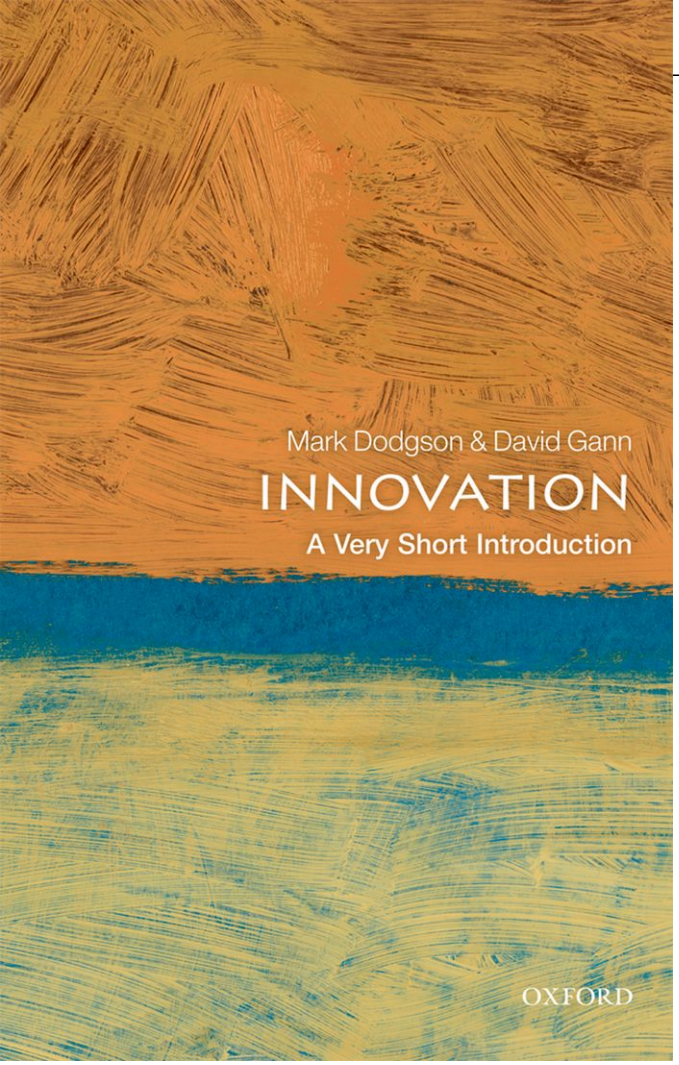
Mark Dodgson & David Gann
INNOVATION
A Very Short Introduction
OXFORD

Innovation: A Very Short Introduction

‘Despite the differences in surname, Mark Dodgson and I are brothers. I have known him and his faults all his life. How he wrote a book like this with David Gann I have no idea, but here it is, and a very good book too.

It tells a fascinating story, and one of growing importance. The ability to innovate is both expected and valued in the worlds of science and the arts: here we read about its importance in the field of business, and about how vastly our lives have changed – and continue to change – because of the innovation talents of individuals, and the innovation strategies of forward-thinking companies. There is a great deal here to fascinate not only those who are professionally engaged in business, but everyone who takes an intelligent interest in how the world is managed.’

Philip Pullman

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Mark Dodgson and David Gann

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For Yo and Anne

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Preface

When we were born, not so very long ago, there were no information technologies or television companies, and airline travel was rare and luxurious. Our parents were born into a world even more different than today's, where television had yet to be invented, and there was no penicillin or frozen food. When our grandparents were born, there were no internal combustion engines, aeroplanes, cinemas, or radios. Our great grandparents lived in a world with no light bulbs, cars, telephones, bicycles, refrigerators, or typewriters, and their lives probably had more in common with a Roman peasant than with ours. In the relatively short period of 150 years, our lives at home and work have been completely transformed by new products and services. The reason why the world has changed so much can be explained in large part by innovation.

This *Very Short Introduction* defines innovation as ideas, successfully applied, and explains why it has the ability to affect us so profoundly. It will describe how innovation occurs, what and who stimulates it, how it is pursued and organized, and what its outcomes are, both positive and negative. It will argue that innovation is essential to social and economic progress, and yet that it is hugely challenging and besotted with failure. It describes how innovation has many contributors and takes different forms, adding to its complexity. It provides an analysis of the innovation

process; the ways organizations marshal their resources to innovate, and the eventual outcomes of innovation, which can take a number of forms.

Innovations are found not only in the activities organizations do, but how they do them. The innovation process is presently going through a period of change, stimulated in large part by the opportunities of using new internet and visualization technologies to access ideas distributed from around the world. The potential sources of innovation are growing rapidly. There are, for example, more scientists and engineers alive today than in past history combined. Furthermore, the locus of innovation is changing as economies become dominated by service sectors and the ownership of, or access to, knowledge is ever more valuable compared to physical assets. Innovation is becoming more internationalized, with important new sources emerging in China, India, and elsewhere outside of the industrial powers of Europe, North America, and Japan. We explore the extent to which our understanding of innovation, developed over the past century or more, might be applied to deal with the restless transformations and turbulence we will witness in the global economy in the future.

The first three chapters explain what innovation is, its importance, and its outcomes. The subsequent chapters examine the contributors to innovation and how it is organized, and speculate on its future.

Our understanding of innovation is based on our research into countless innovative organizations around the world and our learning from the accumulated efforts of numerous scholars in the international innovation research community. Our grateful thanks are extended to all those innovators, and students of innovation, who make our journey so exciting and rewarding. We especially acknowledge Irving Wladawsky-Berger and Gerard Fairtlough, two great innovators who have had profound influences on our thinking.

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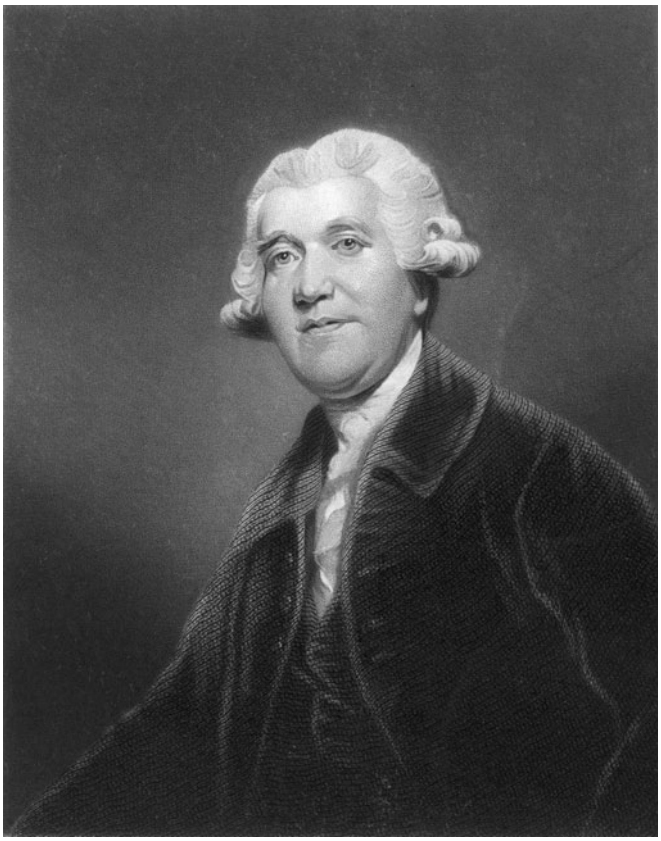
Chapter 1
Josiah Wedgwood: the world's greatest innovator

We begin with a study of an exemplary innovator, a person who tells us a great deal about the innovator's agenda. He established an enduring, high-profile company creating substantial innovations in the products made, the ways they were produced, and the manner in which they created value for himself and his customers. He made significant contributions to building national infrastructure, helped create a dynamic regional industry, pioneered new export markets, and positively influenced government policies. His outstanding scientific contribution was recognized by election as a Fellow of the Royal Society. He was a marketing genius, and bridged the scientific and artistic communities by a wholly new approach to industrial design. His most important contribution lay in the way he improved the quality of life and work in the society in which he lived. He is the potter Josiah Wedgwood (1730–95).

Born in modest circumstances into a family of Staffordshire potters, Wedgwood was the youngest of 13 children, and his father died when he was young. He was put to work as a potter when he was 11. He suffered badly from smallpox as a child and this had a big impact on his life. As William Gladstone put it, his disease 'sent his mind inwards, it drove him to meditate upon the laws and secrets of his art . . . and made for him . . . an oracle of his own inquiring, searching, meditative, fruitful mind'. For the first part



1. The world's greatest innovator

of his career, he worked in a number of partnerships, studying every branch of the manufacture and sale of pottery. By the time Wedgwood began his own business, aged 29, he had mastered every aspect of the pottery industry.

In his mid-30s, the lameness resulting from smallpox proved too much of a constraint, so he had his leg amputated, without, of

course, the aid of antiseptic or anaesthetic. As testament to his energy and drive, he was writing letters within a couple of days. A few weeks later, he suffered the tragic loss of one of his children, but he was back at work within a month of the operation.

By the mid-18th century, the European ceramics industry had been dominated by Chinese imports for around 200 years. Chinese porcelain, invented nearly a thousand years before, achieved a quality in material and glaze that could not be matched. It was much prized by the wealthy, but was too expensive for the expanding industrial classes whose incomes and aspirations were growing during this period of the Industrial Revolution. Trade restrictions on Chinese manufactures further increased the price of imports into Britain. The situation was ripe for innovation to provide attractive, affordable ceramics for a mass market.

Wedgwood was a product innovator, constantly searching for innovation in the materials he used, and in glazes, colours, and design forms of his wares. He applied extensive trial-and-error experiments to continually improve quality by removing impurities and making results more predictable. His favourite motto was 'Everything yields to experiment'. Some innovations resulted from incremental improvements to existing products. He refined a new cream-coloured earthenware being developed in the industry at the time, transforming it into a high-quality ceramic that was very versatile in that it could be thrown on a wheel, turned on a lathe, or cast. After producing a dinner service for Queen Charlotte, wife of George III, and receiving her approval, he named this innovation 'Queen's Ware'. Other innovations were more radical. In 1775, after around 5,000 recorded experiments that were often difficult and expensive, he produced Jasper, a fine ceramic, commonly blue in colour. This was one of the most significant innovations since the invention of porcelain. His major product innovations were still being produced by the Wedgwood company more than 200 years later.

He collaborated with numerous artists and architects in the design of his products, including George Hepplewhite, the furniture maker; Robert Adam, the architect; and George Stubbs, the artist. One of his great achievements was the application of design to the everyday. The renowned sculptor John Flaxman, for example, produced inkstands, candlesticks, seals, cups, and teapots. Products that were previously unattractive were made elegant.

Wedgwood searched everywhere for ideas for designs, from customers, friends, and rivals. He looked in museums and great houses, and trawled antique shops. One valuable source of designs was a coterie of amateur artists amongst well-bred women. Part of Wedgwood's successful approach to working with artists, according to Llewellyn Jewitt, his 19th-century biographer, lay in his effort 'to sharpen the fancy and skill of the artist by a collision with the talents of others'.

In a speech by William Gladstone, a generation after Wedgwood's death, he says of the potter:

> His most signal and characteristic merit lay . . . in the firmness and fullness of his perception of the true law of what we term industrial art, or in other words, the application of the higher art to industry: the law which teaches us to aim first at giving to every object the greatest possible degree of fitness and convenience for its purpose, and next making it the vehicle for the highest degree of beauty, which compatibility with the fitness and convenience it will bear: which does not substitute the secondary for the primary end, but recognises as part of the business the study to harmonize the two.

In his manufacturing process innovations, Wedgwood introduced steam power into his factory, and as a result the Staffordshire pottery industry was the earliest adopter of this new technology. Steam power brought many changes to production processes. Previously the potteries were distant

from the mills that provided power for mixing and grinding raw materials. Having power on-site significantly reduced transportation costs. It also mechanized the processes of throwing and turning pots, previously driven by foot or hand wheels. Technology enhanced efficiency in the way the use of lathes to trim, flute, and checker products improved production throughput.

He was preoccupied with quality, and spent vast amounts on pulling down and rebuilding kilns to improve their performance. Famously intolerant of poor product quality, legend has him prowling the factory smashing substandard pots and writing in chalk 'this won't do for Josiah Wedgwood' on offending workbenches.

One of the perennial challenges of making ceramics was measuring high temperatures in kilns in order to control the production process. Wedgwood invented a pyrometer, or thermometer, that recorded these temperatures, and for this achievement he was elected a Fellow of the Royal Society in 1783.

Many of Wedgwood's most popular products were produced in large numbers in plain shapes, which were then embellished by designers to reflect current trends. Other, more specialist products were produced in short, highly varied batches, quickly changing colour, fashion, style, and price as the market dictated. He subcontracted the manufacture of some products and their engraving to reduce his own inventory. When orders exceeded his production capacity, he outsourced from other potters. Wedgwood's innovative production system aimed to minimize proprietary risk and reduce fixed costs. He was highly aware of costs, having at one time complained that his sales were at an all-time high, yet profits were minimal. He studied cost structures and came to value economies of scale, trying to avoid producing one-off vases 'at least till we are got into a more methodicall way of making the same sorts over again'.

Wedgwood was an innovator in the way work was organized. His organizational innovations were introduced into an essentially peasant industry, with primitive work practices. When Wedgwood founded his main Staffordshire factory, Etruria, he applied the principles of the division of labour espoused by his contemporary, Adam Smith. Replacing previous craft production techniques, where one worker produced entire products, specialists concentrated on one specific element of the production process to enhance efficiency. Craftsmanship improved, allowing artists, for example, to improve the quality of designs, and innovation flourished. One of his proudest boasts was that he had 'made artists of mere men'.

Wedgwood paid slightly higher wages than the local average and invested extensively in training and skills development. In return, he demanded punctuality, introducing a bell to summon workers and a primitive clocking-in system, fixed hours, and constant attendance; high standards of care and cleanliness; avoidance of waste; and a ban on drinking. Wedgwood was conscious about health and safety, especially in relation to the ever-present dangers of lead poisoning. He insisted on proper cleaning methods, work attire, and washing facilities.

As a business innovator, Wedgwood created value by engaging with external parties in a number of ways. He innovated in sources of supply and distribution, astutely used personal and business partnerships to advantage, and introduced a remarkable number of marketing and retailing innovations.

Wedgwood sought the best-quality raw materials from wherever he could find them. In what today would be called 'global sourcing', he purchased clay from America in a deal struck with the Cherokee nation, from China, and the new colony in Australia.

He had a wide range of friends with very diverse interests upon whom he drew in his business dealings. Wedgwood belonged to

a group of similarly minded polymaths who became known as the Lunar Men, because of their meeting during the full moon. Along with Wedgwood, they comprised a core of Erasmus Darwin, Matthew Boulton, James Watt, and Joseph Priestley. The friendship and business partnership with Boulton was particularly influential on Wedgwood's thinking about work organization, as he observed the efficiency, productivity, and profitability of the Boulton and Watt factory making steam engines in Birmingham. Jenny Uglow's book on the Lunar Men argues that they were at the leading edge of almost every movement of their time, in science, in industry, and in the arts. She evocatively suggests that: 'In the time of the Lunar men, science and art were not separated, you could be an inventor and designer, an experimenter and a poet, a dreamer and an entrepreneur all at once.'

Although Wedgwood had somewhat contradictory views on the ownership of intellectual property, he encouraged collaborative research and was a proponent of what today would be called 'open innovation'. In 1775, he proposed a cooperative programme with fellow Staffordshire potters to solve a common technical problem. It was a plan for what was the world's first collaborative industrial research project. The scheme failed to get off the ground, but it illustrates a desire to use a form of organization that was not again explored for over a century.

Wedgwood was the first in his industry to mark his name on his wares, denoting ownership of the design, but he disliked patents, and only ever owned one. Speaking of himself, he explains his approach:

> When Mr. Wedgwood discovered the art of making Queen's ware . . . he did not ask for a patent for this important discovery. A patent would greatly have limited its public utility. Instead of one hundred manufacturies of Queen's ware there would have been one; and instead of an exportation to all quarters of the world, a few

> pretty things would have been made for the amusement of the people of fashion in England.

The period of the Industrial Revolution was one of great optimism as well as social upheaval. Consumption and lifestyle patterns changed as industrial wages were paid and new businesses created novel sources of wealth. The population of England doubled from around 5 million in 1700 to 10 million in 1800. Until the 18th century, English pottery had been functional; mainly crude vessels for storing and carrying. Pots were crudely made, ornamented in an elementary way, and glazed imperfectly. The size and sophistication of the market developed throughout the 18th century. Stylish table accessories were in huge demand in the burgeoning industrial cities and increasingly wealthy colonies. Drinking tea, and more fashionable coffee and hot chocolate, joined the traditional British pastime of imbibing beer as a national characteristic.

Wedgwood sought to meet and shape this burgeoning demand in a number of ways. Initially he sold his completed wares to merchants for resale, but he opened a warehouse in London, followed by a showroom that took direct orders. Browsing customers commented on the wares on display, and Wedgwood took particular note of criticisms of uneven quality, explaining his devotion to researching how to achieve better consistency. The showroom, run by Wedgwood's close friend, Thomas Bentley, became a place for the fashionable to be seen, and major new collections were visited by royalty and aristocracy. Bentley expertly interpreted new trends and tastes, informing design and production plans back in Staffordshire.

Wedgwood assiduously sought patronage from politicians and aristocrats: what he called his 'lines, channels, and connections'. He produced a 952-piece dinner service for Catherine the Great, Empress of Russia, shamelessly using her patronage in his advertising. His view was that if the great and the good bought his

products, the new middle classes, merchants and professionals, and even some of the wealthier lower classes, artisans and tradespeople, would aspire to emulate them.

An astonishing number of retailing innovations were introduced by Wedgwood and Bentley, including the display of wares set out in full dinner service, self-service, catalogues, pattern books, free carriage of goods, money-back guarantees, travelling salesmen, and regular sales, all aiming 'to amuse, and divert, and please, and astonish, nay, and even to ravish the Ladies'. Jane Austen wrote of the pleasure of the safe delivery of a Wedgwood order.

Wedgwood's international marketing efforts were pioneering. When he started his business, it was rare for Staffordshire pottery to reach London, let alone overseas. To sell in international markets, he again used the strategy of courting royalty by using his English aristocratic connections as ambassadors. By the mid-1780s, 80% of his total production was exported.

Products were not sold on the basis of low prices. Wedgwood's products could be two or three times as expensive as his competitors'. As he put it, 'it has always been my aim to improve the quality of the articles of my manufacture, rather than to lower their prices'. He was contemptuous of price cutting in the pottery industry, writing to Bentley in 1771:

> the General Trade seems to me to be going to ruin on the gallop . . . low prices must beget a low quality in their manufacture, which will beget contempt, which will beget neglect, and disuse, and there is an end of the trade.

Wedgwood's innovations extended into many other areas. He expended substantial efforts in building the infrastructure supporting the manufacture and distribution of his products and those in his industry. He devoted significant amounts of time