



ARTICLE

Migrant Innovation: The Movement of Glass-Making Knowledge in Early Modern Britain

Oliver Gunning 

Northumbria University, UK
Email: oliver.gunning@northumbria.ac.uk

Abstract

This research article examines the role of immigrant labour and micro-innovations in transferring glass-making knowledge in early modern Britain. It argues that immigrants played a crucial role in adapting European products to local conditions by providing new recipes and access to trade routes. Furthermore, it emphasises the significance of mobility and secrecy in knowledge transfer. Immigrants created innovations through mobility by tailoring their roles to encourage movement and maintaining the confidentiality of their skills. The article also examines the demands of local settings and conditions for integrating new technology.

Keywords: knowledge transfer; micro-innovations; immigrant labour; glass industry; England; recipes; trade routes; adaptation; inventions; mobility; secret knowledge; local knowledge

Introduction

In 1739, John Cookson established a bottleworks in South Shields near the mouth of the River Tyne in north-east England. Expanding his glass trade into bottles required him to recruit labourers with specialised competencies that were not available locally. He brought in one, William Tyzacke, to lead the furnace and produce the bottles. However, Cookson disagreed with Tyzacke, unhappy with how he went “about the furnace,” and subsequently replaced him with his brother John Tyzacke. Cookson required William to transfer a new skill into his workshop but required him to do it in ways that met his standards. Cookson was a heavy-handed manager who disapproved of workers producing their creations outside of orders and contracts. William Tyzacke in turn disapproved of this and left, while his brother, John, was prepared to stay and adapt to the demands that Cookson created.¹ In this example, the demands of local settings and conditions affected the integration of new technology. Cookson created conditions that one migrant worker refused and the other accepted. Migrants made choices to fit into local settings, and what decisions they made and what form they took shaped how technology moved into a local setting.

The mobility inherent in migration made transferring new skills to new areas easier.² By interacting with traditional recipes and technologies, as well as responding to specific local

¹ Tyne and Wear Archives (hereafter TWAM), DX894/1, *Cookson's Letterbook* (1739–41).

² Patrick Manning, *Migration in World History*, ed. Peter N. Stearns (Abingdon, UK: Routledge, 2005), 7; Jan Lucassen and Leo Lucassen, “The Mobility Transition Revisited, 1500–1900: What the Case of Europe Can Offer to Global History,” *Journal of Global History* 4:3 (2009), 351.

needs, migrants gradually introduced micro-innovations into local glass-making practices. In turn, local workers who came into contact with these migrants began to consider adapting their own skill sets to engage with this new body of knowledge. This process fostered the circulation of expertise between foreign and local labourers, despite the migrants' efforts to preserve and maintain the exclusivity of their know-how. Temporary and permanent mobility of workforces allowed for innovation to flourish as mobile workers consistently adapted their knowledge as they moved from contract to contract. Consequently, when more considerable innovations appeared, a groundwork of mobile knowledge workers was already available to manipulate and adapt technologies.

This article argues against economic theories prioritising centralised institutions, resources, or academic progress as critical factors in Britain's economic development.³ Instead, it focuses on Mokyr's recent arguments that position Britain as the holy land of industrialism.⁴ According to Mokyr, the growth of flexible "Upper Tail Capital Workers" in Britain enabled them to supply the British market with the necessary skills to innovate in coal and steam-based industries faster than in other countries. However, Berg and Hudson disagree and argue that the British Empire and slavery created a demand for British manufacturing, leading workers to gather around Atlantic ports.⁵ The agglomeration of industries around these ports reduced the distance knowledge had to travel, as a melting pot of manufacturers, scientists, and inventors and the capital needed to fund them clustered around the Atlantic ports, facilitating knowledge transfer.⁶

This paper departs from these historiographies in order to focus on the interaction between migrants and hubs of manufacture, to show that they worked hand to hand at a micro level. This took place even if migrants didn't actively want to transfer their knowledge. Their presence and integration into a society and work environment brought the interactions that enabled technological dialogue between locals and migrants. It examines how the different manufacturers and labour forces interacted in central hubs of manufacturing. For example, how a worker from a glass-works in South Shields brought themselves and new knowledge to a new area and adapted it to a new workshop environment in Glasgow reveals the inner machinations of knowledge circulation.

A Focus on the Glass

The link between mobile people and technological change has an extensive historiography, which outlines the increased appreciation of the influence of the mobile skilled workers themselves. Traditionally the focus of research into technological change had been the state. This was challenged by J. R. Harris's *Industrial Espionage and Technology Transfer*, which sought to recenter the focus of technological and industrial history by highlighting importance of individual action.⁷ Following him, works in the field increasingly sought to highlight the agency and skill of the individual, thereby increasingly focusing on inherent or embodied skill. Through this approach, works by scholars such as Lissa Roberts, Simon Schaffer, Peter Dear, and Pamela Smith demonstrate that skilled artisans created innovative

³ Morgan Kelly, Joel Mokyr, and Cormac O'Grada, "Roots of the Industrial Revolution" (UCD Centre for Economic Research Working Paper Series, University College Dublin, School of Economics, 2015).

⁴ Joel Mokyr, "'The Holy Land of Industrialism': Rethinking the Industrial Revolution," *Journal of the British Academy* 9 (2021).

⁵ Maxine Berg and Pat Hudson, "Slavery, Atlantic Trade and Skills: A Response to Mokyr's 'Holy Land of Industrialism,'" *Journal of the British Academy* 9 (2021), 261–5.

⁶ Ibid.

⁷ J. R. Harris, *Industrial Espionage and Technology Transfer: Britain and France in the Eighteenth Century* (Aldershot, UK: Ashgate, 1998).

technologies.⁸ Liliane-Hilaire Perez has revealed that crafts were inherently collaborative, and artisans achieved innovations through constant communication during everyday work processes.⁹ While artisans created new recipes and innovations, elite actors patented major innovations, usurping and masking the collaborative work processes. Collaboration between workers and crafts inherently meant that skills travelled across geographical and metaphorical distances.¹⁰ This article expands on these arguments by highlighting how new knowledge in glass-making spread across the British Isles from city to city through skilled migrant workers who moved out of local microcosms of work processes. By expanding beyond different contexts of collaboration that overcame environmental and market factors, mobile artisans grew their knowledge and increased the flexibility of their skills.

Innovation and technological exchange are not necessarily inherent in movement. However, it was the interaction between mobile experts and local workers that created the productive “friction” that allowed the exchange of technological knowledge and skill to take place.¹¹ This is why it is so important to look at micro-histories in order to ascertain what these interactions are and what makes them productive or not. It is therefore in the micro-innovations that took place on the shop floor that we find this type of process.

During the early modern period, migrant artisans travelled across Europe, exchanging knowledge and skills that led to the development of new technologies, consumerism, and production.¹² These workers moved from place to place, bringing incremental changes to different crafts and industries.¹³ The movement of knowledge through artisans across European geographic boundaries is well documented, but the links between continental Europe and the British Isles are less examined. The high costs of crossing the barrier of the North Sea suggest that the British Isles remained isolated from European artisanal knowledge networks. At least in glass-making, this was different, as immigrant artisans moved to the British Isles throughout the period. The culture of mobility in glass-making allowed for the provision and application of innovative ideas to new contexts, and this continued as European glass migrants moved into the British Isles.¹⁴

To illustrate the argument, examples derive from case studies. Hartley was a small village in Northumberland where a local aristocratic landowner, Francis Delaval, built a glasswork in the 1760s. South Shields was one of the main ports on the Tyne River, and in the 1730s, merchant John Cookson built a glasswork there. Closegate Glasshouse was another house owned by John Cookson, located just outside Newcastle’s city walls, where the Close met the wall. At least three glasshouses were set up in Leith, the central port town for Edinburgh,

⁸ Lissa Roberts, Simon Schaffer, and Peter Dear, *The Mindful Hand: Inquiry and Invention from the Late Renaissance to Early Industrialisation* (Amsterdam: Koninklijke Nederlandse Akademie van Wetenschappen, 2007); Pamela H. Smith, *The Body of the Artisan: Art and Experience in the Scientific Revolution* (Chicago: Chicago University Press, 2004).

⁹ Liliane Hilaire-Perez, Christine MacLeod, and Alessandro Nuvolari, “Innovation without Patents: An Introduction,” *Revue économique* 64:1 (2013), 5–7.

¹⁰ Bert De Munck, “Shared Skills and Technologies of Community Formation: Artisanal Epistemologies, Secrecy and Governmentality in Long-Term Context,” in *The Republic of Skill: Artisan Mobility, Innovation, and the Circulation of Knowledge in Premodern Europe*, ed. David Garrioch (Leiden: Brill, 2022), 36–7.

¹¹ Anna Tsing, *Friction: A Global Ethnography of Global Connections* (Princeton, N.J.: Princeton University Press, 2005), 58.

¹² Margrit Schulte Beerbuhl, “Seducing Europe: Swiss Sugar-Bakers on the Move,” in *The Republic of Skill: Artisan Mobility, Innovation, and the Circulation of Knowledge in Premodern Europe*, ed. David Garrioch (Leiden: Brill, 2022), 103–5; De Munck, “Shared Skills and Technologies,” 35–7.

¹³ David Garrioch, “Introduction: Artisan Mobility and Innovation in Pre-Industrial Europe,” in *The Republic of Skill: Artisan Mobility, Innovation, and the Circulation of Knowledge in Premodern Europe*, ed. David Garrioch (Leiden: Brill, 2022), 9–17.

¹⁴ Corine Maitte, “Artisan Mobility and the Circulation of Knowledge in the Glass Industry in Early Modern Europe,” in *The Republic of Skill: Artisan Mobility, Innovation, and the Circulation of Knowledge in Premodern Europe*, ed. David Garrioch (Leiden: Brill, 2022), 66.

on the Firth of Forth during the second half of the seventeenth century, with a glasswork set up by Sir James Standsfield in 1678 being the focus of this article. Andrew Hutchinson ran a glasswork in the early 1700s in Morrisons Haven on the south bank of the Firth of Forth. Alloa was a small town near Perth that had glasswork in the nineteenth century. Local settings and the passage of workers through them create a larger picture of interconnectedness across the British Isles. As migrants move over distances from glass workshop to glass workshop, the recurrence of connections or disconnections in their social, economic, and political interactions helps conclude their plurality, identity, and how they melded to fit local situations.¹⁵

Split into three sections, this article delves into the specific aspects that show *how* immigrants' innovations emerged and evolved between the years c. 1560 to c. 1780. The first section explains the variety of glass-making innovations during this period. The second section delves into the reasons that motivated migrants to hide their skills and knowledge. It also discusses how this concealment impacted the diffusion and dissemination of ideas and inventions. Finally, the third section highlights how the migrants adapted to local work practices and how their innovations incorporated mobility into business structures. These three sections demonstrate that the innovations that emerged from migrant communities directly resulted from their mobility. Furthermore, it shows how their mobility allowed knowledge to move to new areas, leading to the emergence of new industries and transformative economic growth.

Types of Innovation

Migrant glass-workers introduced product, skill, and management innovations to the British Isles, and these innovations often had interconnections. For example, furnace technology innovations changed the glass product's strength, creating a knock-on effect that changed management structures. The innovation provided by the migrant glassworker depended on the local context and mobility.

At the start of the period, c. 1560, glass-makers travelled to the British Isles as a part of the British mercantilist policy to help stimulate domestic manufacturing. At the turn of the sixteenth century, England adopted a balance of trade policy due to the influx of American gold into the European market.¹⁶ This policy aimed to resist the importation of goods from abroad and stimulate domestic manufacturing to increase the surplus of exports over imports.¹⁷ As part of this policy, economic planners targeted the reduction of glass imports. For example, the English elite consumed substantial amounts of Venetian glass, with over 100,000 Venetian glasses imported to the British Isles in 1626 to satisfy their demand.¹⁸ Manufacturing the same glass domestically aimed to boost British revenue by replacing imports and aligning with the economic philosophy of the sixteenth and seventeenth centuries.

In this context, glass-workers from areas of Europe, such as Lorraine, Normandy, and Venice, came to the British Isles. Thomas and Balthazaar de Hennezel and four other glaziers arrived in the British Isles from the Vosges Forest in Lorraine in April 1568. They built two ovens to produce Lorrainian window glass, making sixty daily bundles. Their product was large windowpanes, which England had previously imported from Lorraine. They collaborated with an immigrant merchant, John Carre/Chevalier, who had procured

¹⁵ Romain Bertrand and Guillaume Calafat, "La microhistoire globale: affaire(s) à suivre," *Annales. Histoire, Sciences Sociales* 73:1 (2018); Maxine Berg, "Introduction: Global Microhistories of the Global and the Local," *Journal of Early Modern History* 27:1–2 (2023), 3–5.

¹⁶ Roger E. Backhouse, *The Penguin History of Economics* (London: Penguin, 2002).

¹⁷ Ibid.

¹⁸ Maxine Berg, *Luxury and Pleasure in Eighteenth-Century Britain* (Oxford: Oxford University Press, 2007), 119.

the monopoly to produce window glass.¹⁹ Likewise, Verzelini, a Venetian, travelled to England to make Venetian crystal glasses for the English domestic market in 1575, attempting to supplant the imports from Venice.²⁰ Immigrants arrived to produce products not made in the British Isles before. They were familiar products to the European market, but manufacturing them in the British Isles was an innovation.

Primarily, glass-makers in England tried to imitate European glass. They attempted to follow recipes created in Europe and transplant them into British contexts. Very quickly, it became clear that the resources and contexts of the British Isles could not replicate recipes from the continent. Problems appeared when workers directly transplanting their recipes from abroad to British conditions failed to make glass equal or superior to the imported glass. Problems were chemical, as the chemical compounds of the main ingredients – silica, flux, stabiliser – differed across separate locations.²¹ Glass-workers had to alter recipes with unconventional products, changing the chemical compounds of the glass they made. Therefore, while initially inspired by imitation, innovation quickly changed form to overcome problems of local resources, with immigrant glass-workers using their experiences from abroad to adapt the recipes to fit local conditions.

One solution was to import primary resources from their homeland, allowing them to overcome the issues of local resources. For example, in 1622 Venetians working in London tried to import resources from Venice.²² Glass-workers had identified that using British-mined silica sources, i.e., sand, was contaminating the glass and producing inferior products. The key ingredient to solve the problem was the Ticino pebble, which formed the silica to make crystal glass when ground into a fine powder. The Ticino River, near Venice, was the only known location of this pebble in Europe, and workers in the British Isles had yet to find an alternative.²³ The immigrants provided access, official or subversive, to critical resources for manufacturing. Instead of adapting the recipe to create desirable glass, this innovation aimed to adapt the logistical supply routes to achieve the desired product. The innovation of supply routes made the British manufactories heavily dependent upon Venice, representing a significant brain and resource drain. Venice tried to limit this outflow.

However, the poaching of workers quickly occurred. James Howell was an agent from England sent to recruit workers in 1618 from Venice and bring them and the required materials to England from France, Holland, and the Low Countries.²⁴ European and British merchants and actors prioritised securing trade routes for new resources alongside securing workers. Howell focused on recruiting workers and expanded the origin of glass resource imports beyond Venice. These trade routes encouraged imitation initially, but in the same mercantilist spirit that attempted to supplant luxury imports, manufacturers looked to reduce the British reliance on the import of resources. Immigrant glass-workers

¹⁹ “De Concessio pro J. Carr et aliis,” 8 September 1567, in Albert Hartshorne, *Old English Glasses* (London: E. Arnold, 1897), 393–6.

²⁰ “De licen speciali pro J. Verselyne,” 15 December 1575, in Hartshorne, *Old English Glasses*, 399–401.

²¹ Thijs Hagendijk, Marcia Vilarigues, and Sven Dupre, “Materials, Furnaces, and Texts: How to Write About Making Glass Colours in the Seventeenth Century,” *Ambix* 67:4 (2020), 330–1.

²² “Venice: April 1622, 21–30,” in *Calendar of State Papers Relating to English Affairs in the Archives of Venice, Volume 17, 1621–1623*, ed. Allen B. Hinds (London: His Majesty’s Stationery Office, 1911), 292–311, British History Online, <http://www.british-history.ac.uk/cal-state-papers/venice/vol17/pp292-311>.

²³ Francesca Trivellato, “Murano Glass, Continuity and Transformation (1400–1800),” in *At the Center of the Old World: Trade and Manufacturing in Venice and the Venetian Mainland, 1400–1800*, ed. Paola Lanaro (Toronto: Centre for Reformation and Renaissance Studies, 2006), 150.

²⁴ James Howell, *Epistolæ Ho-elianæ familiar letters domestic and forren divided into sundry sections, partly historicall, politicall, philosophicall, vpon emergent occasions*, (London: Printed by W. H. for Humphrey Mosely ..., 1650), 18–9.

became the focus of knowledge exchange as they possessed the tacit skills to develop innovative glass and the connections to provide the ingredients. So threatening to Venetian trade was this move that Venetian ambassadors spent considerable time and energy trying to coax the Venetians back, resorting to bribery, criminal damage, and property theft to restrict the diffusion of skills to the English population during the 1620s.²⁵

Venetian recipes suffered from the adverse effects of coal as a fuel, as the recipes from Venice utilised wood for furnaces. Consequently, the recipe struggled to work in England due to the banning of wood fuel in 1615.²⁶ In 1674, merchant George Ravenscroft submitted a patent for lead crystal glass.²⁷ The new glass was more transparent and robust than the previous and successfully used lead to counterbalance the adverse effects of using coal as fuel in furnaces.²⁸

Consequently, glass based on this new recipe and skills became more desired than Venetian-recipe-based glass in English markets. English imitation switched to invention thanks to the impact of immigrant and sojourner knowledge. The recipe worked when Ravenscroft's artisans created and overcame the fuel problem. However, the differences in the chemical compounds of coal, sand, and lead caused new issues when transported to a new area.

Ravenscroft directly recruited workers from Murano to overcome these issues. In June 1674, the glass that Ravenscroft made was still "soft, fragile and extremely dear."²⁹ To overcome these defects, Ravenscroft recruited a glass-maker, Vincenzo. Vincenzo's innovation differed from the imitative innovation of the 1620s and 1630s as he provided skills to manipulate and make a recipe unknown to him work in foreign conditions. Alberti, the Venetian ambassador, wrote that it was "necessary to prevent Venetian workmen from withdrawing to these countries as they bring their art with them," and "As the necessary materials are found here the English, in the course of time, will perfect themselves in it."³⁰ Alberti showed that the invention of the recipe was not the threat to Venice's monopoly. Instead, it was the innate skills of the Venetian workers that could make English lead crystal glass. Ravenscroft recipes fixed issues of resources and contaminants, but immigrant skills would help perfect them. Immigrants' roles in innovation and the innovation they provided changed at this point. They were not providing unknown knowledge to the British Isles but became knowledgeable workers who applied sojourner knowledge to help apply new recipes derived from English contexts.

The links between innovation and migration changed over the period. The change was subtle. Immigrants' roles initially related to mercantilist philosophies, and they became agents of imitation. Tasked with imitating products made in Europe to help the country reduce luxury imports, immigrants adapted their recipes to try to provide quick and straightforward replicas of European products. When this failed due to the chemical differences in resources across Europe, immigrant workers' innovation was logistical, giving entrepreneurs in the British Isles access to trade routes for specific resources. As English glass-making developed new inventions to overcome the chemical imbalances in recipes, immigration to the British Isles did not stop. Immigrants changed their roles and began to provide solutions to overcome the problems of new recipes. Adapting their knowledge

²⁵ "Venice: April 1622, 21–30,"

²⁶ "A Proclamation touching Glasses," *State Papers, Domestic James I: Proclamation Collection* No. 42, 23 May 1615.

²⁷ "Charles II: March 1674," in *Calendar of State Papers Domestic: Charles II, 1673–5* (London, 1904), 187–216, British History Online, <https://www.british-history.ac.uk/cal-state-papers/domestic/chas2/1673-5/pp187-216>.

²⁸ "Venice: June 1674," in *Calendar of State Papers Relating to English Affairs in the Archives of Venice, Volume 38, 1673–1675*, ed. Allen B Hinds (London: His Majesty's Stationery Office, 1947), 261–70, British History Online, <http://www.british-history.ac.uk/cal-state-papers/venice/vol38/pp261-270>.

²⁹ Ibid.

³⁰ Ibid.

and adding new techniques and styles, immigrant workers tried to ease knowledge transfer by controlling the spatial layout of furnaces, workshops, and labour structure. As spatial workshops became more static, immigrant workers brought outsider knowledge into local contexts and helped practically apply new recipes to specific contexts.

Secret Skills

How those new forms of innovation moved into local settings and interacted with local knowledge is the subject of this section. The process of knowledge circulation encouraged the creation of secrets. By importing immigrant workers to the British Isles, British governments intended to gain access to said secrets and transplant them into British manufacturing projects. However, the migrant workers structured their knowledge in a manner that attempted to prevent the diffusion of skills and techniques. The mobile artisans intentionally kept the solutions to problems of resources, procedures, or technology confidential. They accomplished this by integrating their newfound knowledge in a particular manner so that the skill left with them when they departed. This approach allowed them to become the focal point for innovation, ensuring their relevance to present and future contracts.

Gaining access to secrets was the aim of sixteenth-century and early seventeenth-century mercantilist policies. Contracts for immigrant workers aimed at capturing their foreign skills by legally enforcing their skills transfer to the local population. The royal patent for Thomas and Balthazaar de Hennezell in 1563 stated that they practiced “arte ... or Mysterie” of making glass in the “Lorayne and Borgondy” style for twenty-one years. The patent holders were to “teache Englishe men ... the same science or arte of glas making perfecte and effectually so as the same science or arte after the ende of xxi years may be perfectly and substantially used and practysed by englishe men.”³¹ Under another patent in 1569, the Bongards refused to instruct the Englishmen as they were “not bound by contract” to do so and were prepared to use violence to defend the secrecy of their skills, attacking English managers with hot glass blowpipes.³² Furthermore, Verzelini had his patent rescinded in 1593, as he refused to teach the Englishman his skills.³³ Immigrants resisted the usurping of their skills by English patent monopolies and had no intention to transfer their skills to the local population.

By refusing to transfer or teach skills, immigrant workers were continuing a culture of proprietary knowledge found in Europe. Corine Maitte explains that the culture of Franco-Italian glass-making was inherently mobile and encouraged knowledge circulation.³⁴ Glass-makers would leave their villages and head to new areas, searching for suitable glass-making resources. Once they found it, the glass-workers would petition the local rulers or governments to ask for privileges of manufacture. These privileges allowed workers to use the resources to produce and sell glass in the ruler’s district. However, glass-workers did not transfer their skills to the local population. Isolated enclaves of glass-workers appeared in woodlands throughout Europe, staffed exclusively by Franco-Italian workers. Once they had depleted the resources in that area, the workers moved on, taking their skills to another local context.

³¹ “De Concessio pro J. Carr et aliis.”

³² Surrey History Centre, LM/COR/3/108, Copy of a Letter from Richard Onslow and Sir William More to the Privy Council, 17 August 1569; Landsdowne MSS. 59, No. 76, “8. An Alien Glass Manufacturer’s Difficulties, 1568–71,” in Richard Henry Tawney, *Tudor Economic Documents* (London: Longmans, 1963), 305–7.

³³ “De licen speciali pro J. Verselyne.”

³⁴ Corine Maitte, “Migrations et intégrations urbaines des verriers italiens en France, xvie-xviii siècles,” *Cahiers d’Histoire* 132 (2016), <https://journals.openedition.org/chrh/5344?lang=enac>.

In Britain, the patent monopoly system changed this relationship between glass-workers and knowledge circulation, as the patents aimed to centralise manufacturing and prevent movement. Therefore, patents adapted to other methods to adapt to the immigrant's refusal to teach. They did so by binding them to exclusive manufacturing. Patent monopolies for glass manufacture granted exclusivity of manufacture to the patent holder, who was usually an English merchant or knight of the realm. Robert Mansell was a knight under James I, and the Royal Privy Council granted him exclusive manufacture and trade of all glass in England in 1615. Mansell's monopoly prevented the import of glass into the country and made it illegal to manufacture glass outside their workshops. Consequently, Mansell spent time legally shutting down extra-patent furnaces, some of which were staffed by immigrants or descendants of immigrant families.³⁵ A strategy used by Mansell in legal disputes was to force the closure of immigrant workshops and offer them work as sub-contractors under his patent.³⁶ Recognising the importance of retaining skilled immigrant workers in the British Isles, Mansell, as a patent holder, sought to centralise control of the skill under his patent umbrella rather than eliminate it.

Yet immigrants continued trying to keep their skills secret and brought similar tactics from Europe to the British Isles. For example, the easiest method of integrating a new skill into a standard work practice was to create a new workshop, replacing the old workshop, its processes, and sometimes its workers. Overhauling the management and spatial layout of the workshop and establishing a fresh slate allowed for a smoother transition to the new product. In Scotland in 1678, Moses and Joseph Hensell moved from Newcastle-upon-Tyne to create window glass in Leith. Before they made the journey, they told the owners, Sir James Standsfield, what changes they required to produce the needed glass. The Hensells wanted new furnaces built. They wanted coal from a new supplier, along with new workers and new tools made by a specific blacksmith.³⁷ Only with these changes did they agree to work for Standsfield. They believed, without even seeing the furnaces already built at Leith, that this would allow for the most efficient skill transfer and would allow the production of the new glass. In South Shields in 1741, Cookson changed tactics and contacted an immigrant worker in Bristol, Humphrey Perrot, who held a patent to create furnaces with an iron grill to encourage airflow. Cookson had tried and failed to imitate these furnaces, so to resolve the issue successfully, Perrot sent a worker to build him a new one, overhauling the spatial layout and furnace structure of Cookson's already established workshop.³⁸ Immigrants tried to change the new glass-works' spatial design and infrastructure to fit their skills.

Employers were able to circumnavigate this immigrant protective manoeuvring by restricting the spatial control they had on the workshop or manufacturing process. For example, at South Shields, Cookson recruited John Hawkes to make the new glass in his new bottleworks. Hawkes was confused when he discovered he was not in charge of building the furnaces, and a legal dispute ensued. Recruiting workers with the expectation of not creating a furnace was an unusual process. Hawkes had to innovate his skills to fit the technology present at South Shields instead of making the local situation fit his skills.³⁹ In the 1760s something similar was attempted in Hartley, Northumberland, where Oxley, a glass-worker from London, was recruited to try to integrate the manufacture of chemical

³⁵ Smedmore MS. B2/1, British Library.

³⁶ Michael Noble, *Eighteenth Century Glass and Its Antecedents* (Michael Noble, 2016), 32–3.

³⁷ National Records of Scotland (hereafter NRS), RH15/102/6/3, Awaiting References, *Newmilns Cloth Factory, Mines of Wanlockhead, Leith Glassworks, Leith Brewery* (1586–1780).

³⁸ TWAM, DX894/1, Letter to Humphrey Perrot from John Cookson, 17 April 1739.

³⁹ TWAM, FC541, Letter to Mr Jeffreys from John Cookson, 2 July 1739; TWAM, FC541, Letter to Brother [William] Cookson from John Cookson, 18 September 1739.

glassware into an already established bottle works.⁴⁰ Oxley, like Hawkes and the Henzell cousins, tried to build a new furnace, but this was restricted due to the inherent cost and the effect this would have on the already-established production.⁴¹ Oxley had to settle for a test hole in an existing furnace where he could manufacture the product. Other immigrant workers had struggled with a comparable situation in 1701. Isaac Culney left his employment in London as his employers did not give him his furnace room to create his work. He went to work in Leith on the promise that the new employer would provide a separate room.⁴²

In response, immigrants did not teach apprentices or allow others to observe their secrets. For example, Joseph and Moses Henzell aimed to centralise innovative knowledge upon themselves, making themselves the central consultation point for innovations. Shaping capital investment in furnaces, tools, and resources to their specific desires meant that the business at Leith would depend upon their knowledge.⁴³ In 1739, Cookson clashed with Paul Tyzacke by describing himself as a heavy-handed manager who could judge how workers “went about the furnace.”⁴⁴ Tyzacke disapproved of this heavy-handedness, which restricted his ability to hide his skills from the manager. Cookson restricted Tyzacke from making orders for glass, denying him the freedom to create unique glass and demanding that they exhibit their skill. Tyzacke refused, fearful of losing the monopoly of skill, and Cookson replaced him with his relation William.⁴⁵ Oxley also centralised the skill upon himself. In 1781, Oxley fell ill, and there was a manic rush in the Hartley glasshouse to try to learn the techniques from Oxley before he died. In this process, they found that he had not passed any of his knowledge onto his apprentice, and thus, when he died, the ability to make the chemical glass died with him. No remaining workers knew how to use his tools or operate his furnace.⁴⁶

Mobile Innovation

The secrecy of skills did not inhibit the development of technology. Immigrants continued to move throughout the British Isles, providing technical support to make recipes fit local conditions. However, immigrants did not exclusively staff glass-works, and their workforce was increasingly composed of local workers. Ownership of glass-works became more native, and masters of furnaces were decreasingly foreign in origin. Consequently, immigrant workers and their descendants shifted their roles in the business structure. Immigrant workers worked less at the furnace and instead used their mobility and traditions of migration to provide local glass-works with technical intelligence and trade information.

Technological advancements partly caused shifts in labour structures, particularly the development of steam engines.⁴⁷ This change meant furnace workers became less mobile as steam engines deskilled the work process. For instance, in Ravenhead, Manchester, a standardised work process that combined a Boulton and Watt steam engine with a glass-finishing process developed in the late 1780s. This innovative structure integrated

⁴⁰ Northumberland Archives (hereafter NA), 2DE/11/3/10-11, Letters from William Allen, Bottle Warehouse Keeper, Hartley Glassworks, March 1764.

⁴¹ NA, 2DE/11/3/19, Letter from William Allen to Sir John Hussey Delaval, 25 January 1782.

⁴² NRS, PA7/18/55, Petition of Isaac Culney, glassworker and his apprentice William Hynd, 18 August 1703.

⁴³ NRS, RH15/102/6/3, Awaiting References.

⁴⁴ TWAM, DX894/1, Letter to Unknown from John Cookson, 19 October 1738.

⁴⁵ Ibid.

⁴⁶ NA, 2DE/11/3/27, Letters from William Allen, Bottle Warehouse Keeper, Hartley Glassworks, 1781.

⁴⁷ Maxine Berg, *The Age of Manufactures, 1700-1820: Industry, Innovation, and Work in Britain* (London: Routledge, 1994), 260.

a steam engine to reduce the number of workers needed to turn and engrave glass objects. Consequently, glass-works in Leith purchased steam engines and adopted the newly structured work process.⁴⁸ Employers required management innovation to change workers' roles to integrate the steam engine into the process. Thus, the mobility of skilled glass-workers decreased as mobility became more practical in administrative roles.

Therefore, employers began to recruit for the role of a traveller in the second half of the eighteenth century. This role combined the administrative duties of a glass clerk with the technical knowledge of a glass-worker and used the mobility that both roles allowed. Each glasswork required a clerk to manage the shipment of glass from the factory to the market and run the administration associated with storage and warehouses. Therefore, employers demanded that these workers possess administrative skills, which Bethencourt and Antunes terms "merchant cultures."⁴⁹ For example, Cookson recruited a glass clerk with these characteristics. He wanted a glass clerk with sufficient knowledge to teach glass-making and have the administrative skills to apply it to the market.⁵⁰

Travellers could move around freely due to the flexible culture of glass-making and the furnace workshop. Even non-managerial workers were able to move between different factories. In fact, in 1687, workers at the South Leith Whyte Glasshouse moved to the North Glasshouse when the Whyte Glasshouse temporarily closed due to fluctuations in demand.⁵¹ In 1708, Hutchinson faced a problem when his furnaces were not operating due to a lack of fuel suppliers. He then established a connection with Glasgow Glassworks and agreed with their workers. He decided to transfer his idle workers to Glasgow for three months and pay their wages, which added up to seventy-two pounds.⁵² In another case in 1711, a team of glass-workers travelled to Morisons Haven from London. Having found an investor in Francis Russell, a draper in Edinburgh, Hutchinson gained extra orders from him that amounted to double the glass-works' output. To resolve this, Russell organised the movement of a team of workers from London.⁵³

The worker who took on the traveller role could be located at either the manufactory site or the market warehouse due to its proximity to merchants. In the Hartley case study, Mr Harrison was the warehouse keeper in London. He provided the manufacturer in Northumberland with new clients' orders and managed the distribution of glass. He provided detailed breakdowns of the client's bottle sizes and shapes and exhibited knowledge of workshop methods, describing which mould workers would use to create an order.⁵⁴ However, the dislocated nature of his role meant that he travelled and could observe and determine where new markets for glass were. In this context, he recruited Oxley to work at Hartley to produce chemical glass, using his mobility to function as a knowledge broker.⁵⁵ It was through his mobility that Hartley could source new skills to make glass for the market.

⁴⁸ J. R. Harris, "Saint Gobain and Ravenhead," in *Essays in Industry and Technology in the Eighteenth Century: England and France* (Aldershot, UK: Variorum, 1992), chapter 3.

⁴⁹ Francisco Bethencourt and Cátia Antunes, "Merchant Cultures: An Introduction," in *Merchant Cultures: A Global Approach to Spaces, Representations and Worlds of Trade, 1500–1800*, ed. Cátia Antunes and Francisco Bethencourt (Boston: Brill, 2022), 1.

⁵⁰ TWAM, FC541, Letter from John Cookson to Thomas Dodd, 18 November 1739.

⁵¹ National Library of Scotland, DEP175, Box 29, Bundle 43, Contract betwixt Sir James Standfield and William Hamilton and Philip Taylor and John Long Glassmakers, 1687.

⁵² Ibid.

⁵³ NRS, GD1/576/15, Papers relating to the glass works at Morison's Have and Andrew Hutchinson, 1709–16.

⁵⁴ NA, 2DE/11/3/19, Letter from Benjamin Harrison to William Allen, 25 January 1782; NA, 2DE/11/9/33, Letter to William Dobson from Sir John Hussey Delaval, 1764–1808.

⁵⁵ NA, 2DE/11/3/10, Letter to Sir John Hussey Delaval from William Allen, 24 December 1780; Simon Schaffer, *The Brokered World: Go-Betweens and Global Intelligence, 1770–1820* (Sagamore Beach, Mass.: Science History Publications, 2009).

The mobility of these workers, combined with their merchant and artisanal knowledge, was the characteristic that encouraged the movement of innovative technical knowledge. Assuming an itinerant role like that of a pedlar, glass travellers became intelligence workers.⁵⁶ Oxley took the clerk role in 1780 and spent six months travelling the east coast of England to procure new markets for the manufacturer.⁵⁷ Oxley was particularly suited to this task as he knew about glass-making and the trade. However, he made only minor changes to the business, providing new ports to sell glass to on the trip from Newcastle to London.⁵⁸

However, traveller clerks also provided technological changes. In 1682, an immigrant worker, John Baptista Mercier, assumed the role in Leith. Mercier was a Franco-Italian glass-maker who had previously worked at Vauxhall and had immigrated to the British Isles from Nijmegen.⁵⁹ First, he changed the trade routes for resources to Leith, providing new routes for ashes and bricks.⁶⁰ The change in bricks meant a change in furnace technology. Furthermore, he became a mobile broker, using his connections to transport the glass-making knowledge required to the area.⁶¹ He frequently travelled to other glass-works as an industrial spy, bringing back a new understanding of certain ingredients. In October 1682, Mercier travelled to the Hapton Leeds Works to buy a small amount of manganese for trial at the Leith glasshouse.⁶² He then travelled to London, where he bought a shipment of Barilla and other materials for the glass works and employed a new team of glass-workers.⁶³ Mercier used his mobility to introduce technological advancements in furnaces and recipes, enabling the production of new glass products. The role of the traveller was to absorb knowledge of trade or skills and provide information for the factory, acting as brokers between distant points of expertise.

On a meso-level, the role underwent fluctuations. John Dagnia was a manager at the Closegate Glasshouse in Newcastle, collaborating directly with John Cookson. In response to the failure of the South Shields Bottleworks to produce a high-quality bottle, Cookson transferred Dagnia to South Shields to bring in new knowledge.⁶⁴ Behavioural attitudes hindered Glassworks' product, as workers refused to collaborate with the previous manager, Hawkes.⁶⁵ Dagnia used management techniques from his migrations and work at Closegate to resolve the dispute. In another example, John Simes introduced management innovation to the Hartley case study in 1794 to address drunkenness and revolutionary fervour in the workshop.⁶⁶ Mobility between locations allowed new knowledge to move to new areas.

By creating travelling glass clerks, the knowledge of glass products, the methods used to create them, and the resources needed to make them became more fluid and less responsive to restrictive strategies to maintain secrecy. Consequently, non-immigrant workers also fulfilled the traveller role. In 1777, an Irish worker from Dublin applied for the clerk role at the Hartley Glasswork.⁶⁷ Similarly, in 1806, William Tenant and William Anderson applied

⁵⁶ Maitte, "Artisan Mobility."

⁵⁷ NA, 2DE/4/12, Letters from Joseph Oxley, March 1780–December 1780.

⁵⁸ Ibid.

⁵⁹ NRS, RH15/102/6/6/3/8, Newmilns Cloth Factory, Mines of Wanlockhead, Leith Glassworks, Leith Brewery, 1586–1780.

⁶⁰ Ibid.

⁶¹ Schaffer, *The Brokered World*.

⁶² NRS, RH15/102/6/6/3/8.

⁶³ Ibid.

⁶⁴ George B. Hodgson, *The History of South Shields* (South Shields, UK: South Shields Education Committee, 1924).

⁶⁵ TWAM, FC541, Letter to Mr Jeffreys from John Cookson, 27 July 1739.

⁶⁶ NA, 2DE/11/4/9-13, Letters to Sir John Hussey Delaval from William Sime, 1793.

⁶⁷ NA, NRO650/G/2/2, Letter to Lord Delaval from Thomas Reaves, Dublin, 1777.

for the same role at Hartley.⁶⁸ In 1825, four applicants applied for a job at the Alloa Glass Company in Scotland, all four being local workers.⁶⁹ In all the applications, each applicant recognised the need to be mobile and stressed their ability to make glass, manage books, and combine knowledge from different areas to benefit their new employer. The importance of mobility remained despite the erosion of immigrants from this role.

Conclusion

The idea of knowledge transfer becomes more clouded by analysing micro-historical case studies that identify how tiny micro-innovations interacted with local knowledge through immigrant labour. Immigrants provided innovative knowledge that changed from one form of production to another. However, the shift from one method to another depended upon the range of factors and forces explored in this article, which proceeded over extended periods. At the start of the period, immigrants provided new recipes and access to new trade routes to allow the adapted imitation of European products. Once new inventions appeared that adapted to English ecological contexts, the immigrants shifted roles to provide tweaks and micro-innovations to overcome the defects inherent in producing glass made from different organic materials.

English merchants and consumers valued immigrant skills highly. Consequently, immigrants maintained usefulness by being mobile and keeping their knowledge secret. Maintaining confidentiality of skills through reorganising the spatial layout of workshops, technologies such as tools and furnaces, and the trade of resources, immigrants made themselves essential to the work processes that required them. Immigrants became integral blocks to businesses that wanted to provide new glass products to markets. Consciously making themselves irreplaceable, they created work processes that could not function without their skills and abilities. By overhauling the workshop's spatial layout and refusing to teach skills to others, immigrants were able to keep their secrets safe.

These strategies enabled the circulation of "secret knowledge" to operate as a form of currency within the economy of skilled migration. Recent scholarship supports the idea that mobile experts often sought to restrict, rather than promote, the dissemination of technical expertise. The case studies in this paper demonstrate that, to some extent, such efforts yielded benefits for certain individuals; however, they also engendered tensions with employers. The deliberate obstruction of knowledge exchange by migrant experts undermines Mokyr's theory that innovation is primarily driven by the free and open circulation of useful knowledge. Nonetheless, while the deliberate protection of skills may have been effective in specific contexts, this analysis of migrant experts in the north-east of England reveals that knowledge did, in fact, circulate between migrant specialists and local workers. More precisely, exchanges within furnaces and workshops fostered innovations that adapted available materials to local needs. Micro-historical approaches are particularly valuable here, as they illuminate the specific components of technology that were adopted, modified, and disseminated. By narrowing the analytical scale, we gain insight into the often overlooked on-the-ground processes that drive these technological exchanges.

Within the workshop setting, sustained interactions among diverse actors—despite occasionally erupting into conflict—generated the productive tension necessary for innovation. Whether these innovations ultimately succeeded or failed, they emerged from the dynamic interplay of expertise, resistance, and adaptation. Despite the secrecy of

⁶⁸ *Ibid.*; NA, 2DE/11/10/31-34, Correspondence between William Anderson, William Tenant, and George Allen, 27–30 December 1806.

⁶⁹ NRS, GD1/709/2-5, Letters to Maurice Lothian, secretary to the Edinburgh, Glasgow and Alloa Glass Company, 12–16 September 1825.

skills, technology continued to develop with the help of immigrant support. Local workers also became involved in glass-works, resulting in a decrease in foreign ownership and an increase in native ownership. Immigrants' roles changed as innovation flowed, thanks to the mobility of workers, managers, and merchants. Unlike in isolated glass-works, their frequent and flexible movement across firms, locations, and regions facilitated valuable knowledge exchange. The diverse skills of these individuals encouraged movement as the complex glass mixtures required countless micro-innovations to adapt. This tradition of mobility, inherited from Europe and influenced by merchant mobility, allowed for the transfer of knowledge while also keeping specific skills confidential.

Acknowledgements. He received continued, ever-helpful support from his supervisors, Dr Felicia Gottmann and Dr Jennifer Aston, as well as from the editors of this special issue, Dr Floris van Swet and Dr Remi Dewiere.

Funding statement. Oliver's research was partly funded by the Economic History Society, Northumbria University's Research Development Fund, and formed part of Dr Felicia Gottmann's UKRI FLF Project "Migration, Adaptation, Innovation, 1500-1800".

Oliver Gunning, PhD, completed his doctoral research in History at Northumbria University (2021–2026), specialising in early modern migration and innovation in Britain. His research explored the drivers of historical displacement and the ways in which mobile populations introduced transformative social and economic practices into British manufacturing environments. This expertise in analysing complex historical themes of innovation informs his current work for Historic Environment Scotland, where he applies rigorous analytical methods to operational reporting, procurement, resourcing, and financial governance. His professional focus lies in bridging the gap between high-level academic research and the practical implementation of robust, data-driven compliance systems in both the private and public sectors.

Cite this article: Oliver Gunning, "Migrant Innovation: The Movement of Glass-Making Knowledge in Early Modern Britain," *Itinerario* (2026): 1–13, <https://doi.org/10.1017/S0165115326100655>