Proceedings of the International Conference on Adaptive Reuse. Volume 1
Crudeli A., Molle F., Carrai E. (Eds.), STH Press, 2026. ISBN 9791281661141
Paper DOI – https://doi.org/10.65686/EVQM2511

Regenerative Processes at Scale

An Adaptive Reuse Strategy for Port Talbot

James Hepper[a], Daniel Rea[b], Paola Zanotto[c]

[a]Periscope, London, UK, james.hepper@periscope.uk; [b]Periscope, London, UK, daniel@periscope.uk; [c]Periscope, London, UK, paola.zanotto@periscope.uk

Abstract

Across Europe, fossil fuel-based industrial sites are being downsized due to technological advancements and a global shift in energy production. In the UK, this transition is especially pressing in Port Talbot, home to the largest steelworks in Europe and a century-long industrial presence. With the move towards electric arc furnaces, the future of the site—and the communities shaped by it—remains uncertain. This research investigates how adaptive reuse can offer an alternative pathway for large-scale industrial recovery, using Port Talbot as a case study. Conventional approaches to industrial site reuse in the UK typically involve the erasure of industrial features, making way for housing and commercial development. While some iconic buildings are retained for their symbolic value, they are often divorced from their original context and meaning, transformed into aestheticised monuments rather than integral parts of a living heritage. This tendency overlooks the embedded material, cultural, and processual value of such sites. To broach this, our research proposes a method of adaptive reuse grounded in resourcefulness—viewing industrial sites not as derelict voids but as rich repositories of materials, knowledge systems, and narratives. By adopting a hybrid methodology involving landscape-led design, the reuse of reclaimed materials, and the diversion of industrial waste streams, the research demonstrates how architecture can engage with place-specific legacies while fostering sustainable futures. The project emphasises the importance of local craft, materials, and embedded knowledge in shaping an architecture of place. Rather than imposing a top-down vision, it calls for a situated, process-led approach to regeneration—one that understands these landscapes as evolving. Ultimately, the research seeks to define a new post-industrial vernacular for Port Talbot—one that reflects the complexities of transition while honouring the enduring identity of place.

Keywords: Industrial Heritage, Circular Production, Regenerative Design

Introduction

Throughout history, materials and construction techniques have reflected the evolution of societies and the transformation of human settlements. In this context, the regeneration of industrial sites may offer a renewed opportunity to reconsider materiality itself to re-envision the future of large industrial landscapes through the lens of resource reuse and material innovation. Over the past 60 years, the steel industry in the UK has experienced a steady decline; as a result, many steelworks have been permanently closed. Due to their sheer size and the large number of employees required to operate them, these steelworks once contributed significantly to the growth of nearby towns and to the formation of communities that developed around such activities. The closure or reduction of large industrial sites such as steelworks has created a legacy of redundant infrastructures across the country, with associated critical issues such as soil contamination, low land value, and proximity to disadvantaged communities affected by the loss of employment linked to the decline of the main productive industries that once drove their growth—and, in some cases, their very foundation.

Port Talbot

This article explores a potential alternative approach to the regeneration of former industrial sites, focusing on the case of Port Talbot in Wales (Fig. 1). Covering an area of approximately 1,011 hectares, Port Talbot was once the largest steelworks site in the United Kingdom and among the largest in Europe. In the 1960s, it employed around 18,000 people, making it the single largest employer in Wales at the time. The closure of the site's last blast furnace in 2024 marked the end of more than a century of traditional steelmaking, resulting in the loss of nearly 2,800 jobs after a long period of decline.

Fig. 1. Port Talbot Steelwork in an aerial image dated 2025 (Google Earth)

Following the closure, government funding was secured to establish an Electric Arc Furnace (EAF) on-site, aimed at recommissioning part of the complex for steel recycling. While the EAF represents an essential step towards the decarbonisation of Port Talbot and the development of a more sustainable local and national economy, it does not address the future of the entire site or the significant quantities of waste and by-products left behind. These include extensive deposits of coal, pig iron, slag, and ore across the stockyards. The site also suffers from severe contamination, typical of former steelmaking operations, due to heavy metals leaching into the soil over time. Moreover, ongoing EAF activity will continue to generate by-products that will require sustainable, local reuse if the recycling process is to achieve true circularity. The future of much of the former steelworks remains uncertain, while a growing pressure to address the UK's housing shortage has led to proposals for a new generation of new towns focusing land use for residential development in both brownfield and greenfield sites, not including the regeneration of post industrail sites like Port Talbot.

Turning Waste into Resources

In recent years, research has increasingly focused on themes related to the afterlife of industrial sites following the cessation of productive activities. One of these themes involves the reuse of blast furnace and steelmaking by-products within the construction industry. A major challenges facing the steelmaking sector is the high volume of waste produced and the difficulties encountered to recycle most of it for low carbon materials. Numerous studies have explored the potential reuse of steel and its by-products in various construction contexts, ranging from low carbon housing components to road infrastructure materials. In terms of ecological site remediation, the potential of natural soil decontamination processes is also gaining recognition, with recent publications—including those in mainstream media—highlighting innovative approaches. Steelwork byproducts, for example iron slag, not only has the potential to be reused as a construction material but can also be colonised by vegetation, sequester carbon dioxide, and support biodiversity. Remarkably, certain rare plant species have been observed to thrive on and around iron slag deposits, where unique soil and microclimatic conditions foster ecological resilience. A small but growing group of practitioners and researchers is experimenting with ways to transform materials traditionally classified as waste into resources for construction.

A Cultural Value Nested in Materials

The research work mentioned above have been carried in fields connected to bioengineering, chemistry and material science. From a cultural perspective, other branches of research have focussed on the cultural significance of man-made landscapes and their role in the regeneration of industrial sites. Landscape features connected to the productive histories of these areas have been explored in projects such as Clay County Vision, where a China clay stockpile was retained and integrated within a traditional development framework, maintaining a visible link to the site's industrial past (N. Bartolini and C. DeSilvey 2020). Several projects of adaptive reuse have already demonstrated the strong potential of preserving site character while embedding regenerative processes at the core of design thinking. Among the most influential is Landschaftspark Duisburg-Nord (2002), a landmark project in terms of ambition to preserve and reinterpret the existing site industrial fabric as much as possible. The reuse and adaptation of buildings, structural elements, and infrastructure from the original complex remain today a pivotal example of the integration of landscape architecture, industrial heritage, ecology, and community.

A Proposed New Synergy

While the research branches described above have each, to varying degrees, successfully proposed alternative approaches to specific issues related to the decommissioning of large industrial sites, or the reuse of the waste they produce, they have tended to operate in isolation. Although these studies provide valuable enabling tools, they lack an overarching framework that allows them to work in synergy and achieve their full potential. Despite shared aims of making formal industrial sites more sustainable and their reuse more appealing, current and historic research efforts have, substantially, failed to become "the new normal" or to enter mainstream practice in site regeneration and adaptive reuse projects. At the same time, large post-industrial sites continue to face significant challenges in overcoming contamination, financial, and design barriers to deliver schemes that are commercially viable, culturally meaningful, and ecologically restorative. The present research seeks to explore the advantages of applying an "extended and fully integrated" adaptive reuse approach to large industrial sites. The research project ultimately seeks to demonstrate the advantages and potential of reimagining the site's functions, tangible and intangible resources, and values within an open and evolving framework—in contrast to what Caitlin DeSilvey describes as *heritization*: the tendency to stabilise or "freeze" elements of the past in material form, detaching them from their original purpose and character. The ultimate goal is not merely the preservation or reuse of selected structures, but the simultaneous re-industrialisation and re-naturalisation of Port Talbot—a reinvention of the industrial environment that complements the development of the EAF project. This approach seeks to base the future identity of the steelworks not on a static vision of heritage, but on a living and thriving present, where people can once again work, learn, and live within a regenerated and productive landscape.

Regenerative Processes at Scale

Applying adaptive reuse principles to both selected industrial buildings and the substantial quantities of raw material present on-site represents the first step of this approach. The material stock will be surveyed, audited, and assessed to initiate a local production chain of construction materials. Several of the existing steelworks buildings could be adapted and repurposed for this production, while the existing infrastructure would facilitate the movement and distribution of materials between the various stockpile locations. A "Material Lab" (Fig. 4) could be established on-site with a dual function: first, to create employment opportunities linked to the production of low-carbon materials for new construction and retrofit housing; and second, to provide training and educational facilities for local communities. This initiative could form the foundation of a renewed local economy centred on sustainable materials; a high level study of the production processes are outlines in a diagram in (Fig. 2). Some of these products—such as scoria bricks and tiles—would carry a distinct site-specific character, visually and materially expressing the circular-economy principles behind their production while embodying the area's historical connection to steel making. In large-scale masterplanning and in the historical study of cities and towns, the character of new developments often emerges through the deliberate and coordinated use of particular materials. Different materials produced in the Material Lab could also be applied to retrofit existing housing in the nearby communities of Neath Port Talbot, and Margam—the settlements most closely connected to the steelworks. One potential outcome of the Material Lab could be the production of slag mineral wool, a material capable of significantly improving the thermal performance of homes. This would align with the UK's national objectives to reduce energy poverty, lower carbon emissions, and improve operational energy efficiency in the built environment. Other areas of the site would be dedicated to nature-led remediation processes, implemented in phases. In the short term, these zones could provide amenity spaces for nearby residential areas; in the longer term, they could either support new housing development or be integrated as open spaces within future phases of the masterplan. In parallel to the Material Lab, a "Landscape Lab" would be established in selected areas to minimise disturbance from other site activities focussing on the restoration of the local ecology. Here, phytoremediation methods—the use of plants to absorb and stabilise contaminants—could be applied extensively as a low-cost, low-intervention strategy to accelerate natural recovery and improve soil health and air quality.

As a practice, we have previously explored the ecological and social potential of transitional sites through an interdisciplinary research-in-practice project that investigated the role of bioremediation techniques in temporary sites. The capacity of plants such as from the brassica family or fabaceae (sweet peas) to absorb heavy metals is well documented and could be harnessed on a large scale in Port Talbot. This process could stimulate additional productive activities, including the production of bio-based materials—an expanded scope of the Material Lab.

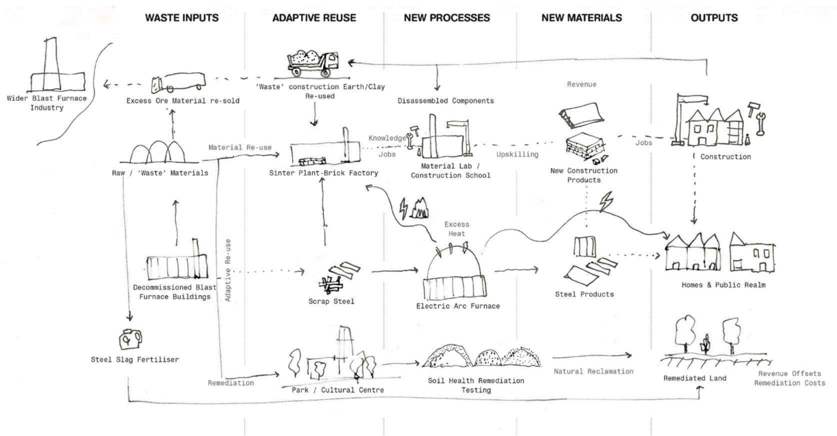

Fig. 2. Concept diagram of the productive opportunities for sustainable material reuse proposed for Port Talbot (Periscope)

The Future of Large Industrial Sites

By exploring the resources and the history of Port Talbot, this work has been able to determine a regeneration strategy that could be applied to many brownfield and industrial sites in UK. The proposed approach does not follow a linear structure where phases are opened and closed in sequence as in a typical regeneration scheme, rather it's based on a simultaneous set of actions to start both nature based or human led processes, which will re-activate areas of industrial sites and initiate an accumulative effect. Figure 3 illustrates in a diagramatic way how the different areas could be dedicated to different strategies depending on time span, resources, and subsequent tranformation from initial project actions. In the short term, industrial buildings could be retrofitted to accommodate offices and research space as needed, while bioremediation is applied to designated sites and coal and slag tips commence "re-naturalisation" also to prevent long term pollution and contamination in sensible zones, for example residential areas. The method presented here deliberately reduces interdependencies between individual strategies, enabling a system of processes operating at different speeds and scales. The project will need to use time as a resource itself, and not as a constraint: the initiation of natural bioremediation of the soil will make good use of the time that will "go spare" in between phases, while waiting for funds, or in areas that will be developed later in the timeline, contributing to de-risk projects to rgenerate the area. The adaptation of the industrial buildings to accommodate new activities and an education and training centre integrated with the industrial activities established in Port Talbot could enable material research and testing for products that are certified, warrantied, and suitable for a national and international market. A lookout or visitors centre and the creation of a public trail through the site would transform the public perception of Port Talbot.

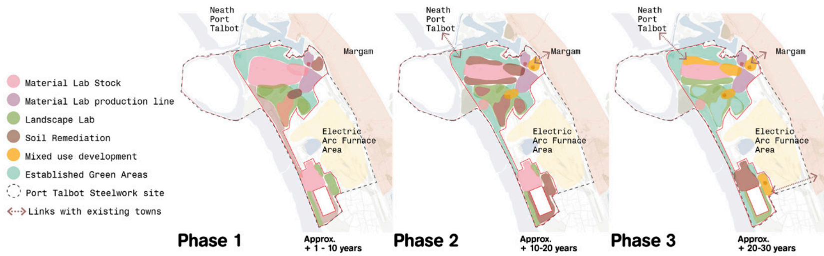

Fig. 3. Indicative phasing strategy for Port Talbot (Periscope)

Conclusions

The adaptive reuse approach proposed in this article focuses on a dynamic, self-sustaining set of strategies that do not seek to resolve all problems at once, but rather maintain a continuous, circular regeneration process built around four main aims: adapt operations, diversify land use, recover ecologies and perpetuate heritage. The overarching aim of this research is to stimulate debate about the strategies, practices, and tools that can be developed to remediate and transform large post-industrial sites, and how they can be adapted to other sites. This process must begin by harnessing the resources already present locally and seek opportunities to initiate productive and ecological regenerative strategies. The research is now progressing to develop beyond its initial speculative phase. If informed by local knowledge and supported by community participation, the process could strengthen the sense of identity associated with Port Talbot, transforming a site of such complex history, contamination, and scale demands with the necessary knowledge and high degree of adaptability. This methodology warrants further exploration, including detailed analysis of carbon savings and sequestration, remediation and construction costs, and the development of a constructive, collaborative relationship with local communities. The innovative dimension of this research does not lie in the novelty of its individual components but rather in the synergistic relationship it establishes among existing techniques and their instrumental role as coordinated strategies within a comprehensive spatial masterplan.

The goal and ambition is to successfully bridge emerging and well-established research themes related to the future of post-industrial landscapes and the reuse of steelmaking by-products, placing these processes at the core of regeneration strategies to inform a new approach to planning and design for industrial sites.

Fig. 4. Illustration of the "Material Lab" at Port Talbot (Periscope, 2025)

Bibliography

Bartolini, Nadia, and Caitlin DeSilvey. "Making space for hybridity: Industrial heritage nature cultures at West Carclaze Garden Village, Cornwall." *Geoforum* 113, 31–41, 2020.

Badenoch, Kirsty, Rebecca Faulker, and Daniel Rea. *Stockpile Garden 001: The Project*. London: Periscope, 2024.

Beatty, Christina, and Steve Fothergill. "The impact on welfare and public finances of job loss in industrial Britain." *Regional Studies, Regional Science* 4, 161–180, 2017.

Cervantes, Puma, Genesis Camila, et al. "Utilisation of Reused Steel and Slag: Analysing the Circular Economy Benefits through Three Case Studies." Buildings 14, 1854, 2024.

DeSilvey, Caitlin. Curated Decay: *Heritage beyond Saving*. Minneapolis: University of Minnesota Press, 2017.

Fu, Shuting, Eilhann E. Kwon, and Jechan Lee. "Upcycling Steel Slag into Construction Materials." *Construction and Building Materials* 411, 134639, 2024.

Harrison, Rodney, Caitlin DeSilvey, et al. *Heritage Futures: Comparative Approaches to Natural and Cultural Heritage Practices*. London: UCL Press, 2020.

Ibrahim, I. K., M. Rady, N. M. Tawfik, et al. "Enhancing strength and sustainability of concrete with steel slag aggregate." *Scientific Reports* 15, 442, 2025.

Ken De Cooman, Kim Förster, Anupama Kundoo, Kerstin Müller, Xavier Ros Majó, and Axel Schubert. "Down to Earth: Transforming Urban Excavated Earth into Building Materials." In *Beyond Concrete: Strategies for a Post-Fossil Baukultur*, edited by Martha Thorne and David Chipperfield, 88–105. Barcelona: Fundació Mies van der Rohe, 2022.

Mayes, William M., et al. "Atmospheric CO2 Sequestration in Iron and Steel Slag: Consett, Co. Durham, UK." *Environmental Science & Technology* 52, 7839–7847, 2018.

Stilgenbauer, Judith. "Landschaftspark Duisburg Nord - Duisburg, Germany." *Places* 17, 6–9, 2005.

Swensen, Grete, and Vibeke Andersson. "The Impact of Images on the Adaptive Reuse of Post-Industrial Landscapes." *Journal of Urban Design* 29, 45–62, 2024.

Tata Steel UK. *Planning Statement—Electric Arc Furnace, Port Talbot Steelworks*. London: Turley, 2024.