering their knowledge without compensation to support the reconstruction of Gaza.

No political or military consideration can justify hostile behavior toward populations, cultures, or individuals. In particular, the Polytechnic University of Bari intends to

protect every member of its academic community, with special attention to students—women and men—who are in vulnerable conditions and may be subject to discrimination and isolation.
The Academic Senate therefore commits the entire Polytechnic University of Bari to continuing and promoting, in all its activities, a culture of peace, dialogue, and respect for human dignity, in the awareness that only these values can contribute to sustainable progress based on freedom, knowledge, and responsibility toward humanity.

Michele Emiliano[†]

I was rereading the Convention on the Prevention and Punishment of the Crime of Genocide, adopted in 1948.
I returned to this text because, in my view, the cases addressed by the Convention are closely linked to what we are discussing today: the deliberate exposure of a group of people to living conditions intended to bring about their total or partial physical destruction; measures intended to prevent births within a group; the forced transfer of children from one group to another.
Article 3 of the Convention lists the punishable acts: genocide; conspiracy to commit genocide; direct and public incitement to genocide; attempted genocide; and complicity in genocide. The States Parties undertake not only to bring those responsible to trial, but also to promote all actions necessary to prevent such acts and their further consequences.
The purpose of this initiative by the Apulia Region, the Polytechnic University of Bari, and the authorities present here today is to open a discussion on how to prevent the

[†] President of Apulia Region

Palestinian people from being killed, from dying of hunger and thirst, or from being forced to abandon their land.
Our aim is to establish the foundations for the continued presence of the Palestinian community in its territory—structurally, legally, socially, and, above all, in terms of international relations.
The Apulia Region, the Municipality of Bari, the Emilia-Romagna Region, and, in a different but equally important form, the Tuscany Region, have taken a clear position so that, in the future, no one may say that the Italian Republic or the Italian people did nothing in the face of what is happening, and that they can therefore be considered accomplices to an ongoing genocide.
It must be clear that the plan for Gaza is open to the contribution of all humanity. It belongs to no one and must not be claimed by any single community. It is open to the widest possible range of contributions and should also serve as a lesson against the egoisms typical of local powers.
What is needed is great generosity, great creativity, and determination—determination that we may be permitted to call a distinctive trait of Apulian culture—as we begin this path of hope, a path we hope will soon attract women and men of goodwill. We started, this we want to say you today. Thank you.

Giuseppe Satriano[‡]

Rebuilding Gaza, giving hope back to the world.
Today, we are here not only to discuss about projects and maps, but to listen to the deep cry of a broken land. Gaza, the strip overlooking the Mediterranean Sea, looks like a

‡ Archbishop of Bari-Bitonto

wound and asks to be looked at with lucid eyes and open hearts. The same happens in Ukraine.

Father Ernesto Balducci, a priest, a writer and a peace builder, said that the history of a city is characterized by two instincts, Eros and Thanatos. The first one, Eros, is the vital and unitive spirit which offers us many beauties and wonders. The second one, Thanatos, the impulse to overpower someone, has defined, and still defines, the history of our cities in a tragic way.

Gaza and the strip of land taking its name are the most dreadful example of Thanatos's victory in the contemporary era.

This meeting shows our responsibility, as believers, as women and men of science.

Christian hope is not an illusion or an escape from reality. It is the ability to look upwards and keep the feet on the ground at the same time. Pope Francis, in a letter entitled "Fratelli tutti", writes that "no one can face life in an isolated way: we all need a community supporting us". Today, more than ever, Gaza needs a community who is able to give support and help, to look beyond the tragic current situation, tormented by the clear violation of the international law and the intentional willing to destroy and devastate a land.

Today, in this place, I want to remind you that no neutral sciences exist. Technical skills can be neutral, not sciences. City planning, architecture, engineering always bring values, ideas, plans.

Rebuilding Gaza means reshaping a vision for the future. What kind of city do we imagine? What kind of humanity do we support? A city can reflect a culture of exclusion or a culture of inclusion.

The wounds of Gaza are not the visible ones, the destroyed houses or the devastated streets. The wounds are the invisible ones, those mining the flesh and souls of women and men who are losing their loved ones, their dreams, their

future. If nobody heals these wounds, they will turn into revenge. For this reason, rebuilding Gaza also means healing moral wounds, promoting reconciliation acts among people, as it happened in South Africa after the apartheid or in Rwanda after the genocide against the Tutsi. Gaza has to be not just a construction site but, most of all, a school of humanity.

Nowadays, technology, instead of being a tool supporting life, is a tool supporting death. The news report that the Israeli forces are using sophisticated software, such as "Lavender" and "The Gospel", which select and destroy human targets and buildings, even at the risk of causing collateral damage upon innocent civilians. This is a tragic paradox, when technology is used to commit a new kind of crime, the *domicide*, which is the systematic destruction of houses, buildings and infrastructures, of places where people live with their loved ones.

To defeat this death spiral, your contribution as women and men of science can be and has to be valuable. Gaza has to be a place of social relations again. We should follow the example of the Abrahamic Family House in Abu Dhabi, where a church, a synagogue and a mosque share the same urban space, respecting each other and promoting dialogue. Gaza can be a prophetic sign of peace, but to make this reality, we need brave choices and generous visions.

Maybe, today, this is just a dream. But, as Father Tonino Bello wrote, "if we do not dream, we cannot go ahead and build our peace". Christian faith teaches us that resurrection happens in the most defeated land, in the most grieved place. We cannot celebrate the resurrection of Christ and then accept the death in Gaza. We hope to see again tree-lined avenues, big squares, alive schools, comfortable hospitals, requalified houses.

The auditorium where we are now, called Domus Sapientiae, the "House of Wisdom", reminds us that being wise means putting together knowledge and life, projects and visions, reason and empathy. Today we are here not only as expert technicians, but also as the guardians of humanity. The reconstruction of Gaza is authentic only if it is able to give back hope to the world. It is not just about stones, but relations. It is not just about cement, but communities. It is not just about mathematical assessments, but compassion.
So, Gaza claims our commitment: human talents and skills must not lead to death, they must lead to life. We are called to be builders of fraternity and not only builders of houses.
Thank you for your commitment, for your expertise and, most of all, for being able to dream and not to give up.

Giovanna Iacovone[§]

Good afternoon to everyone, and I truly thank you all. I thank Polytechnic for this, for the invitation from the Municipality of Bari to this meeting, whose importance I grasp. Because it falls within that mobilization by those institutions and by that society that do not want to remain inert. Because doing nothing is not a neutral act. Indifference kills, Hannah Arendt taught us this. If Europe had not remained silent when it should have spoken, perhaps there would not have been the Shoah. I am a jurist before being deputy mayor and councilor for regeneration, and I know that omission has legal relevance and can meet the elements of a crime, and even before that, a political one. And in fact, the Municipality of Bari approved an agenda with which it not only promotes the recognition of the State of Palestine, but also committed the municipality to interrupt commercial

[§] Deputy Mayor of Bari municipality

relations with the State of Israel, therefore declaring it not welcome at the Fiera del Levante, at the Levante trade fair. A small gesture for a local authority, for what it can do, but words are absolutely important because words can kill or save lives. Modern democracies, the rule of law, laws are made of words that obviously then must be implemented. But first of all they must be pronounced; one must take a position. Calamandrei said that even the Constitution is a little sheet of paper that we can let flutter slowly toward the floor and that instead must live, and must live with our commitment and with our responsibility. And among the responsibilities that we must take on there is that of calling things and situations by their name. And the word that we must responsibly name is that of genocide, a word coined by a Jewish jurist, later adopted by the United Nations. With this word one refers precisely to the commission of acts with the intention of destroying in whole or in part a national, ethnic, racial or religious group as such. And this is exactly what is happening in Gaza, which is before everyone's eyes, with the exception of the eyes of those who do not want to see. And we instead are, as was said by the institutional interventions that have just preceded me, among the subjects who want to see. Among these subjects there are the Municipality of Bari, the Polytechnic of Bari, Apulia Region, the Church, which responsibly have decided not only to denounce but to take a position against genocide. First, obviously, with declarations and with documents contained in official documents, and therefore in implementation of those words contained in the declarations. And then with acts, concrete acts, among which I believe today's conference must be counted, our moment of reflection that precisely raises the theme of the reconstruction of that land. And it is an essential and responsible way of acting against genocide. Why? Because genocide is the destruction of lives. And today we oppose it with an act exactly contrary, that is,

with reconstruction. Because a people is not erased only by physically killing people, but also by destroying the land on which it was born and on which it lives. So much so that in Gaza two million people have not died; tens of thousands of people have died. They are not few, of course, but the Palestinian people have not been physically annulled or erased; nevertheless, this is a genocide, because there is the will to annul this people. Moreover, we have all seen that video in which Trump and Netanyahu on the Riviera of Gaza were enjoying their cocktail with Arabs dancing around them. That video was not a joke, but a different project for treating that land, that is, a project of genocide. That video, in my opinion, truly frightened me. And this is exactly how it happened, as it happened in the 1930s in Hitler's Germany. But I would like to close by saying that the Municipality of Bari has in any case shown its political sensitivity also a few years ago, because October 7 is not the moment from which the genocide began; we have years, decades of occupation of those territories and living conditions at the limits of what is human. And in fact in 2019 the Municipality of Bari, with Acquedotto Pugliese—perhaps someone mentioned it this morning, because I saw that Acquedotto Pugliese was present with Francesca Portincasa—participated with the aqueduct in a project and obtained, with ING1 and the CIS, together with the municipality of Khan Younis, a project for the provision of fundamental sanitary services for the health of the population. Khan Younis is a municipality in the south of Gaza. Only 55% of the city's population is connected to the sewer system, while the remaining 45%, in the absence of a sewer network, uses septic pits, usually built in an improvised and permeable way, thus also creating pollution. And so, together with the aqueduct, we built several kilometres of sewerage, and in addition the network also connected a university building in the Salah Alden area that hosts about 2,000 male and female students. The last part of

the works dates to December 2022, and now we are about to resume with the second tranche of works with 11 kilometres of sewer network, indeed about twenty kilometres of sewer network. Moreover, the municipality is organising a meeting precisely to talk about this and has invited part of the Palestinian technical team, which will take place in September. And therefore on that occasion we can meet them, we can meet them together. Thank you.

Carlo Contesi[**]

I would like to add, Deputy Mayor, that in addition to the institutions you mentioned, we are also here—as the Order of Engineers and the Order of Architects.
We are among those who are witnessing what is happening in those areas, and so, with great enthusiasm, the Order I represent wanted to participate and co-organize this conference. I therefore bring greetings not only from the Council of the Order but from the entire community of 8,000 engineers in Bari.
I won't hide the fact that, when we discussed this conference in the Council and the Training Commission, in addition to enthusiasm, someone—with the pragmatism that often distinguishes us engineers—asked: "Are we really talking about reconstruction while those areas are still experiencing a state of war?" And that question has stayed with me for days.
So, I went to look at some data. The situation reports that about 70% of homes have been destroyed in those territories. Some have even coined new terms, like "*urbicide*". It is said that 88–90% of industrial plants have been destroyed, and perhaps 70% of agricultural land as well.

[**] President of the Order of Engineers of Bari province

Then there are the networks, the infrastructures, public buildings…
This is the starting point for any discussion about reconstruction. Some, based on estimates from satellite images or satellite data, speak of around 50 million tons of rubble to be cleared—a staggering amount that, using traditional methods, might take ten years to remove. Who knows what lies in that rubble—very likely human remains, unexploded ordnance, perhaps asbestos. This is the reality.
So, what can we do today? We must already begin to mobilize—that's why it's important to talk about it now—energy, strength, and resources, both financial and human. And here, the engineering community stands ready with its expertise and capabilities.
The Order of Engineers of Bari—and indeed all Orders across Italy—believes the National Council of Engineers, just as it has done in the past for natural disasters and earthquakes, will once again be willing to form expert teams ready to offer their help and contribution.
I would like to close with one final wish: that one day this reconstruction—surely led and coordinated by the United Nations and the governments involved—won't be imposed from above but will be shared with and shaped by our Palestinian colleagues. I believe this is a wish of great importance. Thank you.

Cosimo Damiano Mastronardi[††]

On behalf of the Council of the Order and the community of Architects, Planners, Landscape Architects, and Conservators of the Province of Bari, I extend my greetings

†† President of the Order of Architects, Planners, Landscape Architects, and Conservators of Bari province

to the civil and religious authorities, to the speakers, and to all those present.

It is not easy to speak of reconstruction while pain is still alive, and the images of destruction continue to shake our consciences. Yet, precisely for this reason, it is necessary to do so: to rebuild does not mean merely reassembling what has been shattered and erased by bombs, but rather interpreting the new needs of a population bowed and deprived of memory, imagining a possible future, and giving shape to hope.

Even though the war is not yet over, an important process of reflection and planning for the reconstruction of Gaza has already begun. In October 2023, an agreement was signed between the IUAV University of Venice and the UNDP — Regional Bureau for Arab States — aimed at drafting a comprehensive reconstruction plan.

Professor and architect Iacopo Galli, scientific director of the project, emphasized that reconstruction must be approached as a process, not as a single project: an open, evolving system that simultaneously acts on urban form, the local economy, building production, and financing models. It is a model that intervenes at the neighborhood scale, designing complete urban units: housing, schools, public spaces, and infrastructure networks.

It should be a progressive reconstruction, ensuring clear timelines, building quality, and social sustainability — but above all a reconstruction decided by the Palestinians. IUAV provides scientific support, while the UN must guarantee the participation of local communities.

This is a completely different approach from what was seen in post-war Europe, where major financiers often imposed settlement models from above. Here, the process starts from the bottom, with replicable, complete, and coherent urban cells.

Yet, as the researchers themselves affirm, Gaza cannot simply be "rebuilt as it was": it had already been declared uninhabitable long before the current conflict. A radical re-founding of the urban fabric — building typologies, technologies, and resource systems — will be necessary, while taking care, of course, to preserve certain historical and identity-related elements, but also having the courage to imagine a profoundly different future.

It is precisely from this point that I would like to begin my reflections. Wars, beyond their human toll, inflict irreparable damage on cultural heritage, which in recent conflicts has become an ideal target for striking at the cultural identity of populations.

In Gaza, systematic destruction has reached unprecedented proportions: according to UN data, 66% of residential buildings have been destroyed or severely damaged. At the beginning of 2024, a new term appeared in the Italian lexicon: *domicidio* — the deliberate and systematic destruction of civilian homes during armed conflict.

The monumental heritage of the Strip, testimony to millennia of history as a crossroads of civilizations, has not been spared. According to UNESCO, as of 5 December 2024, 75 cultural sites have been destroyed or damaged: monuments, museums, archaeological sites — material traces of a deep identity.

As architect Andrea Mannocci wrote: "Every stone, every decoration, every historic structure told a story. The loss goes beyond material value: it is an offense to collective memory and to future generations."

Think of a child in Gaza, growing up playing in the alleys beside the mosque or in the square near their home. All these places, steeped in memory, have been erased. Along with them, emotional reference points and everyday roots have been swept away. Those memories, without a physical place in which to take root, risk fading forever.

As architects, we have the duty to ask ourselves what it truly means to rebuild. It is not only about re-erecting walls, but about restoring meaning, identity, and belonging. For this reason, I believe the real challenge is not only technical but cultural and human: to rebuild the places of life where memory, affection, and community can be reborn. We must prevent haste, economic interests, or externally imposed models from taking precedence.

We need an architecture of memory, capable of preserving and reinterpreting the past to generate the future.

The Rector of IUAV, in a recent interview, announced that Palestinian universities — some of them severely affected — will also participate in the project, and that cross-disciplinary expertise will be involved. This is an important first step.

Allow me a suggestion: let us not forget Palestinian architects — not only researchers, but also local professionals who know the territory, its history, and its needs. Only with their contribution — and with genuine grassroots participation — can we imagine a future Gaza that is just, vibrant, and sustainable.

I conclude with a firm conviction: architecture can be a tool of peace. Building — today more than ever — is never a neutral act. It means deciding whether to nourish memory or oblivion, whether to restore dignity or impose models, whether to offer a future or simply cover over the rubble.

Today, here, we reaffirm our commitment: to build — together — spaces of life, community, and hope. I am proud of the involvement of our Order in today's event, because it reminds us how urgent and necessary it is, today more than ever, to give shape to hope. Thank you.

Atif Kubursi[#]

The Economic Costs of the Palestinian Genocide.

Thank you very much doctor Caterina, my mother would be very proud of you. I am humbled.

I say very humbly that your words and your speaking about our undivided humanity are precious for me.

If the Palestinians have pain, we all have pain. If they are not free, we are not free.

It is very terrible that the Palestinian people have suffered and suffered so much. They are living in an open prison. They are shackled by very vicious restrictions. Their water is stolen water, their oil is stolen, their gas is stolen.

You may not know this, but in the Mediterranean there are more than one hundred twenty-eight billion cubic feet of gas.

And this genocide which is totally political is also largely an economic genocide.

I'm going to walk you through some of the costs that the Israeli occupation has charged on the shoulders of the Palestinians. From restrictions to theft of public money: money that belongs to the Government of the Palestinians and is intercepted by the Israelis.

If you go from one area to the other you could see the difference in the lighting and the electricity. The electricity of the Palestinians is dim. The electricity in the Israeli part is very bright.

The Palestinian economy is divided into three areas: Eastern Jerusalem, the West Bank, and Gaza, this after the Oslo agreement. A period existed in which the Palestinian people were optimistic and full of hope. At that time, Gaza, end of the 1990s, represented 40% of the Palestinian population and almost thirty-five percent of the economy.

[#] Emeritus Professor McMaster University Toronto, Canada

After 1998 up to 2022 the population of Gaza increased to 40% of Palestine, but its economy collapsed to 16%.
At that time the per capita income in Gaza was 2,400 dollars: now it is less than 50%, less than 1,200 dollars. And in real terms, if you consider the inflation, the income is even lower, but this is not because the other economies are growing more.
Eight wars happened from 1992-93 to 2005-06: each of these wars implied massive destructions of the infrastructures, of buildings, universities, schools, hospitals. Now in Gaza all the buildings are destroyed.
We know that 65,000 persons, including many children, died and that 50% of them are women and children: a study from Harvard says that these numbers are underestimated and that the number of people killed is 300,000.
So the issue is not about reconstruction, the issue is about reinvigorating, giving a chance.
In 1980 I estimated the loss of the Palestinians in 1948: this because at that time we were able to lay our hands on all the documents of what people lost, we had every single piece of land, who owned it and who took it.
The loss was 400 billion dollars; this was the reparation payment they got from Germany and from Austria under the program called "Make Things Good Again".
This money was sufficient or not, this was the money that came from Germany and Austria, this is the story. They should have had to include the psychological pain of the Palestinians.
As an economist I made a very minor calculation on the back of an envelope. I took the difference between the Palestinian economy which is growing at the rate of that of Jordan, a country which is very similar to Palestine, a rate of 4.1%.
Currently, the three parts that I described for Palestine - Eastern Jerusalem, the West Bank, and Gaza - with the 4.1%

of growth per year generate in 1998-2022 a loss of growth of 69 billion dollars.
Somebody could say, "Oh, you should not add current dollars." So I did it in constant dollars and it was fifty-nine billion dollars.
Somebody could say that I am considering inflation. No, I am computing the numbers in current prices. Sixty-nine billion dollars.
This is something very annoying but at the same time very unacceptable.
Nobody is sending the Israelis the invoice of all the destruction and of this psychological destruction of the Palestinian population.
So far the only study where we estimated this - we said to the Palestinians: please send this bill to the Israelis, those who destroy are responsible to pay the bill. Nobody has sent them this message. The Palestinians do not consider all this, they have completely lost their hope.
And this is very important because we don't need the Saudis to pay. We don't need the West to pay. We don't need the Germans to pay. We don't need the Americans.
This is wrong. We do not have to send the bill to Austria or to Kuwait.
Is Israel responsible for these costs? The GDP, the gross domestic product of Israel is 400 billion dollars. Could they pay? Nobody is saying this, I said.
No right is lost if there are still persons who claim it.
And it is time that the Palestinians and the Arabs wake up to this reality. They have to ask what is their legitimate right.
This brings me to a very special person, a person that is probably your neighbor, the great Honorable Francesca Albanese. You must be proud of having her as your neighbor.
We are working and we ask you to join us in nominating her for the Nobel Prize for Peace.

She came up with something economists have failed to do. She came up with a theory about compensation that economists did not think of. She's a lawyer, but she came up with some very important points: the economy of occupation.

You do not care about the economy of occupation and about the new economy of today which is the economy of the genocide. We must consider the wives, the hundreds of thousands of persons who could not support their families, who are disappearing, who died.

We must consider the responsibility of all those who are helping Israel to continue its genocide and all the American and the Asian companies that continue to aid and facilitate this genocide.

She named one hundred forty-five major corporations that are benefiting from genocide, that can be accused of genocide: from Lockheed to all the airline companies, Boeing, McDonald's, and many other companies active in the field of food and technology.

Today, if you are being surveilled - anyone of you who uses a phone or uses social media - maybe the Israelis are monitoring you. The story is very clear.

All the social media are monitored by Israel. And they sell these controls, these informations, to a lot of countries, especially the non-democratic or not sufficiently democratic ones. Many Arab countries are surveilled in their activities, in their lives, and suffer from absence of privacy.

The economics of genocide is paying dividends to the Israelis and to their supporters. Could you think of Trump with his son-in-law Kushner who wants to change Gaza into a touristic city on the sea? I do not know how, but they are thinking about the real estate economy. Mister Trump: every piece of land is a building project for him even if this could happen at the expense of a family, of children, of the life of someone.

Clearly this is not an economic issue, it is an issue of justice: what about justice and civil rights? They are not things that can be object of negotiation, of commerce. Here we are really at an important crossroad.
What happens in the Middle East will not stay in the Middle East. It is spreading everywhere.
We are all going to be vulnerable. If the situation in Gaza continues as it is, our indivisible human dignity is in danger, at risk.
We should care about the children of the Palestinians. Today it is the children of Palestine, tomorrow it could be our children.
Because we need to defend the right of people to live.
We need to defend International Law and the sanctity of human life, the instruments of International Law and the dignity of human life.
Without law it is a jungle, a space in which anything can be said, where things that are false or that do not exist can be said, where humanity is not mentioned. Humanity needs law and order and we do not have any surrogate for law, for international law.
We cannot turn a blind eye to the ICC, to the International Criminal Court. We cannot ignore the International Criminal Court.
If Netanyahu flies over Italy, the Italians are responsible, they can imprison him, if I am not wrong.
And if we do not respect the ICC, we must respect the IJC, the International Court of Justice. My argument is very simple.
We are all responsible for this situation. It's our responsibility. We have to take into our hands the defense of International Law.
I would conclude by saying that I am very proud to be in Bari. I was very much energized by these speeches.

I am grateful to the Politecnico di Bari for its very honorable position and to all the professors who are breaking the walls of the ivory towers and coming with their expertise, their knowledge, and their humanity to defend the weak and the vulnerable.

Umberto Fratino[§§]

Grazie. Thank you. Thank you all for coming and for listening. I would like to say just a few words.
As a human being, I want to express my deep sorrow for what has happened in Gaza. This is not acceptable—under any circumstances.
I believe that everyone bears responsibility in the face of this tragedy. We cannot remain in our homes, simply observing what is happening, without saying a word or taking a position. This responsibility lies first and foremost with institutions, which must set an example.
We must take a clear stance on what is happening around us. This is essential—it is part of our role.
I believe we must put culture first, because without culture, tragedies like this can happen again, just as they have happened in the past. What we are witnessing is a humanitarian catastrophe that cannot be accepted.
After more than a year and a half of war, we must be fully aware that approximately two million people are living in extremely dramatic conditions, deprived of basic necessities. This is, above all, a human crisis.
I hope that society as a whole, and the international community, will become fully aware of this and take meaningful action to support those affected.

[§§] Rector of the Polytechnic University of Bari

I have worked for many years with Palestinian people. Throughout my academic life, I have collaborated with many colleagues from that land—brilliant people, with the same talents, dignity, and potential as people anywhere in the world. What is happening to them today is profoundly tragic. As the incoming Rector of this University, I believe that our institution, our city, and our region must take a leading role, working together with others to provide concrete support.
We are capable of welcoming people from the Palestinian territories and helping them grow through education and culture. Before any physical reconstruction, what is needed is a moral reconstruction of the human being.
Thank you all for being here.

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