MANUFACTURING POLICY INITIATIVE AT SPEA
INSIGHT INTO MANUFACTURING POLICY

Why is Germany so Strong in Manufacturing?

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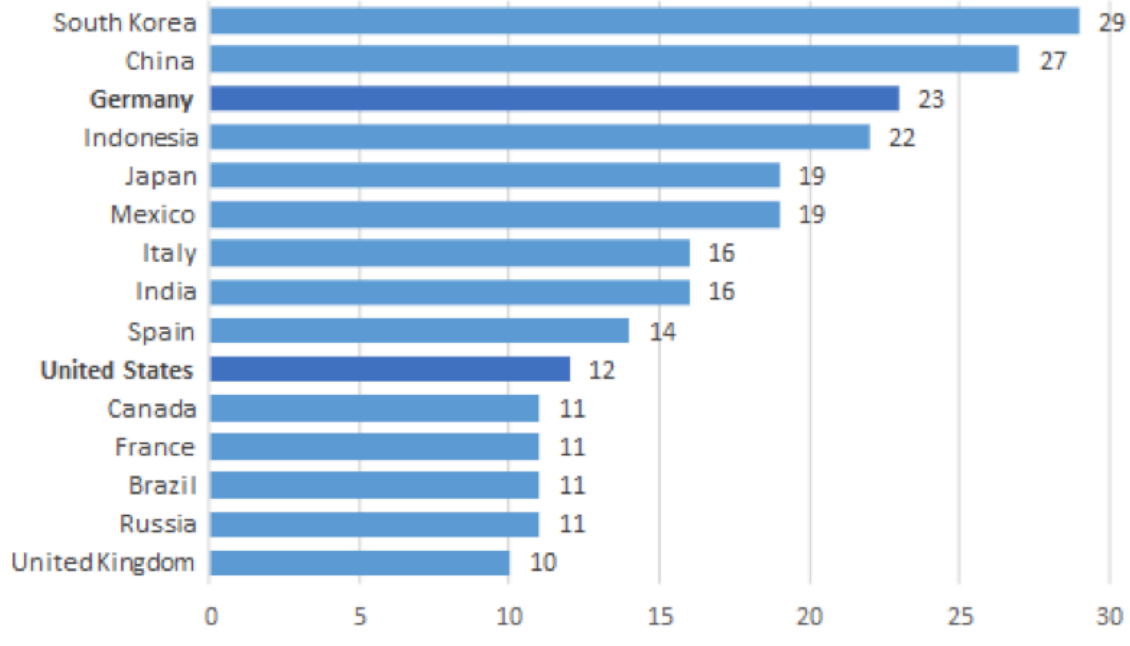
Germany has attained a strong and sustained performance in manufacturing in three important ways. The first is the considerably large role manufacturing plays in the overall economy. As Figure 1 shows, the share of gross domestic product (GDP) accounted for by manufacturing is higher in Germany than in any other European country. Of the major OECD economies, only South Korea and China devote more of their economies to manufacturing than does Germany.

The second key difference involves jobs. Manufacturing jobs account for a relatively high share of total employment in Germany.[i] The third important distinction is with exports. Exports account for 52 percent of GDP in Germany. By contrast, the export share of GDP in the United States is only 14 percent.[ii] This results in a net trade surplus of $425 billion in Germany, compared to a trade deficit of $668 billion in the United States.

Figure 1: Manufacturing Share of GDP (%), 2015



Source: Congressional Research Service, https://www.npr.org/2018/01/03/572901119/how-germany-wins-at-manufacturing-for-now?sc=17&f=1001&utm_source=iosnewsapp&utm_medium=Email&utm_campaign=app

There are four key sources of Germany's manufacturing success. The first has been to invest in workers to create what is arguably the most skill-intensive labor force in the world. This is a sharp distinction from the United States where the focus and priority is on completing a four-year college degree program. In 2014, 42 percent of Americans between the ages of 26 and 64 had a college education. By contrast, the comparable figure in Germany was only 28 percent, ranking it only eighteenth among OECD countries. As Table 1 shows, of those university graduates, only three percent were in a STEM field, compared to 33 percent in the United States. Instead, a greater share of young people are provided with vocational education and training in what is referred to as the "dual education system", which provides more diverse tracks for young people to prepare for a vocation, including highly skilled work in manufacturing. Thus, German workers are trained to develop valuable skills for manufacturing jobs from an early age. The *Realschule* prepares students to be skilled and highly productive workers, typically in a manufacturing company. The pragmatic and skills-oriented training and education of workers gets a real boost from Germany's unique apprentice system, where on the job training is combined with more formal classroom teaching. An apprentice typically splits her time between paid work with a company and an educational training institution, such as a vocational school (*Berufsschule*), with the goal of learning

Table 1: Germany vs. the United States on Key Economic Indicators

	Germany	United States
Economic Output		
Share of GDP in Manufacturing	22%	12%
Share of Manufacturing GDP in Medium & High-Tech Manufacturing	58%	42%
Trade		
Total Exports as a Share of GDP	52%	14%
Share of Merchandise Exports in Manufacturing	82%	62%
Trade Balance in Manufactured Goods	$425 billion	-$668 billion
Innovation		
Total Researchers per 1000 Workers	8.22	8.08
R&D Expenditures as a Share of GDP	2.98%	2.79%
Share of Corporate R&D in Manufacturing	86%	68%
Number of Top 50 Universities in Leiden Impact Rankings	0	39
Patents per 1000 Researchers	53.03	38.74
New Firm Entrants as a Share of Total Firms	7.90%	8.50%
Workforce		
Share of Employment in Manufacturing	20%	10%
Average Hourly Compensation in Manufacturing	$45.79	$35.67
Share of Graduates in STEM Fields (OECD Rank/36)	3	33
Youth Unemployment Rate	8%	14%

Source: Brookings Institution, 2016, https://www.brookings.edu/wp-content/uploads/2016/06/LessonsFromGermany.pdf.

highly targeted and specific occupational skills. Apprenticeships date back to the middle ages and have developed subsequently as part of the country's institutional, social and economic approach. The apprentices are paid for by the company employing them.

As Table 1 shows, the high skill levels are reflected in the higher level of average hourly compensation of workers in manufacturing of $45.79 in Germany, compared to the United States at $35.67. Not only are wages higher in German manufacturing but the hours worked are lower. The mean number of hours worked per worker in Germany in 2013 was 1,388. By contrast, in the United States, the mean number of hours worked per worker was 1,788. German manufacturing companies are able to maintain competitiveness in global markets even having to pay high wages for a relatively low number of hours worked by attaining high rates of productivity.

The second source of manufacturing success emanates from a rich network of policies and institutions, enabling German companies to access highly productive factors that are central to manufacturing, which in turn spurs the competitiveness of manufacturing companies. For example, key translational institutes, agencies and organizations facilitate the application of new technological developments. Technical colleges (*Fachhochschule*) are designed to provide state-of-the-art technology and inventions that feed into the particular product niches of specific manufacturing companies. The Fraunhofer Society, which consists of 69 institutes in specific technologies, is dedicated to translating basic scientific research into innovations that are commercialized by manufacturing companies. Although the Max Planck Society, which consists of 83 institutes, is more focused on basic research, it still provides a fertile source of new technology and innovations for German manufacturing.

Table 1 shows that the surface similarities in terms of research and development (R&D) and technology actually mask more striking differences between Germany and the United States. The two countries appear to be quite similar in terms of total researchers per employee, and R&D expenditures as a share of GDP. However, a much larger share of corporate R&D in Germany is devoted to manufacturing, 86 percent. By contrast, 68 percent of American corporate R&D is in manufacturing. Germany has no universities ranked among the top fifty in the world, while the United States accounts for 39, or 72 percent, of the leading universities. Rather, the focal point on applied and translational research resulting in incremental technological advances is reflected by a patent rate per researcher around fifty percent greater in Germany than in the United States.

The third source underlying Germany's success in manufacturing stems from main street entrepreneurship, or its famous *Mittelstand*. While the *Mittelstand* generally refer to small and medium-sized enterprises (SMEs) in Germany, in fact there are between six and fourteen characteristics distinguishing a *Mittelstand* company,

ranging from small size to governance (family ownership), human resource relations, linkages to the local community, finance, and long-term orientation, among other things. Firm size (i.e. being classified as an SME) is just one among multiple key salient characteristics. The *Mittelstand* provides the backbone of German manufacturing prowess. As Table 1 shows, the share of GDP accounted for by SMEs in medium and high technology manufacturing is considerably greater, 58 percent, in Germany, than the 42 percent in the United States. A subset of the *Mittelstand* is classified as Hidden Champions, which typically dominate a product niche in manufacturing with a leading market share. By contrast, the focal point of entrepreneurship in the United States has been in software and information technology but not manufacturing.

The fourth salient source driving manufacturing success in Germany is the strategic management of place, or *Standortpolitik*. Each state, region, and city has a mandate with the responsibility to achieve and sustain economic prosperity. It is up to the local community working closely with the state and federal levels, to not only leverage and build on its strengths, but also implement many of the key policies, such as the apprentice system, technical universities, translational knowledge institutions, and support of the *Mittelstand*, that drive the success of manufacturing in Germany.

These four policies and strategies are the cornerstones of the success of German manufacturing. It would probably be futile and misleading to try to estimate the relative weights or imports of each of these four cornerstones. Rather, it is their interactions that seems to be not only the source of manufacturing success but also presents the challenge that other countries find so elusive in trying to emulate Germany. Still, the German approach has been to view innovation and technology as complementary to manufacturing, not as a substitute, as in other developed countries where manufacturing's share of the economy has declined over time. Whether this strategy, which has served the country so well over the past decades, continues to reap huge benefits not just for manufacturing but also for the broader German society in a rapidly changing world, remains an open question.

For Further Reading:

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Peer reviewers: Donald Siegel, Professor of Public Policy and Management and Director, School of Public Affairs, Arizona State University; and Stephen Szabo, Senior Fellow, Institute for Contemporary German Studies, Johns Hopkins University

[i] Parilla, Joseph, Jesus Leal Trujillo and Allan Berube, 2015.
[ii] Parilla, Joseph, Jesus Leal Trujillo and Allan Berube, 2015.