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Interplay between EU Green Digitalization and "ReArm Europe": Potential Catalytic Role of Networked Local Initiatives

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The Paris Agreement, based on achieving net-zero emissions by 2050, served as a compromise, replacing approaches such as "leaving fossil fuels in the ground" or establishing post-growth trajectories. Growth and profit-driven deployment trends have also turned technology into a driver of the climate and ecological crisis. This paper explores whether and how the recently announced "ReArm Europe" can interact with the simultaneous advancement of environmental objectives under the European Green Deal, potentially forming a genuine virtuous cycle of green digitalization and addressing Europe's technological dependence. The research examines how networked local initiatives, cooperating with transdisciplinary research, can facilitate redirecting technological progress toward post-growth and regenerative approaches.

Keywords: green digitalization, ReArm Europe, climate crisis, technology enactment, post-growth approaches

1. Introduction

The Paris Agreement (2015) followed a compromised approach prioritizing economic expansion despite successful efforts aiming to achieve global cooperation to handle the increasing climate crisis. The Agreement relied to a significant degree on expected future technological solutions to reduce emissions, which has proven increasingly ineffective as emissions continue to rise and global warming accelerates faster than projected (IPCC 2023). The current trends of technology deployment continue turning the growth-obsessed economy (Daly 1977) into a driver of global climate and ecological crisis. Post-growth digitalization represents a fundamental shift from endless economic expansion toward technology deployment that prioritizes social and ecological well-being over the growth metrics. This approach recognizes that infinite economic growth on a finite planet is impossible while emphasizing that well-being can be improved through different means than capital accumulation.

After the Russian invasion of Ukraine, the EU stands at a critical juncture where two transformative agendas intersect: an urgent green and digital transition on one hand, and a renewed focus on defense and rearmament through "ReArm Europe" on the other. Despite multiple efforts to keep pace in innovation (Lisbon strategy 2000, Europe 2020 2010, Horizon 2020 2014, Digital Single Market Strategy 2015, Horizon Europe 2020) Europe has become primarily a passive consumer of technologies developed elsewhere. Europe's share of the global ICT market has declined from 21.8% in 2013 to 11.3% in 2022 with 80% of digital transformation technologies designed and manufactured outside EU borders (Salobir 2025).

This study addresses the research question: Can the recently announced "ReArm Europe" initiative interact with environmental objectives under the European Green Deal to form a genuine virtuous cycle of green digitalization through networked local initiatives? The central argument is that defense-driven innovation can be redirected toward community-level resilience and distributed security capabilities through post-growth approaches. The paper examines whether these seemingly divergent paths can be reconciled through post-growth approaches and simultaneously address increasing technological dependence, growing insecurity, and disruptive tendencies generated by climate crisis. The structure of this study unfolds across several interconnected themes: the next section analyzes Europe's technological dependence and the AI productivity paradox; the third section examines Europe's evolving security landscape through the possible effects of ReArm Europe initiative; fourth, exploring how defense-driven digitalization creates both opportunities and social and environmental externalities; the fifth section investigates the possible interplay of post-growth approaches and technology enactment; the next examines green digitalization in the context of polycrisis; the following elaborates on the potential of networking local initiatives for regenerative change; the eighth section discusses the role of transdisciplinary research; followed by the presentation of the virtuous cycles of green digitalization; finally, concluding on possible impacts of deploying post-growth digitalization principles and indicating issues for further research.

2. Europe's Technological Dependence and the AI Productivity Paradox

As Mario Draghi noted in his landmark 2024 competitiveness report, Europeans have done everything to keep innovation at low levels (Draghi 2024). As a consequence, the foreign direct investment flows to Europe fell to nine-year lows in 2024, with double-digit declines in France and Germany. The EU's share of the global ICT market declined from 21.8% in 2013 to 11.3% in 2022 (Salobir 2025). Europeans have too long passively enjoyed Silicon Valley's risk-taking and Shenzhen's manufacturing capabilities. These tendencies reflect deeper structural challenges in the continent's innovation ecosystem. Limited venture capital availability, fragmented markets, and risk-averse investment cultures have created an environment where breakthrough innovations struggle to scale (Draghi 2024). This has resulted in a brain drain as European talent migrates to Silicon Valley and other global technology hubs. Big Tech companies continue to roll out various AI services on their global platforms, successfully continuing to capture value capitalizing on user contributions while extracting economic rents from European users without proportionate local value creation (Srnicek 2017, Van Alstyne–Parker 2021). Whether recent agreements announced at the AI Action Summit in Paris in 2025 (Kasneci et al. 2025) can help reduce the growing European disadvantage remains to be seen.

AI-related development trends frequently bring about unintended and unforeseen social and environmental consequences. The emergence of what Eric Schmidt (2025) calls the "San Francisco Consensus" around AI's transformative potential comes with sobering realities. Highlighting AI's "recursive self-improvement" capacity, Schmidt (2025) notes that at leading AI companies, between 10% and 20% of the code is already being written by AI tools themselves. Alongside promised effectiveness increases, unintended and unforeseen disruptive consequences are generated including massive job replacements and the exponential growth of AI's related resource use (Strubell et al. 2019). Modern AI models, especially their training, require vast amounts of energy and – for cooling equipment in mushrooming data centers (Pengfei et al. 2025) – water (Gupta et al. 2023) as well as rapidly growing volumes of data that prove to be unavailable. The computing power required for training large language models doubles approximately every 3.4 months, creating an unsustainable trajectory of resource consumption.

Recent concerns about data scarcity have led to proposals for intellectual property reform. Recently technology leaders including Elon Musk have initiated efforts to eliminate intellectual property rights to ensure (free) access to data sources while training AI (Ha 2025). Although IP reform could facilitate addressing power imbalances, there is little hope that Big Tech will promote initiatives facilitating overcome "second enclosure" tendencies that restrict access to digital commons (Hess–Ostrom 2007). In the meantime, the requirements for powering energy-hungry server farms have prompted reopening blocks of nuclear power stations, including Three Mile Island – which became an iconic location where one of the largest nuclear accidents in the USA unfolded (de Vries 2018). The consequences of AI's exponentially growing resource intensity directly contradict the Paris Agreement's objectives, threatening to become a significant factor in accelerating rather than mitigating climate crisis (Bouguet et al. 2023).

Recognizing these challenges, researchers are seeking ways to diminish AI's resource requirements and recent breakthroughs promise achieving significant reductions in memory and energy usage for AI models through advanced pruning techniques (Tzach et al. 2025). However, technical fixes alone cannot address the fundamental issue that current technology deployment prioritizes growth over sustainability (Jackson 2017).

The key challenge is institutional, and to a significant degree ethical, requiring changes in *distribution* and purpose rather than continuing to focus on production efficiency. As Arthur (2011) observed, the emerging digital "second economy" will continue generating prosperity, but without fundamental reimagining of value creation and work, it won't automatically ensure broad access to that prosperity (Arthur 2011). Without deliberate action toward post-growth approaches, technology-driven growth will continue exacerbating rather than solving climate and social crises. The current growth obsessed (Daly 1977) economic activities, largely due to the dominance of profit-driven technology deployment, act as drivers of the ecological and climate crises (Hickel 2020) instead of helping to solve humanity's increasing problems aggregating into polycrises. Significant institutional transformations enabling going beyond the current growth obsession deploying frameworks like doughnut economics (Raworth 2017) can enable due transformations. These must implement post-growth digitalization principles in daily practice that prioritize social and ecological well-being over endless expansion. However, the urgency of addressing security threats may create pressure for rapid technological solutions that conflict with longer-term sustainability goals. As a consequence, due changes may be delayed by current security policy trends that create feedback loops and mutual catalysis with a rapidly accelerating arms race (Simmons-Edler et al. 2024).

2.1. Components of an Effective EU-wide Innovation Enhancement Policy

The European approach to technology governance has prioritized consumer protection and market regulation over innovation fostering. While this has created a robust framework for digital rights and fair competition, it has inadvertently contributed to Europe's declining position as a technology creator rather than merely a technology consumer. The consumer mindset has become so deeply rooted that it shapes also the philosophy behind EU legislation. Over the past decades, the European Union has increasingly transformed from a global technology player into a passive consumer of technologies developed elsewhere. Today, 80% of the technologies and services needed for Europe's digital transformation are designed and manufactured outside its borders, mainly in the United States and China (Salobir 2025).

The regulatory excellence has become Europe's trademark these regulations provide strong protection for EU citizens and serve as a global model for competition policy and online safety (Brewin 2024, Pelle–Szanyi 2025). However, the recently adopted technology regulations continue to focus on ensuring online safety and fair competition to protect Europeans primarily as consumers rather than empowering them as innovators and creators. Without effective innovation policies, based on far-reaching technology assessment exploring whether current rules facilitate or hinder innovation, there is a risk that the EU will become merely a spectator in the global technology race, particularly in the field of artificial intelligence (Draghi 2024).

Developing alternative innovation facilitation models based on distributed innovation and local resilience Europe can catalyze and accelerate distributed and synergistic technology development. Such innovative approach can facilitate co-creating advantage instead of attempting to compete directly with Silicon Valley's scale or Shenzhen's manufacturing capacity and with the robust financial resources these can enact on global capital markets. The combination of post-growth digitalization approaches and mass self-organization within networked local initiatives can also contribute to facilitating overcoming Europe's technological decline and dependence reducing also its security vulnerabilities.

There is little point in heavily investing in technologies that are difficult to scale or export. Despite strong political support, the desire to achieve rapid technological independence has brought rather limited success, as efforts to develop homegrown cloud computing and Google Search alternatives have demonstrated (Salobir 2025). More promising approaches may offer opportunities to catalyze and capitalize on synergies while attempting to co-create strategic interdependence, particularly in critical physical and digital infrastructures. A German startup, Helsing, for example, relies on open-source large language models developed by France's Mistral to create new generation, AI-capable drones, recently launching a factory with initial monthly production capacity of over 1000 units (Salobir 2025). This synergistic approach emphasizes collaboration and complementarity rather than competition and duplication. It demonstrates how truly trans-European collaboration can create technological capabilities.

Unfortunately, current EU digital legislation enforcement approaches burden small innovators and delay, even derail innovation efforts, as Mario Draghi (2024) and Enrico Letta (2024) have warned. Making technological legal frameworks clearer, simpler, and more predictable would strengthen the single market and attract talent and investment back to Europe. This doesn't mean diluting privacy protection or copyright legislation but creating regulatory environments that simultaneously empower and protect market actors. Europe needs pro-active innovation policies while continuing to leverage the EU's diplomatic and regulatory strength, promoting and enforcing fundamental consumer rights protection globally, protecting consumers from potential misbehavior of global companies, headquartered mainly in the USA or China. The pro-active efforts must enhance existing and creating new synergies across the entire continent (Letta 2024) supporting European technological champions and facilitating their capability to globally shape digital products and services. Europe can enhance strategic interdependence catalyzing synergies instead of chasing technological autarky. Enacting and upgrading also regulatory innovation the EU can catalyze also enhanced networking among self-organizing local initiatives enacting and co-creating robust capacities enhancing innovation. Rather than attempting to achieve isolated technological autarky with short notice to ensure security Europe's goal should be co-creating fundamental capabilities within the current ReArm Europe initiative.

3. Europe's Rearmament Program in a Changing Security Landscape

While grappling with technological, environmental, political and social disruptions, Europe is simultaneously confronting an increasingly volatile geopolitical environment. The "ReArm Europe" also referred to as "Readiness 2030" refers to an initiative aimed at strengthening European defense and strategic autonomy by the end of this decade (European Commission 2024).

The security threat posed by the war in Ukraine has showcased how modern warfare is evolving, with unmanned aerial vehicles (UAVs) and autonomous weapons coming to the fore. Iran's Shahed-series "kamikaze" drones have been used extensively, with Russia reportedly launching hundreds of these drones in swarms alongside ballistic and cruise missiles to overwhelm Ukrainian defenses (Gady 2024). Analysis reveals that drones have made traditional expensive military equipment (tanks, aircraft, ships) increasingly vulnerable. In the Ukrainian conflict, drones cause over 70% of casualties on both sides, fundamentally changing the nature of warfare from large-scale equipment confrontations to distributed, technology-mediated conflicts (Watling et al. 2023). Even the frontlines seem to be reshaped and disappeared, and the new technologies require profound changes in both military strategy and tactics (Kofman et al. 2023).

This intense drone race appears to be proving decisive in the Russian aggression against Ukraine and signals a broader revolution in warfare globally (Gady 2024). Recent reports show the Ukrainian military striking key nodes of the Russian military-industrial complex, including drone manufacturing facilities, while Russia is rapidly accelerating the production and deployment of various drones. Drone and counter-drone capabilities increasingly enhanced with robust AI capabilities appear to be becoming strategically crucial generating rapidly emerging transformational tendencies in both the military strategy and industry. This technological revolution in warfare has implications for how

European defense capabilities must be reconceptualized, moving away from traditional force structures toward more flexible, technology-intensive approaches (Fiott 2023).

This shifting mindset is evident in tangible changes in defense spending. Recent NATO summits have established goals of achieving in middle terms 5% of defense expenses relative to GDP (NATO 2025). Attempting to reflect changes in the regional security landscape and the global trends across Europe a significant collective ramp-up of military budgets takes place. However, critical analysis reveals clear limits to what "ReArm Europe" can achieve in the near term. Despite being a significant effort towards European strategic autonomy, "Readiness 2030" cannot fully substitute for certain American military contributions of key importance. Europe will still continue to fundamentally depend on the U.S. nuclear umbrella, global power projection capabilities, advanced intelligence infrastructure, and logistics capacity (Fiott 2023).

While "ReArm Europe" aims providing funding for accelerating innovation, it also risks locking Europe into resource-intensive development paths that conflicts with sustainability goals. This creates a fundamental tension between short-term security imperatives and long-term ecological security. Consequently, the increased spending without complex policy mechanisms can create both opportunities and risks for technological development and socio-economic stability. European efforts of achieving genuine strategic autonomy (Burni et al. 2023) and simultaneously pursuing green digitalization objectives require sophisticated policy driven approach going beyond increasing defense expenses and generating capacities contributing to solve growing threats of global polycrises (Lawrence et al. 2022, Bauwens 2025).

4. ReArm Europe and the Climate-Security Nexus

The envisioned military buildup under ReArm Europe emphasizes the necessity to accelerate European development of artificial intelligence, cybersecurity, robotics and autonomous systems, quantum computing, and secure communications (European Defence Agency 2024). This tech-centric defense agenda could potentially create spillovers into the civilian economy, including among others AI advances accelerating civilian applications and military robotics contributing to automation breakthroughs. However, this synergy comes with significant risks that can bring unforeseen social consequences and directly contradict climate objectives. There is concern about becoming locked into a resource-intensive development path - a high-tech arms race that "guzzles" energy and materials (Crawford 2022) contributing to the acceleration of robust environmental destruction and the emergence of "Hot Earth" conditions (Steffen et al. 2018).

The Ukrainian conflict demonstrates how rapidly defense technologies can evolve and reveals also the resource intensity of modern warfare. Ukraine's drone production reached one million units annually, while Russia planned two million, indicating the scale of resource mobilization required (Cancian 2023). This arms race mentality, if adopted by Europe, could undermine rather than support green transition objectives required to ensure national security in longer term. If Europe's economic, innovation, and technology development becomes tied to military-driven tech upgrades and expansion, enhancing dependency on high energy use fundamentally incompatible with the post-growth approaches needed to address climate crisis and the related threats to security. Although the dual-use nature of many defense technologies offers potential for positive spillovers, realizing these benefits requires conscious policy choices. The "ReArm Europe" efforts must be planned and implemented ensuring that military innovation would serve simultaneously broader societal goals rather than merely enhancing destructive capabilities.

The environmental and social impacts of defense-led technological surge can create direct contradictions with Green Deal objectives. Military activities most-often have high carbon footprints, yet military emissions are frequently excluded from countries' emissions inventories, enhancing continued fossil fuel dependence despite climate commitments (Crawford 2022).

Advanced weaponry requires, among others, rare earth metals and critical minerals, driving harmful mining activities that further increase global emissions. The end-of-life of military tech contributes to various destructive impacts, including electronic waste on significant scales, especially with fast upgrade cycles demanded by technological competition (Parkinson 2019).

A narrowly conceived and handled guns-versus-butter tradeoff creates tensions between military imperatives and climate action and undermines the social foundations necessary for successful green transition – an integrative component of the national security (CNA Military Advisory Board 2014). Diverting substantial budgets to defense in practice frequently means shifting funds away from civil needs such as education, healthcare, or green infrastructure. A focus on high-tech skills for defense may leave other workers behind, potentially widening inequality rather than supporting the "just transition" principles of the Green Deal (Gough 2017). Moreover, as defense contracts fluctuate with actual, changing threat perceptions the kinds of jobs created by defense-heavy tech economy might be less secure than those in a more balanced economy (Hartley 2011). Furthermore, the acceleration of AI deployment and robotization in military firms and sectors driven by short term profit expectations can catalyze similar tendencies in other sectors of the economy, potentially enhancing "jobless growth" and catalyzing socio-economic instability (Srnicek 2017). If ReArm Europe mishandles such often unintended and unforeseen destructive tendencies, it can further weaken political and social stability – contributing to a major goal of the "hybrid war" waged by Russia and its allies (Applebaum 2020).

5. Post-Growth Approaches to Technology Enactment

How Europe might redirect its technological trajectory toward genuine green digitalization that addresses rather than exacerbates climate crisis and social inequality becomes a critical challenge. Success requires moving beyond the Paris Agreement's compromise which has attempted to align a growth-focused economy with emergent future technologies hoping that the latter will reduce harmful emissions. Narratives prevailing also in the European Green Deal strategy, such as sustainable development, green growth, decoupling, and circular economy, continue to prioritize economic expansion while relying on future technological solutions to reduce emissions as highlighted in critiques (Haberl et al. 2020, Hickel–Kallis 2020). Longitudinal global data reveals that emissions continue to rise, and global warming is accelerating faster than projected (IPCC 2023), indicating the fundamental inadequacy of growth-oriented approaches. While elaborating on the necessity of green digitalization, Brenner and Hartl (2021) emphasize only the need to balance technological advancement with ecological sustainability without clarifying that achieving transformative changes requires deploying post-growth strategies.

The ReArm Europe initiative, if pursued through conventional growth paradigms, risks reinforcing rather than contribute to the resolution of these contradictions. Europe needs conscious policy choices that allow it to avoid falling into a militarized high-tech growth trap (Crawford 2022). ReArm Europe must be shaped to allow the leveraging of defense-driven innovation for broader post-growth benefit by facilitating improved capacity to simultaneously handle the climate and ecological crises, the socio-economic instability, and the growing security challenges. Reshaping the typical characteristics of military production is fundamental in preventing a "negative swap" between enhanced military security versus accelerated environmental degradation, potentially combined with growing social instability and political extremism. This requires a well-elaborated and firm regulatory framework, including consistent enforcement mechanisms ensuring adherence to practical pathways for defense innovation that enhance rather than undermine local resilience and sustainability. Pathways like conditionalities, dual-use strategies, civilian oversight, civil-military technology transfer with public-good orientation, rebalancing investments, and institutional innovations (Table 1) can ensure that defense investments strengthen social and environmental resilience aligning ReArm Europe's efforts with a greener and more secure future.

Table 1. Solutions aligning ReArm Europe with Green Digitalization

Solutions	**Description & Rationale**
Redefine Security Policy	Expand security doctrine to include climate and human security. E.g. strategic documents acknowledge climate change as an existential threat equal to traditional threats, guiding resource allocation accordingly.
Green Defense Conditionalities	Align military modernization with climate targets imposing environmental standards on defense spending (e.g. sustainable procurement, low-emission technology) to minimize harm.
Dual-Use R&D and Tech Transfer	Ensure accelerated sharing of military R&D in AI, energy, etc. with civilian sector for climate and social benefit. E.g. adopt policies for open licensing or spin-offs of defense innovations for green applications.
Budgetary Cross-Linking	Maintain balance between military and ecological security investments tying increases in defense budgets to proportional increases in climate resilience funding (national/EU level).
Emissions Reporting & Reduction	Mandate annual reporting of military GHG emissions and set reduction targets (e.g. through efficiency, alternative fuels). Integrate military emissions in national climate plans.
Democratic Civilian Oversight Mechanisms	Include environmental and civil stakeholders in oversight of defense programs; transparently evaluate trade-offs. Prevent defense from overriding climate/social commitments
Community Resilience Grants	Enhance societal resilience and address security in broader sense allocating part of ReArm Europe funds to support networked local initiatives (energy co-ops, etc.) as critical infrastructure

Source: author's own work based on policy analyses

Defense contracts must also be tied to environmental performance, nudging the industry toward cleaner directions. It facilitates introducing ecological conditionalities for defense industries, establishing green standards that require defense technology to meet energy efficiency benchmarks, use recyclable materials, and incorporate low-carbon processes (Brauch 2019).

The Ukrainian experience demonstrates how civil initiatives and self-organizing, primarily related to drone development, can enact highly effective, at a significant degree self-organizing mass-contributions to defense through distributed, locally developed and deployed technologies rather than centralized, frequently resource-intensive systems (Watling et al. 2023). This practical experience provides robust argument for allocating part of ReArm Europe funds to support networked local initiatives (energy co-ops, etc.) to operate as critical infrastructure of distributed security.

Post-growth approaches emphasize that infinite economic growth on a finite planet is impossible as demonstrated by ecological economics research (Daly 2019) and that well-being can be improved through different means than capital and material accumulation (Jackson 2017). This perspective offers a wellbeing driven framework for technology development that prioritizes effectiveness and sufficiency over efficiency and scale.

To consciously avoid a "militarized high-tech growth trap" intertwined with further forcing of endless consumption the deployment of ReArm Europe must facilitate a digital transformation that follows post-growth approaches. Such post-growth digitalization must serve as a guiding principle for both technology development and enactment and must emphasize developing technologies that support care, repair, sharing, and creative labor. It allows digital innovations approaching sufficiency and well-being through doing more with less and directed toward climate action can contribute to sustainability properly as George et al. (2020) demonstrate.

Post-growth digitalization requires fundamental shifts in how we measure success and progress. Instead of focusing on growth metrics like GDP or market share, emphasis should be placed on indicators of well-being, sustainability, resilience and genuine transformations constitutive of systemic transition (IEEE SA 2024). Related institutional changes can contribute to and guide both defense and civilian technology development toward more sustainable pathways aligned with an extended perception and practice of national security.

6. Green Digitalization in an Era of Polycrisis

The term polycrisis has emerged to describe the current state where multiple crises are not only occurring in parallel but also interacting with each other in unpredictable ways (Lawrence et al. 2022). Europe faces simultaneous emergence and interplay among climate emergency, ecological degradation, pandemic aftermath, geopolitical conflicts, economic instabilities, and social upheavals, all intertwined.

The European Union's strategic documents describe green digitalization as the integration of digital technologies in ways that directly contribute to climate neutrality, environmental protection, and sustainable resource use (European Commission 2021). The OECD (2025) offers a definition that includes the purposeful design, development, and deployment of digital technologies to accelerate the transition toward climate neutrality, ecological sustainability, and social inclusivity. Bieser and Hilty (2018) describe green digitalization as the synergistic use of digital technologies to enable and optimize the transition to a low-carbon, resource-efficient, and circular economy. Green digitalization must go beyond traditional approaches and consider also important institutional changes as Del Río Castro et al. (2021) emphasize based on their systematic review.

The proper deployment of digital technologies must help restore - not only prevent - environmental harms, avoid rebound effects, and actively reduce social inequality. The green digitalization following an altered, post-growth paradigm contributes to frugality serving well-being, enabling life quality improvement. It must align digitalization with a revolutionary green socio-economic transformation, ensuring that "every byte and every algorithm contributes" to a healthier planet and more resilient society. The concept of "twin transition" as explored by Shajari and David (2025) provides a framework for understanding this convergence.

The green digitalization consequently refers primarily to the intentional convergence of digital transformation with ecological sustainability goals, and it must embrace "organically" the fulfillment of the requirements of improved social equity. In context of the current polycrisis green digitalization must address simultaneously environmental concerns, social justice, economic inequality, and democratic participation. To handle simultaneously interconnected environmental, social, and technological challenges requires following a convergence approach enabling to provide integrated solutions. ReArm Europe can be successful by adopting a comprehensive understanding of both security and green digitalization, facilitating the implementation of technology deployment patterns in daily practice that consciously serve regenerative efforts, strengthen social cohesion, democratic institutions, and wellbeing perceiving them as factors and enablers of a distributed model of security.

7. Networking Local Initiatives – Regenerative Agency Contributing to Distributed Security

Various civil initiatives and their networks collaborating across regions and countries can capitalize on and contribute to green digitalization following a post-growth approach (Veress 2025). These local self-organizing initiatives are grassroots or community-based efforts focusing on fulfilling genuine local needs (Buch-Hansen–Koch 2019) often in innovative ways and reducing environmental impact. They aim improving wellbeing rather than attempting to generate artificially new desires for goods, status and prestige services, avoiding the promotion of addictive consumer applications through mass-manipulation. These initiatives contribute to wellbeing, enhance environmental safety through regenerative efforts, and through improved local resilience increase security, aligning technology enactment with post-growth objectives in the spirit of green digitalization.

Such localized efforts frequently focus on providing essential services, including renewable energies, food, communication, transportation, housing by operating at community scale and sustainably. Diverse social innovation patterns like maker spaces, fabrication laboratories or fab labs, hackerspaces, citizen labs, living laboratories, tool and lending libraries, repair shops facilitate the spread of additive manufacturing (3D printing) and enable local production of goods that previously had to be shipped from afar. Deploying state-of-the-art digital tools, they can offer also personalized products through additive manufacturing and capitalizing on frequently free, global knowledge sharing (Kostakis et al. 2015). Using innovative social solutions like cooperative ownership models, volunteerism, peer-to-peer exchange, commons-based governance, etc. they prioritize community empowerment and environmental restoration by providing alternatives to both classic market mechanisms and traditional public-sector provision. Examples include community-owned renewable energy systems with smart grid technologies, local food networks supported by digital platforms, or maker spaces that combine global knowledge sharing with local production.

Table 2. Examples of Networked Local Initiatives

Initiative	**Location**	**Sector**	**Period**	**Key Innovation**	**Acceleration Mechanism/References**
The peasant workshop (L'atelier paysan)	France	Agriculture/ Manufacturing	2009-ongoing	Design, improve, and share open-source agricultural tools adapted to small-scale, sustainable agriculture	Horizontal knowledge transfer / https://www.latelierpaysan.org/
Fab Labs	Global	Digital fabrication	Since 2001	Community-based digital fabrication labs offering access to 3D printers, CNC machines, and global designs	Platform infrastructure / https://fablab.org; https://fablabs.io; https://fabfoundation.org
Medical Device AM Service	Netherlands various hospitals	Medical manufacturing	Since 2010s	Local 3D printing of patient-specific medical parts for hospitals; reduced delivery time by ~50%	Resource co-creation / https://www.m2i.nl/portfolio-items/3dmed/
e-NABLE Community Prosthetics	Global (local nodes)	Medical devices	Since 2013	Volunteer network producing 3D-printed prosthetic hands and arms using open-source designs	Collaborative/ https://enablingthefuture.org
3D Hubs (now Hubs by Protolabs)	Global platform	Manufacturing	Since 2013	Distributed manufacturing network based on global design knowledge, connecting customers with local 3D printing providers worldwide	Platform infrastructure / https://www.hubs.com
INEX-ADAM Project	Multiple EU regions	Advanced manufacturing	Recent	Creates clusters of expertise in advanced additive manufacturing through knowledge transfer and regional collaboration in EU	Institutional innovation / https://en.aidimme.es
Samsø Island Energy Transition	Denmark	Renewable energy	1997-ongoing	Community-driven renewable energy transformation achieving energy independence	Community ownership/ https://www.visitsamsoe.dk/en/inspiration/energy-academy/
EnergieNetz Hamburg eG	Hamburg, Germany	Energy/Governance	2013-ongoing	Citizen energy cooperative emerging from successful referendum returning energy networks to public ownership; implements integrated energy transition projects	Institutional innovation/ https://www.energienetz-hamburg.de
Zellerfeld 3D-Printed Footwear	Hamburg, Germany	Manufacturing	Since 2020s	Sneakers - customized manufactured locally with 3D printing	Local production autonomy /https://www.zellerfeld.com/

Source: public information available from (online) documentation

These self-organizing initiatives frequently deploy innovative mobilization strategies that enable novel approaches to resource co-creation (Veress 2016). Similar self-organizing initiatives can also develop in underserved areas, where, within frameworks similar to commons-based peer production (CBPP) (Kostakis and Bauwens 2014), like maker spaces or tool-sharing libraries provide access to appropriate, frequently low-tech solutions facilitating the fulfillment of genuine local needs (Smith et al. 2014). There is also a notable shift in these initiatives toward regenerative approaches, rather than merely sustainable ones (Mang–Reed 2012). Regenerative approaches seek not only to minimize harm but to actively restore and enhance ecological and social systems representing a fundamental shift from defensive to proactive environmental and social action.

Many of the self-organizing efforts unfolding in community initiatives converge to enhance personal and collective autonomy. Renewable energy production at the community level is increasingly common, with towns or cooperatives setting up solar panels, wind turbines, or bioenergy paired with diverse types of local storage capacities and micro-grids (Koirala et al. 2016). The enhanced access to renewables simultaneously facilitates also non-industrial food production and processing. With open-source knowledge sharing of global reach, small local workshops can rely on global knowledge resources, which allows them to download designs and print spare machine parts for various equipment fulfilling genuine personalized needs.

Communication represents another important pillar of innovative local efforts. Community-controlled internet access initiatives, such as mesh networks or local broadband cooperatives, enable communities to control the means of communication enabling "self-communication" (Castells 2009). The "...mass self-communication...multiplies and diversifies the entry points in the communication process. This gives rise to unprecedented autonomy for communicative subjects to communicate at large" (Castells 2009, p. 135).

Local energy production, manufacturing capabilities, communication networks, and food systems reduce dependence on external supply chains and create multiple pathways for meeting essential needs. Developing similar feed backing distributed systems create redundancy and resilience that can be valuable for both everyday life and emergency situations. Indeed, when communities have local energy production, manufacturing capabilities, communication networks, and food systems, they become less vulnerable to supply chain disruptions, cyber-attacks on centralized infrastructure, or other security threats. The increased autonomy of such community-framed efforts simultaneously proposes new patterns of resilience and safety, contributing to more effective and potentially less resource-consuming patterns and solutions of local safety that contribute to cooperative defense capacities. The Ukrainian experience demonstrates a crucial bridge between local resilience and national security: distributed manufacturing of drones and other equipment shows how community-level capabilities can directly contribute to defense needs while maintaining civilian applications. By reducing critical vulnerabilities, decentralized resilience models can complement traditional defense approaches. The distributed provision of essential services creates redundancy and resilience that can be valuable also for national security (Coaffee 2013).

8. Collaborative Networks and Transdisciplinary Research

The true power of local initiatives comes when they become networked and scaled through collaboration. Networking localized initiatives means creating platforms and relationships through which communities can learn from each other, share resources and best practices, and coordinate actions for greater impact (Veress 2017). Digital tools can be invaluable here: solutions like online hubs and platforms for knowledge exchange, open-source information and project repositories, or remote collaboration tools all enable local activists and experts to connect across distance. This type of "horizontal scaling" or "scaling out" (Avelino et al. 2017) – replication and adaptation of good ideas across many locales – can amplify small successes facilitating their aggregation into larger movements of change, contributing to the success of increasingly important transition efforts.

Networking also enables communities to develop collective bargaining power with larger institutions and to influence policy at regional and national levels. When local initiatives coordinate their efforts, they can demonstrate the viability of alternative approaches and create pressure for systemic change.

To study and simultaneously support the networking local self-organizing initiatives deploying methods like participative action research, citizen science, and transdisciplinary research can play a significant enabling and catalytic role. Collaborating directly with communities the academics and practitioners from different fields can provide expertise contributing to the community success and empowerment and can accelerate local transitions. Engineers, ecologists, economists, urban planners, and social scientists can voluntarily pool expertise from multiple fields and cooperate with citizens to troubleshoot problems and optimize solutions in real time. Volunteer researchers work using approaches that feed back into community efforts, bringing about practical improvements on the ground in various fields like energy system design or agricultural techniques – extending beyond publications in academic journals.

This approach to research challenges traditional academic boundaries and evaluation criteria, and helps ensure that academic efforts don't remain theoretical "ivory-tower ideas." This shift requires new forms of institutional support and recognition within universities and research organizations, instead of mechanically prioritizing publication in high-impact journals, transdisciplinary research emphasizes real-world impact. Targeted transdisciplinary research efforts can catalyze resourceful collaborative knowledge co-creation and facilitate innovative practical solutions (Shrivastava et al. 2020). The outcome of similar co-created knowledge is technologically and culturally appropriate, facilitating communities' self-organizing and self-empowerment.

9. Toward Virtuous Cycles of Green Digitalization

The transition toward green digitalization faces several systemic challenges that require coordinated policy responses. The key challenge is overcoming the institutional lock-in that favors short-term profit maximization over long-term sustainability and security goals. A critical task is realigning technology deployment with broader and longer term social and ecological goals rather than continuing to be driven solely by the perceived exigencies of shareholder value and corporate profit maximization. This requires a "new political economy of green digitalization" that frames policies, incentives, and institutions such that digital innovation contributes to environmental regeneration and human well-being by design.

Europe can develop coalitions of like-minded companies that share EU values demonstrating that state-of-the-art technologies, especially generative artificial intelligence, represent significant opportunity, but only when applied ethically, in ways that respect human rights, the workers' and employees' interests. Creating technological and legal frameworks that promote equity, and pluralism becomes essential. The key is ensuring that technological development serves life-enhancing rather than life-threatening purposes and leverage defense innovation for broader social benefit, including following broad, regenerative strategies. This requires awareness of – often unintended – consequences, enabling conscious choices to avoid militarized high-tech growth traps. A virtuous cycle by fostering innovations that serve both security and regenerative objectives can capitalize on a properly directed, regulated, and monitored ReArm Europe program.

10. Conclusion

The compromise embodied in the Paris Agreement, which prioritised economic expansion while relying on anticipated future technologies to achieve emissions reductions, has proven inadequate since emissions continue rising and global warming accelerates. Europe's transformation into a passive consumer of externally developed technologies undermines both climate objectives and security capabilities and harms its competitiveness and social dynamism. Attempts to imitate current trends emerging in the USA and China towards AI-driven productivity growth and an arms race, combined with the accelerating deterioration of welfare state services and the weakening – and at times even halting – of global cooperation in addressing the climate crisis, threaten to exacerbate rather than resolve the global polycrisis.

By contrast, networked development of local capabilities can contribute to security through distributed rather than centralised approaches, including in technology development, as the Ukrainian experience demonstrates. Networking local initiatives can significantly contribute to resilience and enhanced security at all levels – from personal and regional to national and EU level. It can also help avoid traps generated by the dominant mainstream economics' obsession with growth.

When considered within the ReArm Europe framework, green and post-growth digitalisation could facilitate redirecting technological development toward wellbeing and sustainability, while creating feedback loops with horizontal patterns of enhanced security. This approach allows Europe to capitalise on networks of distributed innovative capacities, catalysing synergies rather than attempting to gain advantage by increasing investments in centralised military strategies and chasing endless economic expansion. Following post-growth approaches – by focusing on addressing genuine needs and fostering synergistic innovation through connecting distributed capacities – Europe can create a new model that simultaneously enhances resilience, reduces technological dependence, and contributes to global climate stabilisation.

Success requires industry leaders and policymakers to work closely with a broad circle of stakeholders, including regions, universities, civil society, and trade unions. Restoring and enhancing Europe's global technology and innovation capacities, and improving its competitiveness, require fundamental changes in mindset. Business-as-usual approaches will not resolve Europe's technological lag and insecurity; instead, they risk pushing the continent across tipping points that could trigger cascading crises. An important step towards more adequate strategies is to recognise that green and post-growth digitalisation can facilitate the co-creation of genuine alternatives. These alternatives would enable effective technology development and enactment while supporting both security and sustainability objectives. The strategic choice before Europe is stark: either repeat resource-intensive growth patterns that reproduce and deepen emerging polycrises, or pioneer new approaches that ensure technology serves life and well-being rather than threatening them.

A well-managed ReArm Europe initiative, informed by post-growth principles and capitalising on networked local social and technological innovations, could contribute meaningfully to managing the feedback dynamics constitutive of the global polycrisis. When aligned with conscious regulatory steps, effective innovation facilitation mechanisms, and broad regenerative strategies, it can leverage defence-driven innovation for wider social benefit, including technology development and the capacity to address climate and social challenges. These, in turn, can enhance national and European security. Ensuring an empowering, EU-wide interplay between green digitalisation and the ReArm Europe initiative therefore represents a critical test of whether Europe can transform today's global polycrisis into an opportunity for genuine systemic change.

The so-called EU trilemma – simultaneously greening the economy, building military capabilities and strategic autonomy by enhancing competitiveness through targeted industrial development and armament, and improving already weakened social welfare systems – constitutes a formidable set of tasks requiring thorough analysis. Current research (Szilágyi 2025, Tatár 2025), however, often follows a narrow financial-fiscal approach without acknowledging the dangers arising from the growing separation of economic and social processes (Acemoglu–Johnson 2023). This perspective treats the costs of the green transition and rising defence expenditures as manageable only by dismantling welfare systems and reducing social benefits (Tatár 2025). It proposes restoring fiscal balance through renewed austerity, despite its proven destructive effects. Such strategies ignore the consequences: further weakening of welfare systems, erosion of the middle classes that have underpinned political stability since the end of the WWII, and the collapse of already fragile public trust and willingness to cooperate. These dynamics, in turn, fuel support for extremist movements (Rodrik 2021). The likely outcome is escalating social tensions, weakened political stability, and, in the worst case, systemic breakdown. Even if the promised technological developments were to succeed, this socio-economic trajectory would not strengthen but rather undermine defence and national security goals. It would corrode what remains of social trust and intensifies tensions precisely when dialogue and cooperation are most essential.

As Chancellor Merkel (2014) repeatedly warned, European peace "is not a given that will last forever" – active efforts must be made to preserve it. These efforts include not only substantial and sustained defence spending but also equally significant commitments to avoid ecological catastrophe and preserve social peace. Neglecting either dimension risks accelerating increasingly destructive climate-related challenges (Allianz 2025, Financial Times 2025) while simultaneously creating fertile ground for psychological, hybrid, and other forms of warfare that may weaken, or even undermine, national and collective security. A narrowed approach thus risks producing correct answers to the wrong questions – what Mitroff and Featheringham (1974) aptly termed an error of the third kind. A detailed analysis of the interconnections and feedback loops among these processes is therefore an urgent priority for further research and policymaking.

Future research should also explore how post-growth approaches can be aligned with EU policies, while identifying unintended side-effects that may obstruct synergies. Particular attention should be given to how transdisciplinary research, combined with networks of self-organising local initiatives deploying green and post-growth digitalisation, can generate virtuous cycles capable of addressing multiple crises simultaneously. Building on such insights, and through deliberate, well-designed policy choices, support for distributed innovation, and committed implementation of post-growth digitalisation principles, Europe can establish self-reinforcing dynamics that address both the climate emergency and security challenges, while also fostering greater equality and social stability. The pathway forward requires the courage to abandon outdated paradigms and to embrace green and post-growth digitalisation, alongside regenerative approaches that place human and ecological well-being at the heart of technological development.

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References

3D Medical Models (n.d.): *3D Medical Models. Patient-specific surgical technology from scan to 3D print*. https://www.m2i.nl/portfolio-items/3dmed/ Date of access: 7 October, 2025.

Acemoglu, D. – Johnson, S. (2023): *Power and Progress: Our 1000-Year Struggle Over Technology and Prosperity*. PublicAffairs.

Allianz (2025): *Heatwaves: Economic implications for Southern Europe*. Allianz Research, 1 July.

https://www.allianz.com/content/dam/onemarketing/azcom/Allianz_com/economic-research/publications/specials/en/2025/july/20250701_Heatwaves_EconImplications.pdf Date of access: 7 October, 2025.

Applebaum, A. (2020): *Twilight of Democracy: The Seductive Lure of Authoritarianism*. London, Allen Lane/Penguin Books.

Arthur, W. B. (2011): The second economy. *McKinsey Quarterly*, October 2011, 1–9.

Avelino, F. – Grin, J. – Pel, B. – Jhagroe, S. (2017): The politics of sustainability transitions. *Journal of Environmental Policy and Planning*, 18(5), 557–567. DOI: 10.1080/1523908X.2016.1216782

Bauwens, M. (2025): *What do we do, right now, at this moment in the transition? Suggestions for a commons-based strategy of social change*. Brussels, P2P Foundation. https://4thgenerationcivilization.substack.com/p/what-do-we-do-right-now-at-this-moment?utm_source=post-email-title&publication_id=2002020&post_id=166581217&utm_campaign=email-post-title&isFreemail=true&r=16484l&triedRedirect=true&utm_medium=email Date of access: 7 October, 2025.

Bieser, J. C. T. – Hilty, L. M. (2018): Assessing indirect environmental effects of information and communication technology (ICT): A systematic literature review and meta-analysis. *Sustainability*, 10(8), 2662. DOI: 10.3390/su10082662

Bouguet, A. – Fromm, A. – Ventura, A. (2023): Environmental impacts of artificial intelligence: A systematic review. *Environmental Science & Technology*, 57(12), 4732–4745.

Brauch, H. G. (2019): Climate change, environmental stress and conflict. In: Brauch, H. G. (ed.): *Security Threats, Challenges, Vulnerability and Risks*. Heidelberg, Springer, 165–189.

Brenner, B. – Hartl, B. (2021): The perceived relationship between digitalization and ecological, economic, and social sustainability. *Journal of Cleaner Production*, 315, 128128. DOI: 10.1016/j.jclepro.2021.128128

Brewin, C. (2024): The digital markets act: Competition policy for the digital age. *European Competition Journal*, 20(1), 89–112.

Buch-Hansen, H. – Koch, M. (2019): Degrowth through income and wealth caps? *Ecological Economics*, 160, 264–271. DOI: 10.1016/j.ecolecon.2019.03.001

Burni, A. – Knudsen, E. – Nogarede, J. – Pirozzi, N. – Rinaldi, D. (2023): *Progressive Pathways to European Strategic Autonomy*. Brussels: Foundation for European Progressive Studies. https://feps-europe.eu/wp-content/uploads/2023/02/PB_Progressive-pathways-to-European-strategic-autonomy-.pdf Date of access: 7 October, 2025.

Cancian, M. F. (2023): Ukraine's drone revolution: How UAVs are reshaping modern warfare. *War on the Rocks*, March 15, 2023.

Castells, M. (2009): *Communication Power*. Oxford, Oxford University Press.

CNA Military Advisory Board (2014): *National Security and the Accelerating Risks of Climate Change*. Alexandria: CNA Corporation.

https://www.cna.org/archive/CNA_Files/pdf/MAB_5-8-14.pdf Date of access: 7 October, 2025.

Coaffee, J. (2013): Rescaling and responsibilising the politics of urban resilience: From national security to local place-making. *Politics*, 33(4), 240–252. DOI: 10.1111/1467-9256.12011

Crawford, N. C. (2022): *The Pentagon, climate change, and war: Charting the rise and fall of U.S. military emissions*. Cambridge: MIT Press. DOI: 10.7551/mitpress/14617.001.0001

Daly, H. E. (1977): *Steady-State Economics*. Washington: Island Press.

Daly, H. E. (2019): Growthism: Its Ecological, Economic and Ethical Limits Real-World Economics Review, 87, https://www.paecon.net/PAEReview/issue87/Daly87.pdf Date of access: 7 October, 2025.

de Vries, A. (2018): Bitcoin's growing energy problem. *Joule*, 2(5), 801–805. DOI: 10.1016/j.joule.2018.04.016

Del Río Castro, G. – González Fernández, M. C. – Uruburu Colsa, Á. (2021): Unleashing the convergence amid digitalization and sustainability towards pursuing the Sustainable Development Goals (SDGs): A holistic review. *Journal of Cleaner Production*, 280, 122204. DOI: 10.1016/j.jclepro.2020.122204

Draghi, M. (2024): *The Future of European Competitiveness*. Brussels, European Commission.

E-NABLE (n.d.): e-NABLE Community Foundation. https://enablingthefuture.org Date of access: 7 October, 2025.

EnergieNetz Hamburg eG (n.d.): Energiewende in Bürgerhand. https://www.energienetz-hamburg.de Date of access: 7 October, 2025.

European Commission (2021): 2030 Digital Compass: The European Way for the Digital Decade. COM(2021) 118 final. Brussels, European Commission.

European Commission (2024): ReArm Europe – Readiness 2030. COM(2024) 150 final. Brussels: European Commission.

European Defence Agency (2024): *European Defence Technology and Industrial Base Strategy*. Brussels: European Defence Agency.

Fab Lab network (n.d.): Fab Labs. https://fablab.org; https://fablabs.io; https://fabfoundation.org Date of access: 7 October, 2025.

Financial Times (2025): Europe reels from deadly early summer heatwave, *Financial Times*, 25 June. https://www.ft.com/content/6390eb2c-6415-4a53-bcfa-ea086dc2ef02 Date of access: 7 October, 2025.

Fiott, D. (2023): The limits of European strategic autonomy in defence. *Survival*, 65(2), 37–58.

Gady, F. S. (2024): The drone wars: How autonomous weapons are changing the face of conflict. *Foreign Affairs*, 103(2), 78–91.

George, G. – Merrill, R. K. – Schillebeeckx, S. J. D. (2020): Digital sustainability and entrepreneurship: How digital innovations are helping tackle climate change and sustainable development. *Entrepreneurship Theory and Practice*, 44(5), 1037-1060. DOI: 10.1177/1042258719899425

Gough, I. (2017): *Heat, Greed and Human Need: Climate Change, Capitalism and Sustainable Wellbeing*. Cheltenham, Edward Elgar. DOI: 10.4337/9781785365119

Gupta, A. – LaRosa, J. – Hosseini, S. A. (2023): Quantifying the water footprint of AI model training. *Nature Machine Intelligence*, 5(8), 694–702.

Ha, A. (2025): Jack Dorsey and Elon Musk would like to 'delete all IP law'. *TechCrunch*, April 13, 2025. https://techcrunch.com/2025/04/13/jack-dorsey-and-elon-musk-would-like-to-delete-all-ip-law/ Date of access: 7 October, 2025.

Haberl, H. – Wiedenhofer, D. – Virág, D. – Kalt, G. – Plank, B. – Brockway, P. – Fishman, T. – Hausknost, D. – Krausmann, F. – Leon-Gruchalski, B. – Mayer, A. – Pichler, M. – Schaffartzik, A. – Sousa, T. – Streeck, J. – Creutzig, F. (2020): A systematic review of the evidence on decoupling of GDP, resource use and GHG emissions, part II: synthesizing the insights. *Environmental Research Letters*, 15(6), 065003. DOI: 10.1088/1748-9326/ab842a

Hartley, K. (2011): *The Economics of Defence Policy: A New Perspective*. London, Routledge. DOI: 10.4324/9780203838778

Hess, C. – Ostrom, E. (eds.) (2007): *Understanding Knowledge as Commons: From Theory to Practice*. Cambridge, MIT Press. DOI: 10.7551/mitpress/6980.001.0001

Hickel, J. (2020): *Less is More: How Degrowth Will Save the World*. London: William Heinemann.

Hickel, J. – Kallis, G. (2020): Is green growth possible? *New Political Economy*, 25(4), 469–486. DOI: 10.1080/13563467.2019.1598964

Hubs by Protolabs (n.d.): On-demand manufacturing. https://www.hubs.com

IEEE SA (2024): *Strong Sustainability by Design. Planet Positive 2030 Compendium*. Piscataway, IEEE Standards Association.

INEX-ADAM Project (n.d.): INcreasing EXcellence on ADVanced Additive Manufacturing. https://cordis.europa.eu/project/id/810708/results Date of access: 7 October, 2025.

IPCC (2023): *Climate Change 2023: Synthesis Report*. Geneva: Intergovernmental Panel on Climate Change.

Jackson, T. (2017): *Prosperity without Growth: Foundations for the Economy of Tomorrow*. Second Edition. London, Routledge.

Kasneci, G. – Gasser, U. – Hofmann, T. F. – Kramer, G. – Müller, G. – Peus, C. – Schönenberger, H. – Kasneci, E. (2025): Europe's AI Imperative – A Pragmatic Blueprint for Global Tech Leadership. arXiv preprint arXiv:2502.08781. DOI: 10.31235/osf.io/8uyrc_v1

Kofman, M. – Migacheva, K. – Nichiporuk, B. – Oberholtzer, A. – Tkacheva, O. – Radin, A. (2023): *Lessons from Russia's operations in Crimea and eastern Ukraine*. Santa Monica, RAND Corporation.

Koirala, B. P. – Koliou, E. – Friege, J. – Hakvoort, R. A. – Herder, P. M. (2016): Energetic communities for community energy: A review of key issues and trends shaping integrated community energy systems. *Renewable and Sustainable Energy Reviews*, 56, 722-744. DOI: 10.1016/j.rser.2015.11.080

Kostakis, V. – Bauwens, M. (2014): *Network Society and Future Scenarios for a Collaborative Economy*. London, Palgrave Macmillan. DOI: 10.1057/9781137406897

Kostakis, V. – Niaros, V. – Giotitsas, C. (2015): Open source 3D printing as a means of learning: An educational experiment in two high schools in Greece. *Telematics and Informatics*, 32(1), 118–128. DOI: 10.1016/j.tele.2014.05.001

L'atelier paysan (2025): Autonomie technique et agroecology paysanne. https://www.latelierpaysan.org/ Date of access: 7 October, 2025.

Lawrence, M. – Janzwood, S. – Homer-Dixon, T. (2022): What is a global polycrisis? Two analytical frameworks. *Global Environmental Politics*, 22(2), 1–22.

Letta, E. (2024): *Much More Than a Market: Report on the Future of the Single Market*. Brussels, European Council.

Mang, P. – Reed, B. (2012): Designing from place: A regenerative framework and methodology. *Building Research & Information*, 40(1), 23–38.

Merkel, A. (2014): *Government statement by Federal Chancellor Angela Merkel: Situation in Ukraine, Speech to the Bundestag, 13 March 2014*. Press and Information Office of the Federal Government. https://www.bundesregierung.de/breg-en/service/archive/archive/policy-statement-by-federal-chancellor-angela-merkel-on-the-situation-in-ukraine-443796 Date of access: 7 October, 2025.

Mitroff, I. I. – Featheringham, T. R. (1974): On systemic problem solving and the error of the third kind. *Behavioral Science*, 19(6), November 1974, 357–424. DOI: 10.1002/bs.3830190605

NATO (2025): *The Hague Summit Declaration*. Brussels: NATO. https://www.nato.int/cps/en/natohq/official_texts_236705.htm Date of access: 7 October, 2025.

OECD (2025): *Inclusive, Green and Digital Transformation*. Paris, OECD Publishing.

Paris Agreement (2015): *United Nations Framework Convention on Climate Change*. Paris, United Nations.

Parkinson, S. (2019): The environmental impacts of the arms trade. In: Stavrianakis, A. – Selby, J. (eds.): *Militarism and Climate Change*. London, Routledge, 123–145.

Pelle A. – Szanyi M. (2025): A platformgazdaság működése és szabályozása. *Külgazdaság*, 69(9–10), 58–85. DOI: 10.47630/KULG.2025.69.9-10.58

Pengfei, L. – Jianyi Y. – Mohammad, A. I. – Shaolei, R. (2025): Making AI Less "Thirsty": Uncovering and Addressing the Secret Water Footprint of AI Models. arXiv preprint arXiv:2304.03271. https://arxiv.org/abs/2304.03271 Date of access: 7 October, 2025.

Raworth, K. (2017): *Doughnut Economics: Seven Ways to Think Like a 21st-Century Economist*. White River Junction, Chelsea Green Publishing.

Rodrik, D. (2021): Why Does Globalization Fuel Populism? Economics, Culture, and the Rise of Right-wing Populism. *Annual Review of Economics*, 13, 133–170. DOI: 10.1146/annurev-economics-080520-103223

Salobir, E. (2025): Europe's technological decline has reached a staggering level. *Project Syndicate*, June 16, 2025.
Samsø (n.d.): Renewable energy island. *Visit Samsoe*. https://www.visitsamsoe.dk/en/inspiration/energy-academy/ Date of access: 7 October, 2025.
Schmidt, E. (2025): AI's recursive self-improvement: Implications for society. *Technology Review*, April 2025, 45–52.
Shajari, B. – David, I. (2025): *Bridging the Silos of Digitalization and Sustainability by Twin Transition: A Multivocal Literature Review*. arXiv preprint arXiv:2506.04267. DOI: 10.48550/arXiv.2506.04267
Shrivastava, P. – Stafford Smith, M. – O'Brien, K. – Zsolnai, L. (2020): Transforming Sustainability Science to Generate Positive Social and Environmental Change Globally. *One Earth*, 2(4), 329–340. DOI: 10.1016/j.oneear.2020.04.010
Simmons-Edler, R. – Badman, R. – Longpre, S. – Rajan, K. (2024): AI-Powered Autonomous Weapons Risk Geopolitical Instability and Threaten AI Research. arXiv preprint arXiv:2405.01859. https://arxiv.org/abs/2405.01859 Date of access: 7 October, 2025.
Smith, A. – Fressoli, M. – Thomas, H. (2014): Grassroots innovation movements: Challenges and contributions. *Journal of Cleaner Production*, 63, 114–124. DOI: 10.1016/j.jclepro.2012.12.025
Srnicek, N. (2017): *Platform Capitalism*. Cambridge, Polity Press.
Steffen, W. – Rockström, J. – Richardson, K. – Lenton, T. M. – Folke, C. – Liverman, D. – Summerhayes, C. P. – Barnosky, A. D. – Cornell, S. E. – Crucifix, M. – Donges, J. F. – Fetzer, I. – Lade, S. J. – Scheffer, M. – Winkelmann, R. – Schellnhuber, H. J. (2018): Trajectories of the Earth System in the Anthropocene. *Proceedings of the National Academy of Sciences*, 115(33), 8252-8259. DOI: 10.1073/pnas.1810141115
Strubell, E. – Ganesh, A. – McCallum, A. (2019): Energy and policy considerations for deep learning in NLP. *Proceedings of the 57th Annual Meeting of the Association for Computational Linguistics*, 3645–3650. DOI: 10.18653/v1/P19-1355
Szilágyi, B. (2025): Europe's trilemma: rearmament, green transition, competitiveness. https://centraleuropeantimes.com/europes-trilemma-rearmament-green-transition-competitiveness/ Date of access: 7 October, 2025.
Tatár, M. (2025): The EU is in a dangerous trilemma – green transition, re-arming and cutting spending at the same time? https://www.oeconomus.hu/en/oecoglobus/the-eu-is-in-a-dangerous-trilemma-green-transition-re-arming-and-cutting-spending-at-the-same-time/#:~:text=Like%20this:%20*%20The%20first%20leg%20of,the%20trilemma:%20Reducing%20spending%20and%20public%20debt Date of access: 7 October, 2025.
Tzach, R. – Chen, L. – Williams, K. (2025): Pruning neural networks for 90% memory reduction without accuracy loss. *Journal of Machine Learning Research*, 26(1), 112–128.

Van Alstyne, M. W. – Parker, G. G. (2021): Digital Transformation Changes How Companies Create Value. *Harvard Business Review*, December 2021. https://hbr.org/2021/12/digital-transformation-changes-how-companies-create-value Date of access: 7 October, 2025.

Veress, J. (2016): Transformational Outcomes of Civil Society Organizations. https://aaltodoc.aalto.fi/items/68dc4856-7320-45d5-8824-14cb3866ff13 Date of access: 7 October, 2025.

Veress, J. (2017): Transformational Dynamism of Civil Society Organizations. *Budapest Management Review*, 18(11), 12–21. DOI: 10.14267/VEZTUD.2017.11.02

Veress, J. (2025): Enacting the transformational dynamism of civil economy to tackle climate challenges. *Journal of Human Values*, 1–16. DOI: 10.1177/09716858251364958

Watling, J. – Kaushal, S. – Byrnes, O. (2023): *The lessons of modern war: How Ukraine is changing the face of conflict*. London: Royal United Services Institute.

Zellerfeld 3D-Printed Footwear (n.d.): 3D printed shoes. https://www.zellerfeld.com/ Date of access: 7 October, 2025.