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The Need for a New Understanding of Manufacturing and Industrial Policy in Leading Economies

Ongoing debates about economic growth in the United States and the United Kingdom following the 2008 financial crisis have given a new primacy to manufacturing within the two countries' respective economies. President Obama's 2012 State of the Union address focused on manufacturing as the bedrock of future growth. The contrast to the financial sector was writ large when he said, "We will not go back to an economy weakened by outsourcing, bad debt, and phony financial profits" and called for "an economy built on American manufacturing."[1] In a similar vein, the UK coalition government has focused on the theme of rebalancing the economy, which is characterized as increasing the role of manufacturing. David Cameron's first economic speech after becoming prime minister set the trend, when he stated, "Our economy has become more and more unbalanced, with our fortunes hitched to a few industries in one corner of the country, while we let other sectors like manufacturing slide."[2]

It is as yet unclear whether these reactions to the crisis caused by the near collapse of the global financial system represent a well-formed approach to achieving long-term growth. The rules of the global economic game continue to change, and the current narratives on the economy, manufacturing, and growth are sadly out of date. Trapped within a framework that has become less and less representative of the economy, laden with ideological baggage, and lacking new thinking on how manufacturing has evolved in terms of production technologies, company organization, and impact on the economy, it should not be a surprise that our current responses to the call for rebalancing and growth might be off the mark.

This article investigates attempts by the UK and the U.S. to focus on and provide support for manufacturing in the wake of the financial crisis. We focus on these two countries due to the significant attention being paid there to this debate, and because their actions highlight the general weaknesses in how policymakers are considering the future evolution of manufacturing.

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FALLING OUT OF LOVE WITH MANUFACTURING AND INDUSTRIAL POLICY

In the 40 years since 1970, one trend has stood out for the developed economies of the G7: manufacturing as a share of national economies has fallen dramatically.[3] Across the G7, the greatest decline has been in the UK, where manufacturing has fallen by 20 percentage points as a share of gross domestic product (GDP), contracting in this sense to one-third of its original size. The United States has seen a similar contraction of manufacturing during this time, from 24 percent to 12 percent of GDP. Some observers believe that these statistics actually underplay the depth of the decline in manufacturing in the developed economies. According to this argument, the loss of manufacturing jobs is not due to rising productivity but is "a function of slow growth in output . . . caused by a steep increase in the manufactured goods trade deficit."[4]

These changes, loosely termed "deindustrialization," were seen by many to be almost a natural part of the evolution of leading economies from agriculture through industry and on to services. Daniel Bell's influential 1973 book, *The Coming of the Post-Industrial Society,* in many ways created a context in which this interpretation flourished. This book capped a long-running narrative of progress in which the leading economies move from the land to industry, then from industry on to services, all the while retaining the high-value elements of research, design, and service delivery.

A strong ideological position appeared in parallel to this characterization of the economy on the role of government in the economy. This was a reaction in particular to the strong state intervention that had taken place in many countries, loosely under the banner of industrial policy. A dominant ideology emerged that supported government creating an environment for innovation or establishing enabling conditions, but it did not support sectoral or targeted interventions. For many at the time, "industrial policy . . . turned out to be an idea with a brief career."[5]

By the turn of the 21st century, it appeared that an "end of policy" had been reached in Anglo-American policymaking, with almost no dissent on the role government was to play and with manufacturing thought to be a declining and almost irrelevant force. From this point on, government was to provide funding for research and then encourage the private sector to take products to market, with no particular concern for the sectoral composition of the economy. This position was, and in some cases still is, supported by the concept of a hyper-connected flat world dependent on knowledge rather than labor. Until the advent of the financial crisis, this conception of how countries and the global economy worked was not called into question. However, when the crisis hit and attention turned to manufacturing, a key problem emerged: there was no compelling description of how developed countries could achieve growth and prosperity based on manufacturing as a key element of their recovery.

THE RETURN OF MANUFACTURING

Given how deeply embedded the narrative on deindustrialization, the knowledge economy, and the postindustrial society were in the UK and U.S. policy and economic thinking, the fact that this narrative has been called into question is an indication of the depth of the financial crisis. Both the UK and the U.S. turned to manufacturing as a potential route to growth, which in many ways was a reaction against financial services. What is less clear is whether manufacturing can provide the desired growth and whether the actions of both governments are as strong as their rhetoric, as many of the policies are a repackaging of existing or planned programs.

Britain's coalition government's Plan for Growth, which focuses on advanced manufacturing without defining what is included in the term, has four major initiatives:[6]

- Provide funding for Catapult Centres (originally called Technology and Innovation Centres), with the first being in high-value manufacturing, which would focus on precompetitive development work
- Form nine Centres for Innovative Manufacturing to carry out research on strategic areas of importance for manufacturing
- Accelerate the relaunch of the Manufacturing Advisory Service to provide expert advice to manufacturing companies on productivity and innovation improvements
- Offer an international prize in engineering worth one million pounds (now termed the Queen Elizabeth Prize for Engineering)

Much of this effort is a continuation of policies that were already in place, with the exception of the Catapult Centres. The Catapult Centres, loosely modeled on the German Fraunhofer Institutes, were developed following the Hauser Review,[7] which was commissioned by the previous government.[8] The high-value manufacturing Catapult is the first of what will be 10 such centers, and it claims to include "all forms of manufacture using metals and composites, in addition to process manufacturing technologies and bio-processing," with the aim of drawing on "excellent university research to accelerate the commercialization of new and emerging manufacturing technologies."[9]

At the core of the government's approach is rebalancing the economy, although the specifics of what rebalancing means are as yet undefined. The share of the economy in manufacturing versus that of financial services, the location of activity in the south versus the north of the UK, and the levels of public and private debt are all mentioned, but no clear definition is given for a balanced economy, nor is it explained how each of the tradeoffs should be resolved.

The policy response in the U.S. has some similar patterns but it appears to take a more holistic view of manufacturers. There are three main elements in the administration's response:[10]

- Support advanced manufacturing through the Advanced Manufacturing Initiative, specifically the Advanced Manufacturing Partnership[11]

• Promote a campaign to have companies manufacture in America via the Manufacturing Extension Partnership

• Provide tools and incentives for companies to reshore (return to the U.S.) some of their manufacturing activities (the Reshoring Initiative)

A National Network for Manufacturing Innovation was recently announced, which is similar to the Catapult Centre under development in the UK. This network of centers is intended to "integrate capabilities and facilities required to reduce the cost and risk of commercializing new technologies and to address relevant manufacturing challenges on a production-level scale."[12] However, these centers have yet to be established; there is a call for input (open until the end of October 2012) on how the network should be structured, and a request for proposals for a pilot center focused on additive manufacturing was recently closed.[13] Finally, the Obama administration has proposed removing tax breaks for companies that move their production overseas and giving a tax break to companies that bring their production back to the U.S., although this has yet to be taken up by Congress.

Fundamental to the U.S. response is a focus on advanced manufacturing, as highlighted in the report by the President's Council of Advisors on Science and Technology (PCAST) entitled "Ensuring American Leadership in Advanced Manufacturing."[14] The report explicitly rejects industrial policy in favor of innovation policy and focuses on manufacturing that is based on new technologies. The emphasis on advanced manufacturing is also written into legislation; the America Competes Act calls for a strategic plan to guide federal investment in supporting advanced manufacturing research and development.[15] Earlier this year, the National Science and Technology Council's Interagency Working Group on Advanced Manufacturing released "A National Strategic Plan for Advanced Manufacturing" in response to the act,[16] which builds on the PCAST report, and a new interagency National Program Office has been founded at the National Institute of Standards and Technology to bring together the federal agencies that have manufacturing-related missions with fellows from academia and industry.[17]

Both UK and U.S. policies created after the financial crisis recognize the need for a new approach to growth and acknowledge that manufacturing has been neglected, although it has a role to play in both economies. However, these changes mask how much of the old narrative has survived the crash, such as government setting enabling conditions and the West being the dominant location for research and innovation.

BADLY BUILT FOUNDATIONS

The fall and rise of manufacturing's importance to policymakers in the U.S. and the UK is being played out against a significant weakness: the frameworks used to describe the economy, in particular the large-scale structure of the economy, are out of date.

Analysis of the economy at the national or global level is mediated by the frameworks available to describe the elements of the economy and how they are changing over time. This may appear obvious to many, but when the structure of companies and the nature of manufacturing is changing so rapidly, it causes a problem. Not only are the categories used to discuss the economy out of date, which creates tensions that do not actually exist, old divisions also are kept alive well beyond their "use by" date.

The roots of the current narrative on the economy and the intrinsic separation of manufacturing and services go back to 1937, when the Interdepartmental Committee on Industrial Classification was formed in Washington, D.C.[18] This committee was formed to provide a standard set of definitions so that data collected by different agencies could be compared and combined. In taking on the task, the committee immediately separated the economy into manufacturing industries and nonmanufacturing industries. This fracture has lived on in the U.S. classification codes and is also reflected in the approach taken in the UK, with clear water between the manufacturing elements of the economy and those based on services.

Even if the description of the economy as having distinct categories of those who make and those who serve was once accurate, it is fundamentally misleading when discussing modern companies and industrial organization. A rising trend of "servicization"—where manufacturers offer services based around the product and extend their offering—has made explicit how companies regarded as manufacturers have a significant portion of their activity and revenue based in providing services.[19] It appears that over half of U.S. manufacturing companies with 100 or more employees are servitized; in other words, the majority of U.S. manufacturers offer services of some kind. The level of servitization globally is approximately 30 percent, with significant variation and growth; for example, China moved from 1 percent to 19 percent servitization between 2007 and 2011. Moreover, companies carry out a broad array of activities, which include production but in many cases span research, design, service provision, and end-of-life management.

Unfortunately, the definition—and, more importantly, the study—of industries has in many ways passed out of fashion just as we need such studies to be carried out. "In both economics and management, the focus of analysis has moved in the last half century from industry to 'inside the firm' . . . Industrial economics gave way to business economics and organization economics, based on game theoretic frameworks, principal-agent theory, contracting and incentive theories."[20] This is also reflected in how governments have addressed issues of growth and support for industry. Because of this, much of our analysis, the responses generated, and the narrative developed around manufacturing in the economy may be off the mark. Our tools for analyzing the economy simply are not up to the job.

Trajectories of Scale and Scope

Besides having an overarching framework that is, at best, out of date to describe and interpret the economy, the policy responses in the U.S. and the UK appear to

have unwittingly adopted a key part of the old narrative—that our future in manufacturing lies only with sophisticated products and processes that are linked to new science and technology. This ignores contextual changes that are occurring in the global economy, and in many cases inadvertently implies both complex products and processes. However, where production is located and what it is producing are intimately linked to both the global economic context and the types of production processes available.

It is important to realize that, over time, various industries have evolved the scale of production at which they operate—which can be thought of as either the efficient plant size for a given industry or the typical batch size in production—and the degree to which their products are produced in a global value chain or close to the customer and their point of use, which in some sense is a distance measure. While not suggesting that there is a single pattern or trajectory, many industries begin with relatively low volume and limited geographic spread, and over time move into higher volume with a larger global footprint for their production and value chain.

The historic pattern is different for every industry, as each starts its lifecycle at different points in time and faces different constraints, such as whether there is a need for significant labor input or if there is access to specific raw materials and leading science and technology inputs. There has been a general trend over the past 50 years toward global value chains, and the scale of production has increased. For example, in the early 1970s, 91 percent of automobile production was concentrated in the U.S., Japan, and Europe. Today there is major investment in automotive production in emerging markets, and the share of production in the top three regions has fallen to 54 percent.[21] The publishing industry, which began with Guttenberg producing books one at a time, now has global distribution via online retailers such as Amazon. Moreover, the possibilities of digital printing on demand have started to bring the consumption and the production of each book together.

Many studies of globalization and internationalization provide a dominant view of the development path of industries and, potentially, countries. In this view, companies and industries develop and mature in the West, then send their production activities overseas, where they can lower input costs and open new markets. However, the interaction of production technology, global trends, and government action is complex, and it will determine at what volume and how far from the user companies will decide to produce for any given industry.

There is a potential inflection point where global value chains are no longer viable, due to rising costs such as oil, transportation, and labor, and the greater regulation of transport emissions. Current discussions on re-shoring, bringing activities back within the company's home country, and near-shoring, having activities in a country usually bordering the home country, are expressions of this, but they do not yet take into account a potential doubling of the price of oil in the next 10 years (admittedly, future oil prices are notoriously hard to predict) or more stringent regulation of emissions in transportation.[22] At the same time, new manufacturing technologies will possibly allow for smaller scale production and fewer pro-

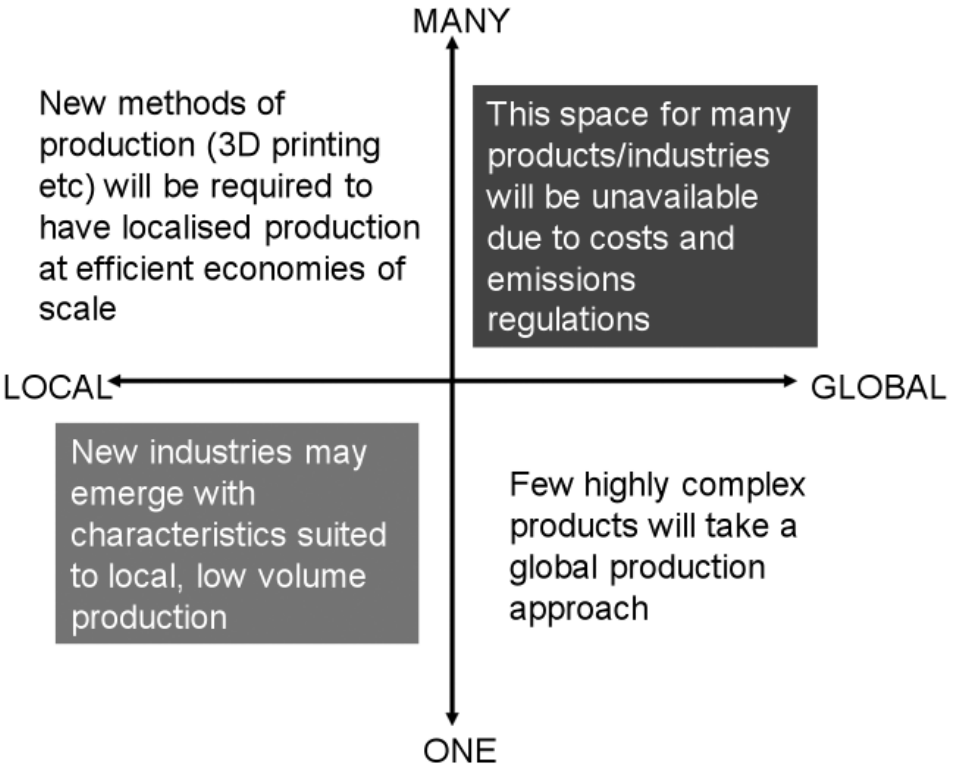

Figure 1. Long-term options for manufacturing organization

duction steps, such as 3D printing, the use of biomaterials, or advances in nanofabrication.

Bringing these together suggests that the long-term pressures will result in fewer truly global value chains and potentially significant amounts of low-volume manufacturing close to the consumer (see figure 1).

Current UK and U.S. approaches to supporting manufacturing do not appear to have this kind of vision for the long-term trajectory of industry, and in that sense they appear to be reverting to the narrative of the past 40 years, in which the leading economies target advanced manufacturing based on advances in science and technology that lead to new products. U.S. policies do appear to focus on process innovations for manufacturing, but there is no clear discussion of scale or of how the interaction of location and scale of production may lead to a new industrial organization.

An "Industrial Commons" Fit for Purpose

The current policies being promoted in both the UK and the U.S. are essentially a reaction to the financial crisis. Primarily responsive, they are to a great extent a repackaging of programs that were either in place or in planning before the crisis hit. Both governments appear to lack a long-term vision for manufacturing, and

thus risk supporting an out-of-date narrative on what companies need and what companies will do as the global context rapidly changes.

This is important for two key reasons: (1) the organization of industries based on more localized production is radically different from what we have today, implying significant changes in the patterns of global trade; and (2) a new understanding is needed for how the industrial commons—"the collective R&D, engineering, and manufacturing capabilities that sustain innovation"[23]—should be structured.

As multinational enterprises emerged and trade expanded during the last quarter of the 20th century, there was a significant rise in the trade of intermediate or unfinished goods.[24] This implied a fragmentation of production, with different stages of the production process for more products taking place in different countries. However, as industries adapt to conditions that favor smaller scale production with shorter supply chains and fewer production steps, it is likely that those activities will be contained within smaller geographic boundaries.

This is much more than simply re-shoring or near-shoring; it reflects a radically different global economy, potentially with significantly lower overall trade. Moreover, if many industries move to lower-scale, localized production structures, trade will be replaced by ownership. This is a very important point of discussion for open economies like that of the UK, as it raises the following question: if the productive assets within the country are foreign owned, how will UK companies access production? Furthermore, if foreign countries restrict the ownership of production assets, access to emerging markets may be highly constrained.

These changes would imply a need for a new "industrial commons" and a radically different approach to industrial policy in the West. How production might be organized at this scale is an open question. For example, companies might have many small, widely distributed production facilities, or many companies might share a large, flexible facility that they use on an as-needs basis. Again, these different modes of industrial organization imply different things for the industrial commons, and for the type of support needed from government. There is a danger that current policies are not well suited to such a context and will not provide the foundation for either the UK or the U.S. to move toward this new industrial structure at the national or international level.

CHALLENGES AND OPPORTUNITIES

In addition to challenging the models of growth in developed economies, these changes may offer significant opportunities to emerging economies. In terms of development, building an industrial commons based around more localized, smaller-scale production would allow countries to link directly to leading-edge production, with potentially lower levels of investment required for each production facility. Multilateral funders may also need to update their narrative on manufacturing in the ways the U.S. and the UK governments have yet to do, which may be a key task for future industrial development in emerging economies.

In all cases, a number of challenges and open questions remain, which are being discussed to a greater or lesser extent in the U.S. and the UK. One is whether this version of the industrial future will create significant job growth, even with a significant increase in manufacturing activity.[25] Given the likely level of automation, the use of digital technologies to prototype, and the potential reduction of waste (i.e., products are made on demand rather than to inventory), how such an industrial future will play out in terms of employment is unclear. This is a difficult political message; if manufacturing provides headline GDP growth but does not create jobs in the sector, it may be viewed as a failure. Whether this is offset by increased employment in related and dependent sectors will be key to manufacturing being viewed in a positive light and as a strong catalyst for long-term growth.

A second point is that, in a more localized manufacturing environment with significantly reduced need for trade, ownership of productive assets matters more. This may challenge openness to foreign direct investment (FDI) in countries that want to favor nationally based companies, and it may make protectionism against FDI easier to engage in. However, countries like the UK, which operate a very open economy and depend on the forces of globalization to work in their favor, may have a problem if little of the manufacturing base is owned by British companies. At the same time, the government, depending on how rules on the repatriation of profits and corporate taxes are structured, may have an issue with the level of income that goes from industry to the exchequer.

Finally, each industry will have a different trajectory over time, and adapting to those changes over time will be a constant challenge for national policymakers. The capacity for developing strategy within government relative to manufacturing has eroded significantly over the past 30 years, and investments in foresight, horizon scanning, and economic modeling are therefore needed to provide the kind of input that the changes in the manufacturing landscape imply.

Changing the narrative on the likely development of manufacturing across existing and new industries will not be a simple process. This article has focused on the UK and the U.S. and their responses to the financial crisis, based on their renewed focus on manufacturing. Their policies are examples of how many governments are using an out-of-date narrative when developing policies to support manufacturing and lack a vision for the long-term future of the sector. These weaknesses may hamper future growth that is based on manufacturing, and in some cases could lead countries to a point where they cannot access manufacturing, due to a lack of the appropriate commons. This article has described a simple framework for discussing how manufacturing industries may evolve, and it is our hope that this will serve as a jumping-off point for a larger discussion in both developed and developing economies, to the benefit of the global economy.

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9. For more detail, see https://catapult.innovateuk.org/en_GB/high-value-manufacturing.
10. Much of the detail on the U.S. position on support for manufacturing is collected at http://www.manufacturing.gov.
11. For full details of the partnership, see http://www.manufacturing.gov/amp/amp.html.
12. Federal Register 77 FR 26509, May 4, 2012.
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