

- LECTURE -

## **Copperopolis: Swansea's Heyday, Decline, and Regeneration**

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It might be surprising to some that Swansea features in a series of lectures on cities and regions that loom large in the history of capitalism, but there is little need to spend much time justifying its inclusion.<sup>i</sup> Strictly speaking, for much of the period to be discussed Swansea was a town not a city but, semantics aside, it nonetheless almost completely dominated the development of the global copper industry, and in so doing it exemplified the ways in which the key elements of capitalism combined to catalyze the early growth of industrialisation. So dramatic was this process that Professor Chris Evans speaks of a 'Swansea moment' in world economic history, between c. 1830 and 1870, as Swansea and its hinterland were transformed into 'copperopolis', the epicentre of the first globally integrated heavy industry.<sup>ii</sup> As we will see, the case of Swansea thus throws considerable light on some of the key avenues of inquiry set out in the prospectus for this series: it will examine the making of a certain moment in time; it will explore the interaction of the global and the local; and it places emphasis on how the capitalist dynamo, driven by aggressive, innovative entrepreneurialism, shaped patterns of economic development. But the Swansea case also offers scope for examination of some of the downsides to be found in the history of capitalism, as were evident in the consequences of its rapid and devastating de-industrialization, and by bringing the story right up to date the lecture will explore how the legacy of the industrial past is now being incorporated in regeneration of the area.

### **Heyday**

When the annual conference of the British Association for the Advancement of Science paid its second visit to Swansea in 1880, one of the images used for publicity purposes was a view of the Lower Swansea

Valley as it would have looked from the air. The message being conveyed was not simply that Swansea was ‘Intelligent Town’, a Welsh crucible of modernity and intellectual inquiry whose scientists and scholars had established its own Royal Institution in 1835.<sup>iii</sup> Emphasis was also placed upon the density and intensity of its industrialisation, and foregrounded in the image was the bustling port which provided the lifeblood of the town by its facilitation of a wide range of global linkages. There was very good reason for doing this. Swansea had been a very early starter in terms of its industrialisation, and not just within Welsh frames of reference, and by 1880 the whole area and its infrastructure was defined by the haphazard, cheek-by-jowl development of copper smelting that had taken place over the previous 150 years or so. It is estimated that as early as 1800 Swansea smelted 90 percent of Britain’s total copper output, and by the 1860s it was producing around 65 percent of total world output. The port was central to this success, but not only because it enabled the export of smelted, refined, or manufactured copper. Rather, it allowed the importation of the very large quantities of copper ore that found their way to Swansea from mines scattered across the globe. And herein lies perhaps the most remarkable aspect of Swansea’s growth to industrial ascendancy: it had no local deposits of copper ore, and from the very beginning it was wholly dependent upon imported raw materials.

In view of this resource issue, the obvious question that needs to be addressed is why, in the absence of copper ore deposits, did the smelting industry locate in the Lower Swansea Valley in the first place? The answer lies in the agency provided by a small number of highly mobile and innovative entrepreneurs who had the capital, knowledge, and practical skills necessary to organise long-distance supply chains. Small-scale metal smelting had been undertaken in the nearby Neath Valley in the sixteenth century, but Bristol emerged as the main centre of British smelting as local merchants took advantage of Cornish ore deposits to develop copper and brass production. With local sources of charcoal depleted, there was a move to the Wye Valley at Redbrook, before, in the face of further resource depletion, a search began for more sustainable places of production. Technological advance was achieved by the development of coal-fired furnaces, and a search began for suitable coal deposits. This extended along the South Wales coast and by 1717 it was recognised that the Lower Swansea Valley possessed not only rich seams of easily extracted coal but also a suitable navigable river, the Tawe, capable of taking larger ocean-going vessels. The key factor in this transfer of the industry to Swansea lay in the fact that three tons of coal was required to smelt one ton of ore, and this meant that it was far more economical to ship Cornish ore to Swansea than it was to take coal to Cornwall. Moreover, the emerging ‘Welsh method’ of smelting ore in

reverberatory furnaces required up to twenty roasting in long lines of smelters and this served only to increase the amount of coal required.

The first operational smelter in Swansea was that at Landore belonging to John Lane of Bristol, and he was the forerunner of a significant number of inward investors in an area where local gentry wealth, although not absent from industrial enterprise, was limited.<sup>iv</sup> Others followed from Bristol such as the Coster family who had strong links with the West African slave trade which was oiled by copper trade items. London-based financiers also spotted the emerging opportunities and at the forefront in 1729 was Richard Lockwood, a merchant who had strong link as with the Levant Company. Of course, finance was no guarantee of success without technological expertise and a skilled labour force, and, recognising this, Lockwood formed a partnership with Robert Morris, originally from Shropshire, who had acted as the Landore works manager before Lane went bankrupt. This type of combination of finance and expertise was replicated time and again in the next century and a half, first by Bristol and London based individuals, who were then followed by entrepreneurs from Birmingham and Cornwall.

By 1730 the pioneers had established a connection between resources, expertise, and capital, but to make the nascent copper industry sustainable it was necessary to ensure that there was a steady demand for its products. Demand is often absent from economic history because emphasis is placed on the supply side, but all forms of capitalism are dependent on demand for goods and services. In this case, a key element in the rapid early growth of Swansea's copper industry was provided by overseas market. Some products went to the slave trade and consumer markets in colonial America, but rising amounts of copper were directed towards India via the East India Company.<sup>v</sup> Through Richard Lockwood's City connections, Lockwood, Morris & Co. were the early beneficiaries of the Company's attempts to open up Asian markets to British copper from 1729 onwards, with Richard Lockwood's city connections forging an enduring relationship which provided an expanding outlet for their bars, ingots, sheets, and manufactured items. The expansion of British India from 1750 onwards provided further scope for expansion, and a second wave of Swansea companies, established by men such as the serial industrialist Chauncy Townshend, were all involved in the East India trade, which by 1780 was accounting for between one-sixth and one-quarter of total British output. Indeed, the successful and rapid penetration of Indian markets by the copper smelting firms of south-west Wales had a considerable long-term effect upon the maritime economy of Asia. A recent detailed study demonstrates that from the 1760s the importation of copper from Britain eclipsed the long-established inward flow of that commodity from Japan, and this process of

substitution enables the author to claim with some degree of justification that ‘it was British copper, not British cotton textiles, which acted as the harbinger of the Industrial Revolution to the world economy.’<sup>vi</sup> Virtually all of that copper was produced in Swansea by eight smelting works located in very close proximity to one another.

Until about 1780 copper smelted in Swansea used Cornish ore supplemented by small quantities imported from southern Ireland, but Anglesey then emerged as a new source of supply. This was largely as a result of the aggressive entry into the industry of Thomas Williams a north Wales solicitor who has been described as the ‘near-dictator’ of the copper industry. Williams had secured the rights to mine large ore deposits discovered on Parys Mountain, and embarked on an ambitious attempt to exert control over the entire industry. He proved to be remarkably efficient and systematic in his organisation of the supply, production, and distribution chain, a process that brought an unprecedented and unparalleled degree of integration and cohesion to the industry. This meant that in addition to his mining interests, he purchased the Upper and Middle Bank smelting works in Swansea, obtained a fleet of ore-carrying vessels, and established a rolling mill on the Thames which enabled him to supply copper sheathing to the Royal Navy. He was ruthless in his price-cutting strategy, which was aimed at his main Cornish competitors, and relentless in his pursuit of overseas markets which meant that by the 1790s he had been able to establish a near-monopoly over supply to the East India Company. It is perhaps little wonder that Williams’s biographer labelled him the ‘copper king’.<sup>vii</sup>

Thomas Williams flashed like a comet over Britain’s late-eighteenth-century industrial landscape, although he does not loom large in economic histories of Britain. He died in 1802, and, although his enterprise survived for another 23 years in the form of Williams. Grenfell & Co., his legacy was not enduring because the supplies of ore from Anglesey were exhausted shortly after the time of his passing. This loss of supply represented a serious problem for Swansea smelters because it was also becoming evident that Cornish ore was no longer alone sufficient to sustain an industry that was still expanding, not least through the development of Cornish entrepreneur John Vivian’s new state-of-the art Hafod works which went into production in 1810, and the adjacent Morfa works of Foster, Grenfell & Co which opened in 1835 and was destined to become the largest enterprise of its type in Europe.

The ore supply crisis was the catalyst that fully extended the global reach of the Swansea copper industry. A world-wide search for alternative sources of ore was initiated during the 1820s, and this process (about

which we know very little) saw Swansea connected with far-flung mines on several continents. Shipments of ore from Chile first arrived during 1823, and the ports of Valparaiso and Coquimbo soon became vital nodal points in the supply chain, as Swansea's copper barques, known as Cape Horners, plied the notoriously difficult trade route around the Cape of Good Hope to and from the West coast of South America. Similar supply chains were established from Cuba, where ore was mined by slaves operating under the harshest of regimes at the infamous El Cobre mine;<sup>viii</sup> and from South Australia where at Burra the Monster Mine produced ore that was shipped to Swansea from Port Adelaide during the 1850s. Other sources tapped over time were located in the United States (Montana, New Mexico), South Africa, and different parts of Europe. The value added to the volume of this global trade lay in the fact that the quality of the ores was much greater than those located closer to home, with the copper content per ton being twice that still being extracted from Cornish and Irish mines. This reconfiguration of the copper trade put Swansea itself at the heart of a world-wide network which facilitated flows of not only raw materials and finished products, but also migrant labour, expertise, knowledge. The price of copper was set in Swansea, and global connections were inscribed into a townscape - home to 15,000 people in 1821 and 31,000 in 1851 - through the establishment of Consulates and the naming of wharves, streets, public houses, and hotels.

The effect that the copper industry had on the development of Swansea itself was profound.<sup>ix</sup> The Great Western Railway arrived in 1853, a process facilitated by Brunel's construction of his extensive Landore viaduct which spanned not just the River Tawe but also some of the copper works that nestled on its banks. The nine major works operating in 1850 provided employment for some 10,000 men, women, and children. The wealth generated by the copper magnates enabled estates and country houses to be established around the edge of Swansea Bay in picturesque places such as Singleton, Clyne, and Grenfell Park, and it trickled into the burgeoning urban infrastructure through the construction of the aforementioned Royal Institution, as well as assembly rooms, banks, shipping offices, and a multitude of chapels and churches. More prosaically, copper magnates sought to provide housing and basic amenities for some of their labour force, and this gave rise to the satellite industrial townships of Morris Town, Vivians Town, and Grenfell Town. These have been strangely neglected in the literature on the planned company towns of the nineteenth century yet they were in many ways highly innovative and their imprint is very visible today even though they have been subsumed into the wider urban environment.

One must be careful not to exaggerate the localised effects of the growth of the copper industry on the port and town of Swansea, because the very nature of copper smelting was such that output and the size of the workforce were both modest by comparison with the coal industry and the later-emerging ferrous metal industries of the region.<sup>x</sup> Nonetheless, the effects of inter-connected copper-related expansion upon Swansea are reflected across a range of statistical indicators.<sup>xi</sup> Equally, it is important not to portray the development of the industry as an unqualified triumph of the onward and upward march of industrial capitalism. The human costs were considerable, not least because copper smelting required long hours of hard labour in intense heat and an atmosphere poisoned by the constant output of noxious sulphurous fumes that were produced when arsenic and other impurities were burnt off during the roasting process. The works themselves were blighted by giant waste tips formed of these by-products, and the surrounding landscape became devoid of plant, tree, and animal life as the ever-present copper smoke took a heavy toll on the natural environment.<sup>xii</sup> The effect was to transform a once scenic valley into a vision of a living hell, which found expression in many artistic representations produced in the mid-nineteenth century. And, as one poet put it in 1897:

*It came to pass in days of yore,  
The Devil chanced upon Landore.  
Quoth he, by all this fume and stink,  
I can't be far from home, I think.*

## Decline

If the construction of global supply chains of ore represented a remarkable achievement for those involved in the copper industry, then so too it sowed the seeds of decline. Economic logic dictated the creation of shorter supply lines or indeed more tightly integrated operations in which smelting took place as close to copper mines as possible. Smelting in places such as Chile had occurred on a small scale since 1830 but a robust challenge to Swansea became a reality from the 1850s onwards as far more extensive and systematic smelting was undertaken in South America, North America and Australia as large coal seams were opened up. Ironically Swansea knowledge and labour played a key role in this process as workers migrated and took their skills with them, but technological improvements to furnaces also played their part.

If Swansea smelters were ultimately unable to prevent their loss of a tight grip on the copper industry, which fully manifested itself by 1880, they were not passive in their acceptance of decline. Most of them, by inclination and outlook, had always been portfolio industrial capitalists and as such had run multiple enterprises. During the 1850s, for example, Vivian & Co. operated an iron works, a cobalt and nickel works, and a phosphate plant close to its Hafod copper works, and when in 1874 it took over the White Rock works copper smelting was ended there and replaced by silver and lead refining.<sup>xiii</sup> Diversification and adaptation were the name of the survival game, and the effect of this was evident in the type and distribution of enterprise that was emerging just as the tag ‘Copperopolis’ was being applied to Swansea. It was calculated that in 1883 within a five-miles radius of the centre of Swansea there were 36 collieries, 8 iron works, six tin works, 3 steel works, 6 spelter or zinc works, 12 copper works, 5 fuel works, and 13 miscellaneous works. This represented a second wave of industrialisation, and the effects of this were evident in 1908 when the Daily Mail produced a supplement guide to Swansea and its economy. The map published on the front page demonstrated that the Lower Swansea Valley was now arguably the most intensively and diversely industrialised part of Great Britain.

Yet, the process of diversification could not mask the long-term decline of the copper industry in the face of ferocious international competition. Smelting ceased in 1924 and although mergers and takeovers enabled the manufacturing of semi-refined copper to continue at the unified Hafod-Morfa works until 1980, most works were either given over to other forms of metallurgical production or abandoned to become derelict. Together with the deeply polluted landscape and the general effects of the interwar depression, this created a very strong sense of stagnation and decay, which accelerated after 1945, to the point that the Lower Swansea Valley became the largest post-industrial landscape in Western Europe.

## Regeneration

Processes of regeneration were evident in Swansea from the late 1950s onwards and just as it was one of the first places in Britain to experience intensive industrialisation so too it was the first to attempt a strategic programme to reverse de-industrialisation and environmental degradation. The problems were complex and interlocking, but the simple underlying motivation was that something had to be done to offset the ravages of capitalism that now manifested themselves in mile after mile of dereliction, desolation, and despoliation created by more than two hundred of industrial activity conducted in an

environment that was largely unregulated at a time when notions of corporate responsibility were almost non-existent.

The response took the form of what became known as the Lower Swansea Valley Project which had its origins in 1960 in meetings convened by Robin Huw Jones, the director of courses in social administration at what is now Swansea University. This brought together members of the university and borough council under the chairmanship of Principal and historian J.H. Parry. The following year the group was formalised as a committee and the emerging project was supported by grants of almost £50,000, including £22,500 from the Nuffield Trust.

The scope of the task was at once recognised as being very considerable indeed. As the project's published findings of 1967 put it,

'The Lower Swansea Valley ... is notorious for its blighted appearance. This once economically active area has in large part become derelict and is now covered with ruins and mounds of industrial debris; there are acres of noxious land that bear no vegetation at all; over the rest the vegetation is so poor that it accentuates the bleakness of the scene. This blighted area lies at Swansea's front door for it adjoins the principal railway station and is only a few minutes by road from the High Street and the docks. The town suffers accordingly in reputation, morale, and in its economy.'<sup>xiv</sup>

The aim of the project was sharply defined: 'To establish the factors which inhibit the social and economic use of land in the Lower Swansea valley, and to suggest ways in which the area should in future be used.' To achieve this, studies were divided broadly into two types: those which examined the physical problems of the valley floor; and those which undertook socio-economic analysis of the resident and industrial populations. These studies generated 12 reports, which incorporated numerous detailed recommendations, and they ranged widely from the human ecology of the Valley through to analysis of the many tips and volume of material contained therein. In passing, some intriguing suggestions were made including a proposal to construct an aircraft landing strip and helicopter port.

It was acknowledged at the outset that this type of project was unprecedented and one can only be struck by the boldness of the ambition and method. It was the sort of venture that modern Vice Chancellors cry out for because it ticked so many of the boxes that now need to be ticked in an environment in which

academic research is now assessed for its impact and public engagement. It involved extensive collaboration: the College, Borough Council, Welsh Office, and also industry. It was multidisciplinary; with projects centred on six academic departments; It involved pure and applied research; and 'knowledge transfer'. It had the potential to have very considerable local impact and effect. And it had very considerable levels of community activity, most notably and visibly through the planting of many thousands of trees by local schools, clubs, and societies.<sup>xv</sup> As such it represented a prototype for large-scale socio-economic regeneration projects, and it attracted very considerable interest because it provided a model for actions in blighted post-industrial areas. Visitors from across Europe and the wider world came to inspect the area and discuss what was referred to as Swansea's 'experimental method'. The many and varied recommendation of the Project were not translated directly into action but instead framed discussion of the development processes implemented by successive local authorities after 1967 when the findings were published. Some recommendations were ignored; others eventually found incarnations but not in ways originally anticipated. The five 'parks' that would host different forms of economic activity were never delivered, although some of the ideas found expression in the creation of an Enterprise Zone and Retail Park. Crucially though there was extensive land clearance and soil remediation, which provided the necessary preconditions for the development of housing, leisure, and sporting activity, and the end product was a Valley that was not only green again but capable of sustaining new forms of economic enterprise. What of course is so striking is the contrast between a process of industrialisation sparked by individual entrepreneurs using private funds, and a programme of regeneration implemented by public sector organisations using public finance.

One notable casualty of regeneration was the rich metallurgical heritage of the area because a guiding principle of the LSV project was that the destruction of industrial remains was a necessary precursor to improvement and progress. At a time before the statutory protection of significant historic industrial buildings was in place it was deemed imperative to turn a back on Swansea's poisoned and polluted past so that it could be freed from a historic straitjacket and thus participate in a shining new modern world of the 1960s that was to be dominated by new build. Indeed, the Project made no direct connection at all between the area's industrial past and its future development. The response was the systematic and indiscriminate destruction of nearly all of the industrial remains in the Lower Swansea Valley.

There appears to have been no archaeological study or survey of buildings; and no attempt to make even the case for selective presentation. Consequently what has survived appears to have done so purely by

chance or accident, and the listing process did not get properly underway until sometime later. In many ways, this is not surprising. Industrial heritage was not yet widely seen as acting as an agent for positive change or regeneration, and it is noteworthy that the word ‘heritage’ does not appear in either the report of 1967 or subsequent conference proceedings of the 1970s;<sup>xvi</sup> which is a reminder of just how recently that word has come to feature in our lexicon.

The overall effect of this process was that by 2010 almost all of the remains of Swansea’s industrial past had been swept away, and that past was not looming at all large in the public consciousness as people and communities often struggled to adapt to their place in a post-industrial world. There was not one single information sign or interpretation board in the Lower Swansea Valley to indicate what had happened there and the distinctiveness of the area had been almost entirely eradicated by the onward march of generic forms of housing, retail, and service sector development. In 2011 historians and others at Swansea University sought to address this problem through the implementation of an ESRC funded copper project which, alongside academic research, placed very heavy emphasis upon raising public awareness of Swansea’s place in the world as leading centre of industry, innovation, and entrepreneurship. By any measure this proved to very successful indeed and demonstrated emphatically that a wide cross-section of society wished to reconnect with the area’s history and heritage.

A sudden and unexpected broadening of the project occurred in 2012 when the City and County of Swansea issued a marketing brief aimed at attracting commercial developers to the site of the former Hafod-Morfa copper works. The site, with an attractive river frontage, lies just to the south of the Liberty Stadium. It is 12 ½ acres in size, and contains 12 listed historic structures, including the iconic Vivian engine houses, one of which contains the ruined remains of a rare Musgrave engine that once powered the rolling mills. There was a very strong sense that these last tangible remains of the copper remains should not be lost or be subsumed within unsympathetic developments, and a case was put forward for a programme for heritage-led regeneration shaped by the area’s copper heritage. As a result of these representations, Swansea University emerged as the City’s preferred development partner for the site and the Cu @ Swansea project was born.

In its first phase the project made the site safe and accessible to the public, installed trails and interpretation, stabilised buildings, and created a framework for sustainable mixed use through feasibility studies, remediation work, and master-planning defined with close reference to the area’s historic

character. It must be stressed that this is not about creating a museum or heritage park because far too many of those have proved to be costly and unsustainable. There will certainly be a ‘Living History Laboratory’ drawing on a range of digital, virtual reality, and hand-held mobile technologies being developed within the University, which can be applied to the interpretation, better awareness, and clearer understanding of Swansea’s multiple contributions to Britain’s Industrial Revolution. Indeed the research and educational possibilities associated with this project are very considerable indeed.

But, important though it is, the project aspires to rather more than a better engagement with the past. Phase 2, which is currently underway, centres on working with private sector partners to undertake an programme of building restoration, which will ensure that businesses will secure sustainable future for the site and generate revenue. Here an initial focus is on copper and copper-related technologies to ensure that as much enterprise as possible moves with the historic grain rather than against it as so often has happened in the past. This is crucial both for ‘branding’ and distinctiveness. But the site also has considerable potential for the enhancement of traditional industrial/craft businesses; as well as the development new ‘green’ technologies centred on a land and marine environment that is slowly coming back to life. With the core of buildings brought into use and creating jobs, the rest of the site will become a much more attractive proposition, and in line with the master plan, the aim is to attract commercial investment for housing, leisure, and social amenities that can be located on the extensive ‘empty’ spaces.

This programme has enormous potential to add very considerable real value to the existing wider economic regeneration plans for the city by attracting visitors – cultural tourists – and facilitating the social, cultural, and educational regeneration of the local community through routine use of, and creative interaction with, the site in spaces given over to public use. Moreover it will also help to create a stronger sense of ‘place’, identity, and civic consciousness among those who live and work in the area.

Will this work? Certainly, as we move towards the full emergence of what is now being described as an ‘experience economy’ in Britain, it is clear that, even in an age of austerity, heritage (broadly defined) can act as a powerful catalyst for inward investment, the creation of jobs, and the development of old and new skills. Of course, the pump usually has to be primed through grant income, but the value and distinctiveness of historic buildings do have the capacity to enable creative engagement with the private sector. Industrial heritage poses its own challenges, but the signs are positive and we have already demonstrated the ability to attract firm commitment from the private sector, where businesses see the

value of aligning with striking historic narratives. This alignment is also now occurring beyond the narrow boundaries of our site. The nearby Liberty Stadium is drawing on copper heritage themes during its latest phase of development, and it is no coincidence that this season the playing colours of Premier League football club Swansea are white and copper.

This lecture has focused on the life-cycle of an industry and the way it has shaped the rise, decline, and regeneration of a city and its hinterland. In order to explain properly that historic experience and its legacy, emphasis has been placed upon the importance of interactions between the local and the global, but such interactions do not happen by accident. The capitalist dynamo was the crucial agent of that interaction, and it was the ambitions, knowledge, skills, resources, and risk-taking of individuals that forged the complex interconnected processes that underpinned the creation of Copperopolis. Those processes were taken to the absolute limit, and Swansea suffered the consequences when the dynamo slowed. The current re-invention of the city is now being driven by multiple dynamos, but I very much hope that an important one will prove to be that which draws its strength and inspiration directly from Swansea's rich industrial past.

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<sup>i</sup> . For general studies of Swansea see Glamor Williams (ed.), *Swansea: an illustrated history* (Swansea, 1990); W.G.V. Balchin, *Swansea and its region* (Swansea, 1971); Ralph A. Griffith (ed.), *The City of Swansea: challenges and change* (Gloucester, 1991).

<sup>ii</sup> . See Chris Evans 'A world of copper: introducing Swansea, globalization, and the Industrial Revolution', *Welsh History Review*, 27 (2014), 85-9; Chris Evans with Olivia Saunders, 'A world of copper: globalizing the Industrial Revolution, 1830-1870', *Journal of Global History*, 10 (2015), 3-26. For a general overview of the development of the Welsh copper industry see Ronald Rees, *King Copper: South Wales and the copper trade, 1584-1895* (Cardiff, 2000).

<sup>iii</sup> . For a detailed study of the economic and urban development see Louise Miskell, *'Intelligent town': an urban history of Swansea, 1780-1855* (Cardiff, 2006).

<sup>iv</sup> . For detailed studies of the rise and fall of Swansea's copper industry see E. Newell, "'Copperopolis': The rise and fall of the copper industry in the Swansea district, 1826-1921', *Business History*, Vol. 32, No. 3 (1990), 75-97; R.O. Roberts, 'The development and decline of copper and other non-ferrous metal industries in South Wales', *Transactions of the Honourable Society of Cymmrodorion*, (1955), 78-115.

<sup>v</sup> . On the relationship between the growth of the copper industry and exports to Asia via the East India Company see H.V. Bowen, 'Asiatic interactions: India, the East India Company, and the Welsh economy, c.1750-1830' in H.V. Bowen (ed.), *Wales and the British Overseas Empire: Interactions and Influences, 1650-1830* (Manchester 2011), pp. 202-28.

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- <sup>vi</sup> . Ryuto Shimada, *The intra-Asian trade in Japanese copper by the Dutch East India Company during the eighteenth century* (Leiden, 2006), chapter 5 (quotation on p. 79).
- <sup>vii</sup> . For a detailed biography of Williams see J.R. Harris, *The copper king: A biography of Thomas Williams of Llanidan* (Liverpool, 1964).
- <sup>viii</sup> . Chris Evans, 'El Cobre: Cuban ore and the globalization of Swansea copper, 1830-70' *Welsh History Review*, 27 (2014), 112-131.
- <sup>ix</sup> . Stephen R. Hughes, *Copperopolis: landscapes of the early industrial period in Swansea* (London, 2000).
- <sup>x</sup> . For a judicious and well-balanced study of the place of copper smelting in the wider economic development of Swansea, see Miskell, '*Intelligent town*', chapter 3.
- <sup>xi</sup> . Thus, to take just one example, the number of ships entering the harbour increased from 694 in 1768 to 2,590 in 1800, and the registered tonnage of these vessels rose from 30,361 to 154,264 during the same period.
- <sup>xii</sup> . On the several lengthy legal disputes that arose over the pernicious effects of copper smoke see Ronald Rees, 'The South Wales copper-smoke dispute, 1833-95', *Welsh History Review*, Vol. 10 (1981), 480-96
- <sup>xiii</sup> . Robert R. Toomey, *Vivian and Sons, 1809-1924: a study of the firm in the copper and related industries* (New York, 1985).
- <sup>xiv</sup> . Kenneth J. Hilton, *The Lower Swansea Valley Project* (London, 1967). , p. vi.
- <sup>xv</sup> . On this see Stephen J. Lavender, *New land for old : the environmental renaissance of the Lower Swansea Valley* (Bristol, 1981)
- <sup>xvi</sup> . For the proceedings of a major conference which reviewed the project and its outcomes see Rosemary D.F. Bromley and Graham Humphrys (eds), *Dealing with dereliction: the redevelopment of the Lower Swansea Valley* (Swansea, 1979).