

2010

Global Manufacturing Competitiveness Index



About this study

To learn how manufacturing CEOs and other senior leaders view their industry's competitiveness around the world, the Global Manufacturing Industry group of Deloitte Touche Tohmatsu (Deloitte) and The U.S. Council on Competitiveness (Council) have undertaken a multi-year Global Competitiveness in Manufacturing initiative. The initiative is based, in part, on the responses of more than 400 senior manufacturing executives worldwide to a wide-ranging survey discussing the current business environment and global competitiveness in the manufacturing sector. The study also draws on select interviews with key manufacturing players as well as unique insights provided by the professionals at Deloitte, the Council, and Clemson University. For more information concerning the specifics of this study and its participants, please consult the appendix.

Preface

We are pleased to present the 2010 Global Manufacturing Competitiveness Index, a collaboration between Deloitte Touche Tohmatsu (Deloitte) and the U. S. Council on Competitiveness (Council). The study gathered data from CEOs and senior manufacturing business unit leaders in late 2009 and early 2010 and represents the first major deliverable of a multi-year initiative by the Council exploring the issues of policy and capability development necessary for a nation to achieve superior manufacturing competitiveness.

This study provides unique insight into the new state of 21st century manufacturing. Today, manufacturing spans ideas, products, and services—well beyond the sole production of goods, as in the 20th century. This post-industrial manufacturing ecosystem represents a complex and highly integrated globalized value web. This web includes cutting-edge science and technology, innovation, talent, sustainable design, systems engineering, supply chain excellence and a wide range of smart services, as well as energy-efficient, sustainable and low-carbon manufacturing.

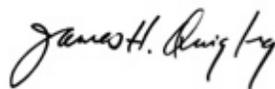
The findings of the study confirm that the global competitive landscape for manufacturing is undergoing a transformational shift that will reshape the drivers of economic growth, wealth creation, national prosperity, and national security. Manufacturing is and will continue to be an essential path for attracting investments, spurring innovation, and creating high-value jobs. Developed and emerging nations are in heated competition to create the most compelling opportunities to innovate, build a highly-skilled workforce, and improve standards of living.

We would like to thank the U.S. Department of Commerce for supporting this survey. We would also especially like to extend our sincere gratitude to all the CEOs around the world who took the time to share their valuable insights about the current and future states of global manufacturing competitiveness.

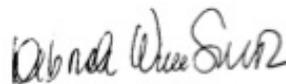
Yours sincerely,



Samuel R. Allen
Council Chairman
Chairman & CEO, Deere & Co.



James H. Quigley
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A view of global manufacturing

Staying competitive in a changing world

There is no doubt that the competitiveness of a country's manufacturing sector is critical to its long-term economic prosperity and growth. A globally competitive manufacturing sector creates a sustainable economic ecosystem, encourages domestic and foreign investment, and improves a country's balance of payments. It creates good jobs—not just within the sector but spilling over into such areas as financial services, infrastructure development and maintenance, customer support, logistics, information systems, healthcare, education and training, and real estate. And a strong manufacturing sector boosts a country's intellectual capital and innovativeness, underwriting research and development, pushing the technological envelope, and driving the growth in demand for highly skilled workers and scientists.

With manufacturing playing such a vital role in the economic health of a country, a country must, in turn, play a key role in building an environment in which manufacturing can thrive. Especially today, when the landscape of manufacturing dominance is shifting, synchronizing government policy with the investment decisions of manufacturing executives is critical for a country to remain competitive and create a positive cycle of prosperity. Yet the competition among nations to create and maintain a vibrant manufacturing sector is now fierce—and only just beginning with the latest expansion of markets into Asia, South America, and Africa.

The reality is that manufacturers have the ability to locate in any part of the world they believe will help them achieve a competitive advantage and best serve customers. Regardless of size and the extended timelines incumbent upon entering a new market, manufacturers like any other business, must make decisions and act upon them in the appropriate time frame in order to grow and prosper. And once business investments are made, with brick and mortar in place, they are difficult to unwind, even as circumstances change.

The implication then for policy-makers is clear: take action before the proverbial “train” has left the station—and take action early. Policy-makers must look to the mid-term future of manufacturing competitiveness—as little as a five-year window—to enable a thoughtful dialogue between policy-makers and business leaders. Those governments that fail to understand the barriers that prevent investment may find themselves missing the window of opportunity to create a sustainability-based business-investment climate. Their interests and those of the manufacturers must be balanced—and this requires a heightened combination of corporate responsibility and a government awareness of the macro-manufacturing environment for competing across nations.

A new approach to the competitive index

Policy-makers need as many tools as possible to help them understand the global competitive landscape and make informed decisions. Currently they can consult several comprehensive indices based on historic country-level data that provide vital information on overall country competitiveness. These include those from the World Economic Forum¹ and IMD Lausanne² as well as the United Nations Industrial Development Organization³.

In this report, Deloitte and the Council present an additional tool for policy-makers: a global manufacturing competitiveness index based on the views of more than 400 senior manufacturing executives worldwide. By drawing directly on the experience of manufacturers—those who develop business and manufacturing strategies and make the decisions regarding investments in research facilities, plants, equipment, technology, and labor—the index delivers a unique perspective on the global competitive landscape, identifying the countries considered as the most competitive now and in five years. This report also identifies what manufacturers view as the most important drivers of competition and presents their views on what governments can do to improve overall manufacturing competitiveness. It also offers an important glimpse of the manufacturer response to a period of extreme economic contraction, with the study having been conducted during one of the most dire manufacturing environments since the Great Depression of the 1930s.



The on-the-ground and forward-looking knowledge offered in this report can serve to further inform the conversation that governments and manufacturers must have when making decisions impacting this critical sector and its investments. With a richer dialogue, more favorable outcomes can be achieved for nations wise enough to heed the insights uncovered.

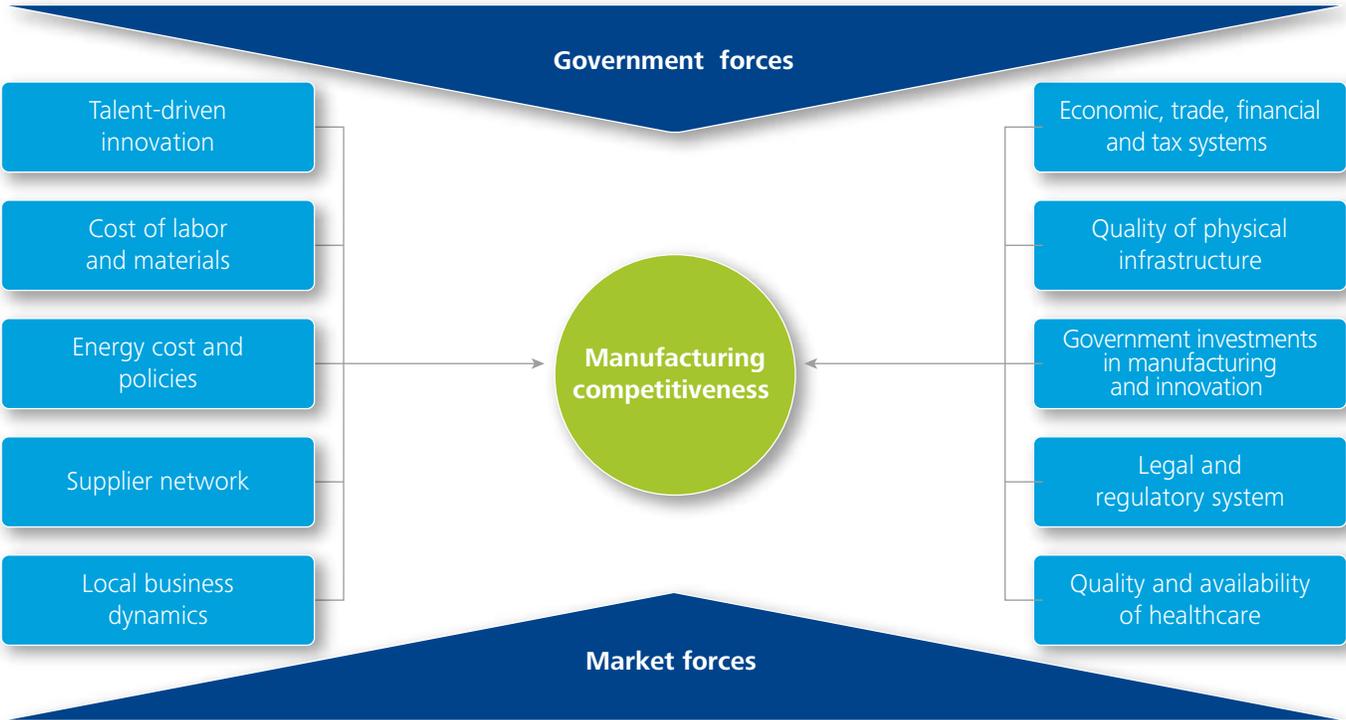
Drivers of countries' manufacturing competitiveness

Competitive dynamics: distinct but correlated

As organizations internationalize and expand their global manufacturing footprint, they must consider the multiple factors that underpin the competitiveness of a particular country. Manufacturing competence-building at the country level is a complex process. To better understand and explain the dynamics of a country's overall manufacturing competitiveness, they must be examined as two major, inextricably linked forces—market and government.

All of the ten drivers identified in this study reflect the critical interplay between market and government forces (see Figure 1). The drivers are broadly defined and grouped, based on the 25 component indicators included in the original survey (see Appendix Table A1).

Figure 1: Drivers of global manufacturing competitiveness



Source: Deloitte and US Council on Competitiveness - 2010 Global Manufacturing Competitiveness Index ©Deloitte Touche Tohmatsu, 2010

As viewed by the manufacturing executives who participated in the study, the drivers have also been ranked in terms of importance (see Table 1). And while distinct, the drivers are critically correlated, working together in an integrated way to define the competitive landscape upon which a nation's manufacturing sector either flourishes or withers.

Relative importance of drivers

Overall, the classic factors of production—labor, materials, and energy—are the most important drivers of global manufacturing competitiveness, as identified by the senior manufacturing leaders who participated in this study (see Table 1). These are all primarily driven by market forces, even though they can be greatly influenced by government policy. While this result should not be surprising, it is important to note that there is a qualitative difference between the classic view of production and these findings. Namely, the availability of talented people—scientists, researchers, engineers, and production workers—also drives manufacturing innovation and influences its overall competitiveness. Coupled with the cost and availability of materials and energy, the three drivers are the “foundations” of manufacturing competitiveness, according to manufacturing executives surveyed.

The next four drivers of manufacturing competitiveness are “contributory” government forces: economic, trade, financial and tax systems; the quality of physical infrastructure; government investments in manufacturing and innovation; and the legal and regulatory system. It is telling that after the key factors of production—labor, materials, and energy—government forces have the most significant impact on the competitiveness of the manufacturing sector in a country. Environmental, institutional, and infrastructural elements largely owed to government policy and investments also help to shape and define the competitiveness of a nation in a material way.

The final three drivers of manufacturing competitiveness, as rated by manufacturing executives, are more “localized”: the supplier network; the dynamics of the local business environment, including the size of the market opportunity and the intensity of local competition; and the quality and availability of healthcare. While these final three drivers fell lower on the list than the others, all of them were identified by executives as important considerations in defining the competitiveness of a country and all were deemed to be significant in an overall competitiveness equation. Thus, the three clusters of drivers—foundational, contributory, and localized—are all necessary conditions of country-level manufacturing competitiveness.

Each of the ten drivers is discussed below in rank order as determined by their index value (see Table 1). Reflective of at least one of the 25 component indicators included in the study, the drivers are described in terms of their relative importance and the rationale and implications of their rankings.

Table 1: Drivers of global manufacturing competitiveness

Rank	Drivers	Driver score	
		10=High	1=Low
1	Talent - driven innovation	9.22	
2	Cost of labor and materials	7.67	
3	Energy cost and policies	7.31	
4	Economic, trade, financial and tax systems	7.26	
5	Quality of physical infrastructure	7.15	
6	Government investments in manufacturing and innovation	6.62	
7	Legal and regulatory system	6.48	
8	Supplier network	5.91	
9	Local business dynamics	4.01	
10	Quality and availability of healthcare	1.81	

Source: Deloitte and US Council on Competitiveness - 2010 Global Manufacturing Competitiveness Index ©Deloitte Touche Tohmatsu, 2010

1. Talent-driven innovation

Clearly this driver goes beyond classical economic notions of low-cost inputs or the modern view of manufacturers chasing “cheap labor” around the globe. In contrast, the most important competitive driver identified by manufacturing executives surveyed—talent-driven innovation—comprises both the quality and availability of a country’s brain trust. This includes its skilled workers, scientists, researchers, engineers, and teachers—who collectively have the capacity to continuously innovate and, simultaneously, improve production efficiency. Worldwide, manufacturing executives and governments consistently view their talented people as one of their greatest assets and as having the greatest potential for realizing this winning combination of outcomes.

Though difficult to measure through conventional indicators, the innovative capacity of a country depends largely on the quality of its human capital and supporting technology and business processes. Research from the Organization of Economic and Cooperative Development underscores the significance of the interactions among the people and institutions involved in technology development and its translation of inputs into outputs.⁴ And according to CEO surveys from the Business Council and the Conference Board, acquiring and developing the right talent is viewed as the most important practice within an organization to make a company innovative and to improve the overall competitiveness of the country.⁵

2. Cost of labor and materials

The overall cost of labor—including all costs of development, compliance, and employee benefits along with the total cost of materials, which include logistics costs and material availability—continues to be a critical driver of manufacturing competitiveness. Labor and raw materials are two major factors of production that have been a keen consideration for manufacturing competitiveness since the dawn of the industrial age. As typified by Henry Ford’s Dearborn Michigan Rouge plant⁶, the historical roots of industrialization confirms that manufacturing managers have actively sought efficiency in production by reducing labor and materials costs. Today, for example, the well-known just-in-time production system characterizes these efficiencies in terms of improved worker utilization and reduced inventories.

Not surprisingly, the relative costs of labor and materials within a country will continue to drive its manufacturing competitiveness—at least in the short term. For example, outsourcing of production is mostly associated with low-cost manufacturing capabilities and priorities.⁷ However, companies are finding that in their relentless chasing around the globe and outsourcing of low-cost labor, they can lose longer-term leverage and internal competencies required to play the competitive game at the next level⁸. Constraints on the availability of raw materials also influence production costs.

3. *Energy cost and policies*

Now more than ever, clean, reliable energy is an ever-increasingly important factor of production for all industrial sectors. As energy becomes scarce and countries compete to attain energy security and independence, the cost competitiveness of energy, and particularly country-specific clean and sustainable energy leadership, will be a prominent component of country manufacturing competitiveness.

With increasing demand and limited supplies of traditional energy, market forces are expected to play a more formidable role in the development and diffusion of alternative forms of energy and its efficient use. Government policies, which act to increase energy efficiencies and accelerate the demand for cost-effective alternative energy, will provide the springboard whereby a country can leapfrog competing nations. This message was delivered with clarity in the recommendations of the Council on Competitiveness' recent Energy, Security, Innovation, and Sustainability project.⁹

4. *Economic, trade, financial, and tax systems*

A country's economic, trade, financial, and tax systems are a key driver of its overall level of manufacturing competitiveness. Financial markets provide the necessary capital for entrepreneurial and private-sector investments in manufacturing. Thus, appropriate regulations and policies on corporate taxes, trade, central banking, and overall financial systems foster the necessary business climate for a country's industrial sectors to thrive. In contrast, burdensome, nontransparent, and inappropriate regulations and tax policies or an unstable central banking and financial system can stifle the manufacturing sector and be a drag on national competitiveness.

5. *Quality of physical infrastructure*

The productivity of an industry in any country is directly related to the quality of its physical infrastructure for commerce. Physical infrastructure includes the roads, ports, electricity grids, and telecommunication networks. An efficient transportation infrastructure plays a vital role in logistics—moving raw materials and finished products on time and with minimum costs.

State-of-the-art grids and networks play similar roles in moving energy and information. Uninterrupted availability of power supply is an imperative for a manufacturing industry to thrive in any country. And, in today's networked world, a robust communications network is critical. It helps businesses to communicate across geographies on a real-time basis, which improves efficiency and aids faster decision-making, faster time-to-market, and more robust customer service. A well-developed physical infrastructure is central to integrating the local market as well as cost effectively connecting it to international markets thereby enhancing the competitiveness of the entire manufacturing value chain.

6. *Government investments in manufacturing and innovation*

Government investments in the areas of science, technology, and engineering—including the establishment and support of research institutions; the provision of technological support for manufacturers; and the development of local manufacturing clusters—creates a country-level climate for manufacturing innovation. These types of government investments foster knowledge creation and dissemination and have a strong positive influence on the long-term competitiveness of a country's manufacturing sector.

7. Legal and regulatory system

Legal and regulatory environment, regulatory compliance costs, labor laws and regulations and intellectual property protection and enforcement have a strong influence on competitiveness and growth. Absence of a highly transparent and well-functioning legal framework can put investments at risk. Labor laws, which protect the interests of both employees and employers and allow for flexibility in the deployment of labor, have a positive influence on the productivity and efficiency of operations. By the same token, a cumbersome, complex legal and regulatory system with high costs of compliance or ineffective intellectual property protection creates an obstacle to competitiveness for the manufacturing sector.

8. Supplier network

A highly qualified local supplier base supports manufacturing's eco-system by contributing significantly to the value-add of the sector and is essential to improving a nation's manufacturing competitiveness. Manufacturing enterprises have steadily moved away from the vertically integrated business models of the early 20th century. Today, companies compete on the competitiveness of their overall supply chains. They rely on complex supplier networks not only for parts and materials but increasingly for sharing knowledge and innovation processes.

Increasingly, suppliers are becoming vital assets for the manufacturing enterprise, which, in turn, can promote processes that enhance and expand collaboration and teamwork between highly skilled suppliers and themselves. For instance, as more information content is offered in products and as part of associated services, software developers are often deeply embedded in the supply network. When executed successfully, the competitive capabilities of this type of network is formidable, as it underpins the focal manufacturers' ability to adapt and navigate through uncharted competitive waters.¹⁰ Thus, buyer competence in managing its supply base can be a strategic driver of manufacturing competitiveness in the 21st century.



9. Local business dynamics

The size of the local market impacts productivity as large markets allow manufacturers to exploit economies of scale as well as develop customized products and services. Research shows that market size—population regardless of per capita income—is a relevant driver of multinational firms' location and investment choices.^{8,11} Competition from local companies as well as foreign multinationals also pushes companies to proactively seek efficiency and productivity as well as innovation. Those that make the grade are not only survivors but also raise the bar for the entry of future competitors. Collectively, local competition changes the dynamics, and in turn, raises the overall manufacturing competitiveness of the country.

10. Quality and availability of healthcare

Availability of affordable and quality healthcare is essential for the workforce to be efficient and productive. In the developed world, where the median age of the population is nearing 40, healthcare assumes further significance.¹² Companies are finding that losses due to absenteeism and unfit workforce also create a drag on the competitiveness of the manufacturing sector and the overall economy. Sick workers can spread diseases among co-workers. Absenteeism can result in reduced overall throughput and even reduced quality, since substitute workers can rarely perform with the same efficiency as a well-trained, regular employee.¹³

Regional perspectives

There are regional variations in the importance of the competitive drivers that can provide useful insights for policy-makers (see Table 2). While the overall top three drivers remain relatively stable across all regions, there is some juxtaposing in their relative importance. Manufacturing executives within each region localized their views of the top five drivers of manufacturing competitiveness based on the country where they are located.

Talent-driven innovation remains the top driver of manufacturing competitiveness across global regions. The exception is Mexico and South America, where executives rate the quality of the physical infrastructure as the most important, followed by talent-driven innovation. For European executives, this driver takes third place.

Cost-related drivers also take different positions across global regions. Costs of labor and materials were ranked second by U.S. and Canadian executives. However, this driver was rated lower by their counterparts from Asia, Europe, and Mexico and South America, where it fell to third, fourth, and fifth, respectively. Labor cost advantages of developing countries are projected to enable them to continue whittling away at their industrialized counterparts' market strongholds.¹⁴ Further, the costs of materials have been rapidly escalating because in part, they are fueled by speculative market prices driven largely by China's unabated hunger for commodities and this is now making its way through the supply chain. These factors are plausible causes underlying the rising cost pressures U.S. and Canadian manufacturers are experiencing, especially from the capital markets.

Energy costs and policies were viewed as the second most important driver by the European executives, as opposed to third by those from Mexico and South America, fourth from the United States and Canada, and fifth from Asia. The European Union (EU) faces serious challenges concerning security of supply, import dependence, and the competitiveness and effective implementation of the internal energy market as well as those related to sustainability and greenhouse gas emissions.¹⁵ Overall, the EU currently has an energy dependency (total net energy imports as a percentage of gross energy consumption) of 53.8 percent.¹⁶ (It should be noted that the survey was administered prior to the 2010 oil spill in the Gulf of Mexico, which may push the relative importance of energy availability and costs significantly upward for the United States in the near future.)

Minimizing the EU's vulnerability concerning imports, shortfalls in supply, possible energy crises, and uncertainty with respect to future supply is a clear priority for policy-makers as well. The member states, dependent on one single gas supplier, are more vulnerable to energy uncertainty. Clearly manufacturers in Europe see availability of cost-effective energy and related policies as key to a country's manufacturing competitiveness. The importance of energy supply is also expected to grow in Asia to fuel the region's economic growth. However, right now these executives consider energy cost and policies a relatively less important driver.

Table 2: Regional comparison - Drivers of manufacturing competitiveness

United States and Canada		Mexico and South America	
Drivers	Rank	Drivers	Rank
Talent-driven innovation	1	Quality of physical Infrastructure	1
Cost of labor and materials	2	Talent-driven innovation	2
Economic, trade, financial and tax systems	3	Energy cost and policies	3
Energy cost and policies	4	Economic, trade, financial and tax systems	4
Legal and regulatory system	5	Cost of labor and materials	5
Quality of physical infrastructure	6	Legal and regulatory system	6
Government's investments in manufacturing and innovation	7	Government's investments in manufacturing and innovation	7
Supplier network	8	Quality and availability of healthcare	8
Local business dynamics	9	Supplier network	9
Quality and availability of healthcare	10	Local business dynamics	10

Source: Deloitte and US Council on Competitiveness - 2010 Global Manufacturing Competitiveness Index
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Asian executives do see government investments in manufacturing and innovation as critical—ranking it the second most important driver for manufacturing competitiveness. This view is borne out by China’s direct foreign investment in global resources—steel, oil, and minerals—as inputs to its manufacturing sector. China’s foreign investment has increased from US\$9.11 billion in 2005 to US\$63.87 billion in 2009, with the majority in energy, metals, and chemicals as well as transportation and communications.¹⁷ And China has many initiatives to support manufacturing, for example, recalling scientists trained in the developed world.¹⁸ In the Republic of Korea, significant government support also has been provided to establish industrial clusters and special economic zones. Notably, such government investment does not appear as a top-five driver for any other regional group, perhaps because of the lesser role governments (versus private enterprises) play in manufacturing competitiveness in those regions.

Economic, trade, financial, and tax systems versus legal and regulatory systems are two other drivers prioritized differently by executives from different regions. The economic, trade, financial, and tax systems emerged as the third most important driver supporting manufacturing competitiveness as indicated by executives from the United States and Canada, whereas those from Asia, Mexico, and South America, ranked it fourth. It did not make the top five for European executives, with this group giving more precedence to legal and regulatory systems. The U.S. executives also placed legal and regulatory systems in fifth place. While these systems have typically been viewed as a burden to competition in developed countries, the regulatory systems of the rising emerging markets have been perceived as “anything goes.”

Europe		Asia	
Drivers	Rank	Drivers	Rank
Talent-driven innovation	1	Talent-driven innovation	1
Energy cost and policies	2	Government’s investments in manufacturing and innovation	2
Quality of physical Infrastructure	3	Cost of labor and materials	3
Cost of labor and materials	4	Economic, trade, financial and tax systems	4
Legal and regulatory system	5	Energy cost and policies	5
Economic, trade, financial and tax systems	6	Quality of physical infrastructure	6
Supplier network	7	Legal and regulatory system	7
Government’s investments for manufacturing and innovation	8	Supplier network	8
Local business dynamics	9	Local business dynamics	9
Quality and availability of healthcare	10	Quality and availability of healthcare	10

Source: Deloitte and US Council on Competitiveness - 2010 Global Manufacturing Competitiveness Index ©Deloitte Touche Tohmatsu, 2010

The global manufacturing competitiveness index

Index methodology

In order to quantify country competitiveness more precisely, manufacturing executives were asked to rate the overall manufacturing competitiveness of 26 countries, currently and in five years. The selection of the countries was based on the conclusions of a sampling of executives as well as subject-matter experts from the Council on Competitiveness, Deloitte, and Clemson University. Also, executives who participated in the survey could add and rate any other country not included on the list. The Global Manufacturing Competitiveness Index (GMCI) was developed directly from their responses, assigning a single number for each country reflecting its relative attractiveness in terms of manufacturing.

For the computation, executive responses were standardized to adjust for potential country and cultural bias as well as for company size, which is captured through annual revenues in U.S. dollars. A company's relative global experience in manufacturing was based on the physical presence of manufacturing operations and/or sales, service and distribution offices spanning multiple global geographic regions (Asia, Europe, North America, South America). Manufacturers were deemed as having more global experience if their operational footprints were more dispersed regionally. Those manufacturers with presence in only one region received the lowest global experience weight, whereas operating in four global regions received the highest. Prior research found company size correlated strongly with manufacturing operations in multiple regions. Larger manufacturers, as measured by total annual revenue, tended not only to have physical presence in multiple geographic regions but were also more globally experienced.

As a result, larger, more globally experienced manufacturing organizations had a greater influence in defining the index rankings as well as in determining the key drivers and components of manufacturing competitiveness. This approach to weighting responses also resulted in less regional variation among the ten drivers of manufacturing competitiveness and their components as well as within the GMCI of the most competitive countries. Not surprisingly, regardless of the location of company headquarters, large, globally-experienced manufacturers had a more common perspective on competitiveness of nations as well as the underlying drivers of competitiveness with each other, than they did with their less experienced, and often smaller, counterparts located within their home countries. Details are given in the appendix.

A clearer picture of competition

The underlying drivers identified in the previous section point to the complexity of competitiveness and the many components that can interact in determining the relative position of nations. The competitiveness drivers, and their underlying defining components that were captured in the survey, offered an insider's view of where executives see the most competitive nations—currently and in five years from now. And from the complex web of drivers, the 2010 Global Manufacturing Competitiveness Index (GMCI) reveals some very clear competitive trends of note for policy-makers and manufacturers alike.

The rise of Asia: China, India, and Korea

In less than a decade, a new world order for manufacturing competitiveness has emerged along with a tectonic shift in regional manufacturing competence. The rise in the manufacturing competitiveness of three countries in particular—China, India, and the Republic of Korea (Korea)—appears to parallel the rapidly growing and important Asian market. As gleaned from Table 3, the collective wisdom of manufacturing executives globally underscores the significance of Asia as being the most competitive location for manufacturing now and in five years.

China

China's ascent to the top of the list is not surprising, given its rising eminence in the manufacturing sector over the past ten years, particularly as a regional hub for foreign outsourced production, foreign direct investments, and joint ventures. Executives see China as possessing strength along most of the top drivers of competitiveness. An abundance of highly skilled workers, scientists, researchers, and engineers contributes to a high rating for talent-driven innovation. The government's dedication to investments in science, technology, and manufacturing physical infrastructure is aimed at accelerating the technological value-add of Chinese production and innovation. Couple this advantage with a relatively low-cost base that is geographically mutable, and China has a clear leadership position, taking the top spot for manufacturing competitiveness, now and in the near future. Because of the speed and magnitude of change over the past two decades, China's role as a manufacturing superpower has been solidified.

India

Perhaps more surprising is that India is now positioned at number two—and gaining an even stronger foothold on that position over the next five years. India's rich talent pool of scientists, researchers, and engineers as well as its large, well-educated English-speaking workforce and democratic regime make it an attractive destination for manufacturers. Since the mid-1990s, India's software industry has escalated to new heights and post-economic liberation has also opened a pathway to unprecedented market opportunities for Indian manufacturing. Moreover, beyond low-cost, Indian manufacturers gained experience in quality improvement and Japanese principles of quality management, with the largest number of Deming Award winners outside of Japan.¹⁹ The country is also rapidly expanding its capabilities in engineering design and development and embedded software development, which form an integral part of many modern-day manufactured products.²⁰

The importance of India to manufacturing executives around the world underscores two important points. First, strength in research and development—paired with engineering, software, and technology integration abilities—are viewed by global executives as a vital element of the talent-driven and innovative manufacturing enterprise of the 21st century. Second, manufacturing executives increasingly view India as a place where they can design, develop and manufacture innovative products for sale in local as well as in global markets.²¹ These factors explain, in part, India's rise from a low-cost, "back office" location to a country that is well-positioned to be an active participant in the entire value chain—as well as it now being viewed by many executives as an integral part of their global manufacturing enterprise and location strategy.

Korea

Korea holds the number three position both today and in five years, solidifying Asia's dominance in the manufacturing industry's new world order. Korea's position is based on its economic growth over the past decade and its steadily-gaining strength that is built largely on the back of its strong manufacturing sector. With many of its largest companies vertically integrated, Korea has ceaselessly heightened the value-add of its production and technological innovation through a persistent focus on economic development, targeting industrial sector growth and exports.

Korea's industrial policy supports a broad base of manufacturing infrastructure development, including industrial parks, ports, and transportation systems. Key manufacturing industries have now garnered recognition in the global arena, and Korea has emerged as the world's largest shipbuilding nation and ranks first in terms of semiconductors and displays.²² Moreover, Korean automobile manufacturers are now a significant force around the world as are its appliance makers.

Changing dynamics for superpowers: the United States, Japan, and Germany

The dominant manufacturing superpowers of the late 20th century—the United States, Japan, and Germany—are now lagging on the GMCI in comparison to the three Asian juggernauts. This may indicate that the rules of the game are changing, and thereby limiting the influence of traditional Western theories and conventional wisdom.

The United States

The late 1980s and early 1990s was a period of manufacturing renaissance in the United States, as manufacturers became proficient in world-class manufacturing practices, especially as they took a global leadership position in quality and business process management.²³ Today, the GMCI shows that the United States ranks fourth-place overall. Despite

this position on the index, the United States can still boast high labor productivity and remains the largest manufacturing economy, with 20 percent of the world's manufactured outputs, followed by China with 12 percent.²⁴ Estimates suggest technology advancement has accounted for as much as 85 percent of the U.S. growth in its per capita income.²⁵ However, this study provides some empirical evidence that the competitive dynamics are changing in the downward direction for U.S. manufacturing, as the U.S. ranking drops off to fifth in five years. This is consistent with a Milken Institute report that states "there is no denying that the dominance of U.S. manufacturing has been steadily eroding."²⁶

Competing in U.S. manufacturing has changed dramatically. Globalization and technological progress, especially in advanced communications, have put American workers in an unprecedented level of direct competition with its lower-wage counterparts as well as with rising leading-edge talent pools available worldwide. Much of this projected decline has been attributed to the hollowing out of manufacturing by the outsourcing of not only millions of U.S. manufacturing jobs, but also, increasingly, the export of research and development and customer support to foreign partners and subsidiaries. Many manufacturing skills—such as welding, software development for numerically controlled machines, and quality management—have a high degree of accumulated tacit knowledge, and, if lost, is difficult, if not impossible, to recover.²⁷ Moreover, the added complexity costs of long supply chains are not well understood. The projected decline can also be seen as driven in part by a perception that a services sector can sustain prosperity without the vital support of a strong manufacturing sector and from a lack of a cohesive national policy on manufacturing competitiveness.

Japan

In the 1980s, Japan was heralded by many as the epicenter of manufacturing best practices. The tide turned in the 1990s, the “lost decade” caused by an overall economic downturn. The manufacturing leadership Japan once enjoyed has now been profoundly altered, with China viewed as the new Asian anchor. A recent study on Japanese manufacturing competitiveness strategy reports that Japan is facing formidable competitive pressures due to a declining workforce, an aging population, and the “loss of a manufacturing culture”.²⁸ Additionally, Japan faces higher manufacturing costs as well as a relative scarcity of natural resources, which means it must import raw materials along complex supply chains. And while it is rapidly replacing line workers on the shop floor with complex robotics—an area of strategic manufacturing strength—it is scaling up its production workers with higher-cost scientists and engineers.

Today, about one-third of Japan’s employees are engineers. The study also reported that Japan is rapidly replacing workers. As a result, the authors reached a conclusion that many Japanese manufacturers are emphasizing “design-based production,” which implies that physical production and design should be coupled.²⁹ The emphasis on robotics also signals the need for the co-evolution of the mechanical, electrical, and software aspects of its product and process development. Yet Japan’s relative competitiveness in software development is reportedly weak. One academic study concluded that in terms of software as a whole, “there is an overwhelming import surplus; while exports are less than 10 percent of the value of the imports”.³⁰ Further, like their U.S. counterparts, many Japanese manufacturers continue to outsource and/or offshore their more routine manufacturing operations, in particular to other lower-cost Asian countries, which may reduce their country leverage and know-how. As such, Japan is expected to drop from sixth to seventh place in the GMCI in the next five years.

Germany

The global executives rank Germany eighth on the index—which may seem puzzling as German manufacturing is often touted to be among the most competitive worldwide. German manufacturers have steadfastly pushed the envelope in “mechatronics”—the science of merging information technology, electronics, and old-fashioned mechanics. Manufacturing accounts for one quarter of Germany’s GDP, 30 percent of its jobs,³¹ and the label “made in Germany” continues to be a symbol of superior quality. Germany’s reliance on exports to the EU has also shielded it somewhat from the fluctuating euro. Even with the economic downturn and overall European demand declining, Germany is still benefiting immensely from the booms in India and Brazil. Particularly in China, as the country moves away from consumer products toward producing more sophisticated, high-technology products, the demand for Germany’s specialized manufacturing systems—precision machine tools, highly engineered goods, and complementary technical support services—has shot up to keep pace.

But these benefits may only be near term: though Germany’s rank remains the same in five years, its actual index value declines. China is rapidly moving up the technology food chain, making significant headway in renewable energy, aircraft, and automobiles—and has caught up with Germany in some sectors, such as wind power generators.³² Other reasons cited as chipping away at Germany’s competitiveness are its bureaucracy, sluggish pace of start-ups, and relatively high labor costs. Industry Week has already reported that Germany’s high labor costs are likely to be construed as reducing its competitiveness. Employee wages at manufacturers in western Germany are nearly double that of U.S. counterparts, which are, in turn, higher than those paid to Japanese workers. Manufacturers are more likely to be drawn to eastern Germany where hourly employee labor costs are substantially less.^{33,34}

So while the U.S., Japan, and Germany remain three of the most formidable manufacturing locations in the world, their future GMCI, based upon the input from executives surveyed, shows their competitiveness eroding. The index indicates that the competition is already heating up—and in the next five years the staying power of these manufacturing giants of the 20th century will be challenged even more.

Markets to watch

A review of the remaining countries on the index indicates that several newcomer economies are soaring in importance as manufacturing hubs. In particular, executives expect Brazil, Mexico, Poland, and Thailand to improve their manufacturing competitiveness in the next five years, when each of these countries becomes a part of the top-ten most competitive locations, most likely due to either their natural resources or attributes of their workforce. Brazil jumps past the United States into the fourth position and is within striking distance of Korea. Mexico, despite an index value that remains identical, moves into sixth position replacing Japan. And both Poland and Thailand move up, rounding out the top ten in the ninth and tenth positions, respectively. Also experiencing significant progress on the index are the economies of Eastern Europe and of Russia, which are showing strong competitive potential.

Brazil

Almost as impressive as the ascendance of Asia, is the rise of both Brazil and Mexico in the western hemisphere. Brazil's impressive advance on the GMCI in five years, based both on a significant improvement in its own index value as well as a decline for the United States, is particularly noteworthy. Brazil's manufacturing sector has historically focused on commodities and the export of low-technology products, with the exception of aerospace. It has also pursued an industrialization policy centered on replacing imported manufactured products with Brazilian-made ones, yielding a highly diversified manufacturing sector.

Industrialization has evolved with infusion of domestic capital investment by the government in industries such as steel, petrochemicals, and aircraft; and by foreign capital in automobiles, chemicals, and electrical goods manufacturing. As a result, today Brazil is one of the world's major steel producers and car manufacturers³⁵. Moreover, Brazil can draw on its significant resource wealth and further develop its technological edge in agriculture and alternative energies in order to capture the more profitable stages of the value chain. Brazil is also one of the few countries with a sufficiently large natural resource base as well as a relatively sophisticated research infrastructure in promising sectors such as bio-fuels—placing it in a unique position,³⁶ especially if it can grow in an ecologically sustainable way. Additionally, Brazil's hosting of the FIFA World Cup in 2014 and the Olympics in 2016 is expected to improve infrastructure and bring in foreign investment, which are likely to have a positive influence on the country's manufacturing sector.

Mexico

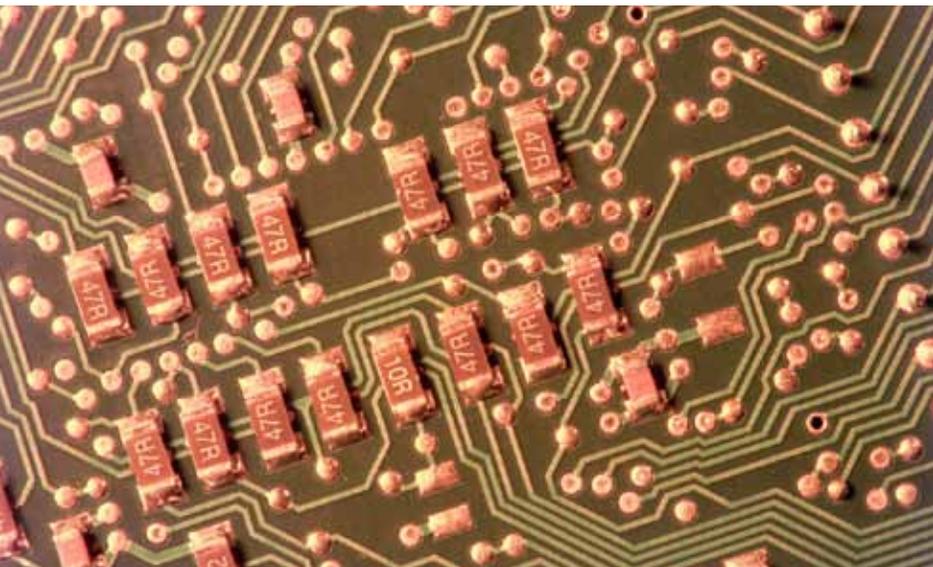
The signing of the North American Free Trade Agreement in 1994 helped set the stage for today's manufacturing strength in Mexico. Mexican manufacturing plants were initially located along Mexico's northern border and today the majority of the manufacturing plants are located just south of the United States. Throughout Mexico, however, the manufacturing industry has become a key engine for growth in the overall economy. Mexico now ranks eleventh in the world in automotive production with globally recognized quality. Manufacturing of electronic components, building and construction materials, aerospace products, and other areas of labor-intensive manufacturing constitute the other large industries in the Mexican economy. Mexico has also begun to develop a broader and more technologically sophisticated portfolio of products that enable it to leverage significant foreign direct investment and an abundant, young and eager workforce. Manufacturers in Mexico still enjoy lower labor rates, while many of its plants now manufacture higher-quality products supported by better technology, and specialization in key areas. Proximity to the United States has boosted Mexico's manufacturing potential and has helped position it firmly in the top rankings of the most competitive manufacturing locations.³⁸

Eastern Europe and Russia

Eastern Europe has a few significant bright spots. Poland remains an attractive location for a range of manufacturing, including automotive and electronics, due to its cost competitiveness with Western Europe. It also helps that it has a large qualified talent pool, a sizable domestic market, and is within close proximity to customers across Europe.³⁹

Notably, the most significant move on the entire GMCI belongs to Russia, which jumps from 20 to 14. This may reflect Russia's current initiative to create an innovative economy supported by an environment where talent and business acumen can be brought together. Government emphasis on the education and development of the workforce will play a critical role in this effort.⁴⁰ It is also likely that executives in the study are eyeing the strategic moves by the EU in recent years to bolster relations with Russia.⁴¹ Most foreign direct investment in Russia comes from the EU—and as Russia's third-largest trading partner, the EU aims to improve cooperation in a number of areas.

Interestingly, Russia's momentum within the GMCI appears to be largely driven by the perspectives of executives from China. China has been seeking opportunistic relationships with Russia to garner strategic mineral and oil resources, military weapons and hardware, and to increase cross-border business and tourism. The influence of China on Russia's rising index rank is further corroborated by China and Russia's current plans to expand cooperation on the deep processing of raw materials as well as within the aircraft and hi-tech sectors.^{42,43}



Losing ground: Western Europe

Overall, the story for Western Europe is a sobering one. While Germany maintains its grasp on the index's eighth position, Western Europe sees declines for Switzerland (the most significant downward change for any country on the list), the Netherlands, the United Kingdom, Italy, and Belgium. Each of these countries experienced deterioration in both their current GMCI rank and future index value (see Table 4). Only Spain moves up from rank nineteen to sixteen, albeit with a lower index value, surpassing its falling Western European counterparts in relative position. And France, while remaining at 23, is the only Western European nation that actually improves its index value and relative strength over the next five years.

The competitive challenge

The GMCI rankings ascribed by senior manufacturing executives in this study indicate that barring any significant macro-level shocks, such as war, economic collapse, natural catastrophe, major shifts in consumer dynamics, or major government interventions, the competitive landscape for manufacturing will be significantly altered within the next five years. Five of the top-ten most competitive manufacturing locations will be in Asia; two, in Europe; and the remaining three, in the western hemisphere, with two in North America. Mexico moves into sixth place, and the United States falls to fifth, replaced by Brazil—sandwiching U.S. manufacturing between its western hemisphere counterparts. Western Europe sees a near across-the-board decline in manufacturing competitiveness, while Eastern Europe picks up steam. The Asian manufacturing juggernauts—China, India, and Korea—remain entrenched at the top of the manufacturing pyramid.

The regional implications of the GMCI could be significant, as North America, South America, Western and Eastern Europe, and Asia all challenge one another for dominance in manufacturing—a vital source of jobs and country prosperity. Many of these rising countries appear destined to be important only within select manufacturing sectors, while others possess the breadth and depth of resources and capabilities to be dominant players across the board. Government policies within these respective regions may hold further clues to a country's competitiveness going forward and are discussed in the next section.

Table 3:
Current competitiveness

Rank	Country	Index score	
		10=High	1=Low
1	China	10.00	
2	India	8.15	
3	Republic of Korea	6.79	
4	United States of America	5.84	
5	Brazil	5.41	
6	Japan	5.11	
7	Mexico	4.84	
8	Germany	4.80	
9	Singapore	4.69	
10	Poland	4.49	
11	Czech Republic	4.38	
12	Thailand	4.17	
13	Canada	4.11	
14	Switzerland	3.07	
15	Australia	3.07	
16	Netherlands	2.90	
17	United Kingdom	2.82	
18	Ireland	2.78	
19	Spain	2.67	
20	Russia	2.58	
21	Italy	2.42	
22	South Africa	2.28	
23	France	1.70	
24	Belgium	1.18	
25	Argentina	1.03	
26	Saudi Arabia	1.00	

Competitiveness in 5 years

Rank	Country	Index score	
		10=High	1=Low
1	China	10.00	
2	India	9.01	
3	Republic of Korea	6.53	
4	Brazil	6.32	
5	United States of America	5.38	
6	Mexico	4.84	
7	Japan	4.74	
8	Germany	4.53	
9	Poland	4.52	
10	Thailand	4.35	
11	Singapore	4.30	
12	Czech Republic	3.95	
13	Canada	3.71	
14	Russia	3.47	
15	Australia	3.40	
16	Spain	2.63	
17	Netherlands	2.63	
18	Switzerland	2.62	
19	South Africa	2.52	
20	United Kingdom	2.51	
21	Ireland	2.43	
22	Italy	2.37	
23	France	1.92	
24	Argentina	1.53	
25	Saudi Arabia	1.32	
26	Belgium	1.00	

Source: Deloitte and US Council on Competitiveness - 2010 Global Manufacturing Competitiveness Index ©Deloitte Touche Tohmatsu, 2010

Table 4: Expected change in manufacturing competitiveness in 5 years

Moving up		Rank change	Sliding down		Rank change
Brazil	↑	5 th to 4 th	United States of America	↓	4 th to 5 th
Mexico		7 th to 6 th	Japan		6 th to 7 th
Poland		10 th to 9 th	Singapore		9 th to 11 th
Thailand		12 th to 10 th	Czech Republic		11 th to 12 th
Spain		19 th to 16 th	Netherlands		16 th to 17 th
Russia		20 th to 14 th	Switzerland		14 th to 18 th
South Africa		22 nd to 19 th	United Kingdom		17 th to 20 th
Argentina		25 th to 24 th	Ireland		18 th to 21 st
Saudi Arabia		26 th to 25 th	Italy		21 st to 22 nd
			Belgium	24 th to 26 th	

Source: Deloitte and US Council on Competitiveness - 2010 Global Manufacturing Competitiveness Index ©Deloitte Touche Tohmatsu, 2010

The impact of public policy

Policy and competitive advantage

As government action plays a key role in the competitiveness of a country, manufacturing executives participating in the study were asked to identify the national policies they perceived as contributing to the competitive advantage—or disadvantage—of their businesses. The following section is devoted to China, Europe, and the United States, given the significant role these areas play in the global manufacturing economy. Across these regions, the results show some striking differences in policy, helping to explain their shifting positions on the GMCI now and in five years. Additional context surrounding the rationale of why executives may have identified these policies as advantages or disadvantages has also been provided. This discussion can serve to further illuminate relative competitiveness of these regions as well as inform the on-going debate around the policy measures deemed by respondents as having the most significant impact on manufacturing overall.

China

Science, technology, and innovation

Government policies in support of science, technology, and innovation are at the top of the list of policy advantages identified by nearly 70 percent of the Chinese executives participating in the study (see Figure 2a). Over the past decade, the Chinese government has made it a top priority to invest in building science and technology capabilities. It has developed a plan to build an innovation-oriented country in the next 15 years and become a world power in science and technology by the middle of the 21st century. According to the guidelines on medium- and long-term programs for science and technology development (2006-2020), China's entire investment in research and development is expected to reach 2.5 percent of its GDP by 2020, while science and technology will contribute 60 percent and above to the country's development. Meanwhile, the country's reliance on foreign technology is expected to drop to 30 percent or below. China also expects to rank among the top five in the world in terms of the number of patents granted to Chinese nationals and academic essays authored by them.⁴⁴

The Chinese government is also investing in its brain trust, providing incentives to Chinese scientists and engineers educated in the developed world to help build the country's science and technology base. And the Chinese Academy of Sciences is providing incentives, such as increased salaries, additional research funding, and tax breaks, to encourage overseas scholars to return. These benefits are administered through such vehicles as the Cheung Kong Scholars Programme, the Distinguished Young Scholar Programme, and the Hundred Talents Programme.⁴⁵



Sustainability

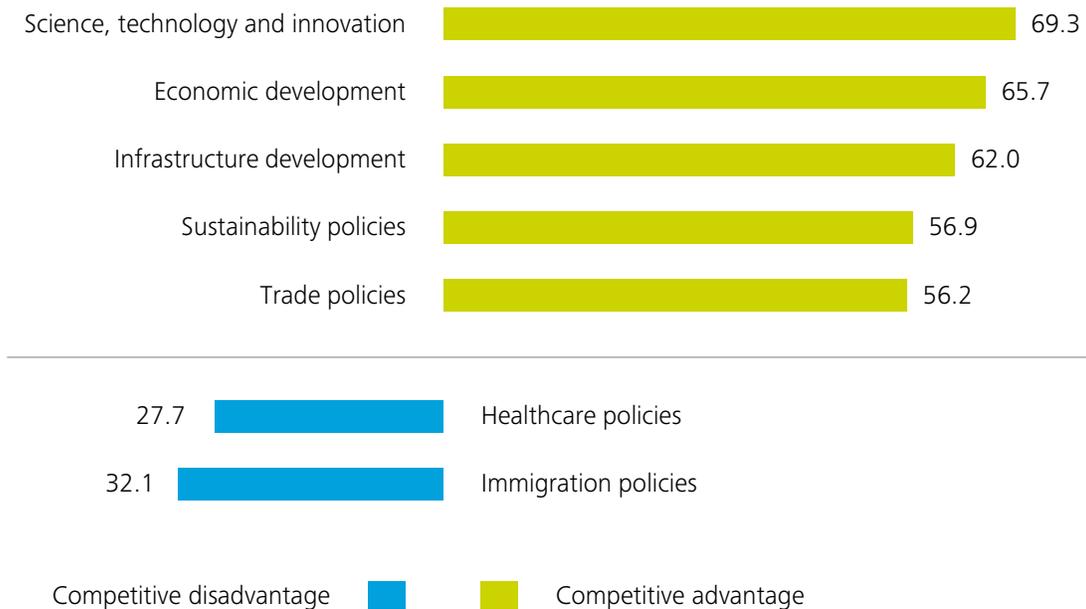
The advantage Chinese executives see in their country’s sustainability policies is inextricably linked to the “Green Growth Agenda” promoted by the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) and rapidly taking hold across Asia and the world. In China, the agenda is viewed as one of the key policy elements powering its manufacturing sector of

next-generation energy technology—solar panels, wind turbines, electric rail, electric batteries, electric mobility, etc.—that will be necessary to achieve green growth objectives. With a significant percent of GDP derived from the manufacturing sector and the associated challenges it can place on the environment, as already experienced in China, Chinese leaders—both government and business—have embraced the importance of UNESCAP’s

Figure 2a: Policy advantages and disadvantages for China

China policy

(percent indicating advantage or disadvantage)



Neutral policies

- Central bank and economic policies
- Anti-trust laws and regulations
- Employee education & assistance
- Safety & health regulations
- Energy policies
- Government intervention & ownership in companies
- Product liability laws
- Foreign direct investment
- Technology transfer & adoption
- Intellectual property protection
- Corporate tax policies
- Labor laws & regulations
- Environmental policies.

Source: Deloitte and US Council on Competitiveness - 2010 Global Manufacturing Competitiveness Index
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mantra to abandon a “grow first, clean up later” mentality that has plagued many rapidly developing economies. In the past year, attitudes of business leaders have changed dramatically. Where once they saw green growth as a cost burden, now it is seen as a means of reducing costs, improving business and manufacturing processes, and opening the door for the development of new products and services for both domestic and global consumption.⁴⁶

Another element of the “green growth agenda” that intersects with trade policy and helps drive Chinese manufacturing are China’s policies favoring local technology and innovation, referred to collectively as the “indigenous innovation policies.” These policies give Chinese manufacturers an advantage over foreign rivals in the market for new energy-efficient and renewable-energy technology. Indigenous innovation policies include preferential treatment in government procurement as well as significant incentives for domestic companies to develop technology. Foreign investors are required to reward local staff for innovation and, increasingly, to use technology developed in China. Chinese policies also require intellectual property to result from research and development carried out in China.⁴⁷

But while these government policies boost local manufacturing, the challenge they represent for most foreign firms, who are essentially blocked from participating in the green growth agenda and the associated market for innovative products and technologies, is creating tensions with major trading partners around the world. Intellectual property protection was already a key source of concern for foreign manufacturing organizations operating in China, and the indigenous innovation policies further open the door to abuse of intellectual property protection, according to major trading partners.⁴⁸ Indigenous innovation has also recently come under scrutiny from the World Trade Organization and was one of the issues addressed in the fair-trade agreement reached between China and the

United States during recent strategic and economic cooperation dialogues in Beijing.⁴⁹

In addition to these trade tensions, indigenous innovation policies also block China from benefiting from foreign innovations, which could accelerate their energy efficiency and sustainability efforts. In fact, it is becoming obvious to government and business leaders in China that major challenges, like electrification of mass transit and personal mobility, will require worldwide cooperation. And while China may lead the world in the number of patents filed—and even the number of academic papers published⁵⁰—it is generally acknowledged that their commercial and scientific value remains limited. As such, a softening of the indigenous innovation constraints appears to be under way, as can be seen in the automotive sector, where strategic alliances were recently forged by China’s non-JV automakers with major global vehicle brand owners.

But while China will need foreign input to implement its green agenda, its “socialist-market economy” may provide a unique benefit as there seems to be a consensus in every major economy that meeting green growth challenges will require a new level of partnership between government and business. From research and development (R&D) funding to utility regulation and key infrastructure planning and investment, strong government-business relationships will most likely be critical. China’s comfort with this kind of relationship, as well as its decades of experience, could be a source of significant competitive advantage.

Infrastructure development

Over the past decade, the Chinese government has taken concrete steps toward building the physical infrastructure—logistics, roads, ports, rail, telecommunications, and electric grids. In 2005, China’s infrastructure development spending was 7.3 percent of GDP; in 2009, it rose to around 9 percent—a large share going to the rail sector

alone, which saw a 70 percent increase in fixed-asset investment.⁵¹ As part of China's response to the global economic crisis, last year the central government also allocated 908 billion yuan for public investments to affordable housing projects, rural projects on water, electricity, roads, gas, housing, major infrastructure construction projects, social projects on healthcare and education, energy conservation and emission-reduction projects, environmentally friendly projects, independent innovation and industrial restructuring, and reconstruction of the Wenchuan earthquake area.⁵² As China's march toward urbanization continues, the demand for and the continued growth of all facets of its infrastructure will be a top priority and an ongoing challenge.

Healthcare

Despite the many advantages for companies operating in China, healthcare policy is often cited as limiting the country's competitiveness. Lack of access to healthcare and insurance is a major contributor to poverty in China and a significant issue for a country where 450 million people are over the age of 50 or soon will be. Low levels of insurance coverage have resulted in high savings rates and reduced consumption—key determinants of economic growth.⁵³ And though easing at the turn of the millennium, the marked rise in healthcare's relative price has pushed up the share of overall expenditure in China's GDP.

China's leaders recognize that they need to improve the equity and efficiency of the healthcare system, which plays a critical role in the economy. Reform began in the early 1980s, but failed to meet ambitious goals for improvement in cost and access.⁵⁴ In budget year after budget year, spending on social infrastructure lagged other categories of spending. But recently, several new reforms have been initiated, including a number of major changes launched in 2009 aimed at establishing safe,

affordable, and effective basic healthcare by 2020. However, the continued issues of cost, availability, and effectiveness of healthcare in China may explain why healthcare policy is viewed as a disadvantage according to Chinese executives participating in the study.

Immigration

Immigration policy as well as China's internal migration policy is also an area identified by Chinese executives as a current competitive disadvantage within their country. Until recently, the Chinese cultural norm of never leaving one's home region or province did not generally impact the needs of business. Indeed, historically, China's efficient administrative and tax system was rooted in a largely immobile population, bound to such highly developed infrastructure as large complex irrigation systems and massive terraced wet fields for rice.

But as China grew as a global player and consumer market, a more comprehensive policy was needed. The traditional *hukou* registration policy was significantly eased, allowing as many as 100 million workers to move in and out of cities as employment opportunities arise. However, as Chinese policy-makers continue to tie household registration to social benefits, medical care, and education, internal migration in China is still viewed as more complex and difficult than that of Western countries.⁵⁵ Additionally, the number of illegal immigrants entering China from Vietnam, Russia, and North Korea seeking higher wages is steadily increasing, causing a strain on local governments, healthcare, and infrastructure.

Yet immigration is critical to China in order to attract foreign expertise and build its economy. Open and flexible immigration policies are a hallmark of fast-growing, highly competitive environments, from Silicon Valley to London to Hong Kong. To this end, after fully opening to foreign tourists in 1995, Beijing lifted restrictions on foreigners' accommodation

in 2003 and allowed them to choose residential places freely. Since 2004, after the Measures for the Administration of Examination and Approval of Foreigners' Permanent Residence in China took force in 2004, the central government has granted permanent residence to foreigners in multiple provinces and municipalities, including remote regions in the northwest.⁵⁶

By October of 2009, however, only 311 foreigners had obtained permanent residence in Beijing. So China is now preparing to overhaul its patchwork of immigration policies with one of the key purposes to attract skilled workers, investors, and particularly "seagulls," a Chinese term that translates loosely as "foreign merchants who work with multinationals and must travel across the world."⁵⁷ These efforts should aid China's manufacturing sector, which will continue to need a steady flow of talent from both inside and outside the country to meet the demands of its growing economy.

Europe

Science, technology, and innovation

Policies that strongly support science and technology and intellectual property protection are seen as significant competitive advantages by European executives participating in the study (see Figure 2b). The European Commission (Commission) has continued to provide policy leadership for research, science, and technology with numerous programs and significant investment aimed at bolstering the region's overall science, technology, and innovation capabilities, known as the 7th Framework Programme (FP). The overall budget dedicated to the program is 521 million euro for the period 2007-2013.⁵⁸

To address concerns about intellectual property and promote mobility within Europe, in 2008 the Commission began programs supporting the careers of Europe's researchers and providing guidance on the management of intellectual property by public research organizations. The EU has also created a Research Executive Agency to implement parts of the FP and help manage researchers' SME-specific activities, and a European Research Council Executive Agency to support investigator-driven frontier research (all these initiatives take place in the broader context of the European Research Area). Additionally, a legal framework for European research infrastructure was adopted in 2009, and, after decades of negotiations, a new level of agreement was reached on how a common EU patent should be designed and regulated.⁵⁹ The patent is aimed at promoting innovation and providing European industry with a better chance of competing in the global market.⁶⁰

In an effort to drive green innovation, in 2009, the Commission also budgeted 5.5 billion euro for more than 3,000 projects addressing such issues as climate change, energy security, food supply, sustainable agriculture, and health.⁶¹ And the enterprise strategic



energy technology plan of the Commission calls for six new European industry-led programs in wind and solar energy, carbon capture storage, grids, bioenergy, and fission as well as the establishment of research-led programs in a European energy research alliance.⁶²

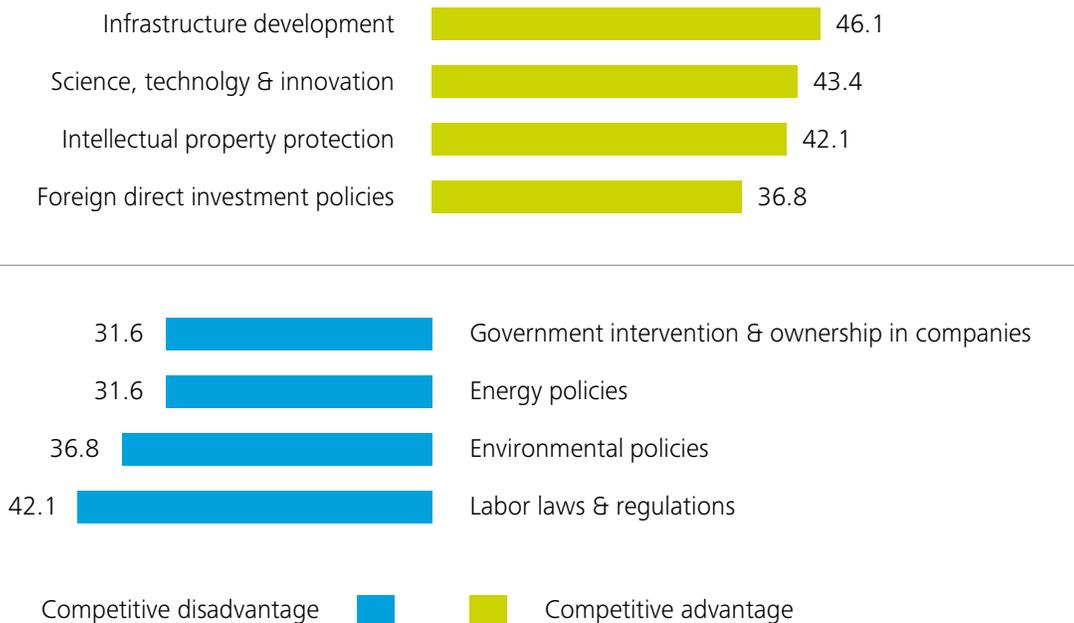
Further demonstrating their commitment to the technology sector, in March 2010, the Commission

launched a new research and innovation strategy that aims at making Europe the world leader for communication technologies. Also, the European Institute of Innovation and Technology—created in 2009 to promote excellence in innovation in Europe through the stronger integration of higher education, research, and business—issued its first call to establish “knowledge and innovation

Figure 2b: Policy advantages and disadvantages for Europe

Europe policy

(percent indicating advantage or disadvantage)



Neutral policies

- Central bank and economic policies
- Anti-trust laws and regulations
- Sustainability policies
- Employee education & assistance
- Economic development
- Technology transfer & adoption
- Trade policies
- Safety & health regulations
- Product liability laws
- Healthcare policies
- Immigration policies
- Corporate tax policies.

Source: Deloitte and US Council on Competitiveness - 2010 Global Manufacturing Competitiveness Index
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communities” in climate change mitigation and adaptation, sustainable energy, and the future information and communication society. And within the framework of the Europe 2020 Strategy, a new research and innovation strategy will be developed by September 2010 and discussed during the Autumn European Council, in order to further develop an “i-economy” and a Europe based on an innovation economy.⁶³

Labor

Despite the region’s vigorous support for technology and innovation, European executives identified labor laws and regulations as one of Europe’s leading disadvantages in terms of competitiveness. The most-cited reason by business leaders for this include high minimum wages, heavy unemployment benefits, and employment protection laws that act as significant barriers—especially in Western Europe—to companies hoping to produce job growth and develop a flexible deployment of skilled labor. In Europe, governments play a very active role in legislating wages and working conditions. The challenges brought on by the recent global economic downturn and the resulting high unemployment has further strained the debate over these issues between senior manufacturing leaders and policy-makers. Politicians are under pressure to protect troubled industries and to safeguard jobs; crafting regulations that encourage rather than hinder competition and growth is increasingly difficult at this time of rapidly changing global competition for manufacturing jobs and on-going economic uncertainty.

Environment and energy

In addition to labor laws and regulations, both environmental and energy policies were identified as competitive disadvantages in Europe by respondents. The far-reaching nature of the former versus the far-too-fluid nature of the latter are considered the main reasons for this view.

As noted, environmental policy is one of the most far-reaching areas of EU legislation, with the EU now considered as a pioneer in the area of environmental affairs. Advocates of EU policy cite the global nature of the threat to the environment, requiring a response on an international scale, and that the EU should play an important role in setting this agenda. Similarly, policy supporters argue that the EU’s commitment to environmental protection provides guidelines for other countries to adopt similar measures and that the policies are one area where there is a great deal of public support for action across Europe.

However, some critics of EU environmental policy argue that the cost of complying with regulations makes European businesses uncompetitive, particularly in front of increased competition from countries such as China and India, which do not have such strict environmental rules. It has also been argued that the amount of greenhouse gas emissions businesses are allowed to produce under the EU’s Emission Trading System (EU ETS) has been set too high, leaving them little incentive to cut emissions to meet the EU’s wider targets. The cost of compliance for the ten new member states has been estimated at 100 billion euro, with EU funding covering only 4 percent of this sum.⁶⁴

Energy policy is also viewed as a disadvantage by the European executives participating in the study. At issue here appears to be the EU member states’ scattered approach to energy policy and the attempt to remedy this in the European Council’s Energy Plan for Europe (EPE), proposed in April 2007.⁶⁵ With the EU importing 50 percent of its oil and gas, rising to 70 percent by 2030, the EPE sought to address energy access and security. Priorities under the plan included a common energy foreign policy; creating an internal market for energy; guaranteeing security of supply; promoting the use of renewable energy; and promoting research into energy technology. In essence, the plan aimed to negotiate energy more

effectively as a united bloc, while diversifying supply and promoting competition to ensure security and sustainability of energy supplies.⁶⁶

However, strong arguments have been made against negotiating a common energy policy in Europe. Access and sources of energy supply is considered by some as too critical to national security and should remain under the control of member states. Also, individual countries' energy needs are seen as too different for a common policy to make sense. Each EU member state has its own energy priorities and uses a different energy mix. This is exemplified by the difference in reliance on the Russian gas supply—with some countries (e.g. Poland and Romania) obtaining almost all of their gas from Russia and other states obtaining very little (the e.g. United Kingdom and Spain)—and the uneven use of nuclear power (14 of 27 member states have nuclear power plants). Individual countries like Germany and Sweden have had very effective national policies that incentivize investment in non-fossil energy sources and aid in the development of new technologies and the manufacturing to support those technologies. In contrast, other countries are too distracted right now with financial woes to contemplate any meaningful energy policy initiatives.⁶⁷

As such, energy policy among the EU states continues to be uneven. For example, the EU Commission's Natural Gas and Electricity Directives liberalized—that is, introduced competition into—the energy sector, but have been frustrated by the more protectionist member states. A report by the Commission in January 2007 criticized several members for failing to separate ownership of energy production and distribution, thereby restricting competition.⁶⁸

Energy security is also an issue. This was highlighted in the past few years by Russia's periodic cancellation of the flow of natural gas into the Ukraine and

Belarus due to payment disputes. As these countries act as transit states for natural gas flow via pipelines to many European countries, the Ukraine and Belarus drew off natural gas for their own use, spurring supply crises downstream in western and southeastern Europe⁶⁹.

Though the Lisbon Treaty in 2007 emphasized "solidarity" on energy policy, the problem was not solved and Russia again stopped the flow of gas into the Ukraine in 2009. Continued Ukrainian withdrawals significantly reduced the supply to 18 EU states. In April 2010 the new government of Ukraine reached a comprehensive agreement with Russia signing a treaty obtaining lower future gas prices and resolving the issue⁷⁰. But this was not before an EU-U.S. Energy Council was established to strengthen cooperation on energy security and supply between the EU and the United States in 2009.⁷¹

To make matters worse in terms of energy policy, there is a varying commitment by member states to cleaner fuels and setting standards for lower carbon emissions. At a summit in March 2007, the European Council agreed to a binding 20 percent target for the use of renewable energy by 2020. However, no decision has been made as yet on how to share the burden.⁷² Additionally, the EU's target for biofuels to provide 10 percent of road fuel by 2020 has been fiercely criticized. In July 2008 the World Bank publically criticized the biofuels target for causing a 75 percent increase in global food prices. The Commission has also estimated that achieving a 20 percent share for renewable energy will cost about 18 billion euro per year, if oil costs US\$48 a barrel in 2020.⁷³

The overall climate and energy package—often referred to as the 20-20-20—is also considered problematic. The package, which came into force in April 2009, seeks to reduce greenhouse gas emissions by at least 20 percent from 1990 levels;

to increase the share of renewable energy sources in total energy consumption to 20 percent ; and to save primary energy consumption of 20 percent against a “business as usual” scenario. The package is complemented by two further legislative acts agreed to at the same time: a regulation requiring a reduction in CO2 emissions from new cars, and a revised directive requiring fuel suppliers to reduce greenhouse gas emissions from the fuel production chain.⁷⁴

Critics argue that the 20-20-20 package is a politically neat but economically inefficient set of targets and that the “20” in all the targets is unlikely to be justified by the underlying costs and benefits. Critics also note that the package doesn’t address key issues, including a long-term price of carbon; an approach to base-load technologies (notably nuclear power and coal and natural gas power plant carbon capture and sequestration); and long-term funding for R&D. And, they argue, there is little account taken of the implications for security of supply of the main climate-change targets. Finally, critics point out that the package may credibly address climate change but not the totality of energy policy that is needed for a competitive Europe.⁷⁵ Most importantly, in the view of some observers, energy policies such as these have failed to deliver the efficient and fluid electric market that was envisioned for and is needed by Europe.

United States

Intellectual property and technology transfer, adoption, and integration

Executives surveyed with businesses operating in the United States consider intellectual property protection laws and technology transfer, adoption, and integration policies as contributing significantly to U.S. competitive advantage in manufacturing (see Figure 2c). U.S. policy-makers recognize that protecting American intellectual property—whether it is trademark protection for a new

brand that distinguishes the high quality of an American company’s goods or services from its competitors or patent protection for the latest technological innovation—is critical to ensuring American companies can compete in the global environment.⁷⁶

Strong intellectual protection not only encourages innovation, it provides the level of confidence in an economy needed to attract foreign investment and spur technology transfer. This has been shown in a number of studies looking at the relationship between intellectual property, especially patents, and development.⁷⁷ Specifically, using data from U.S. multinational firms, a 2005 report on intellectual property rights (IPR) states that improvements in IPR regime result in increased technology transfers by multinational enterprises. The authors show that royalty payments for the use or sale of intangible assets made by affiliates to parent companies increase in the wake of strengthened IPR regimes.⁷⁸ The results of this report, as well as the findings of prior research, are highly consistent with this competitiveness study, which indicates a linkage between stronger intellectual property rights (IPR) regime and competitiveness. The U.S. executives surveyed in this study clearly consider strengthened IPR and technology transfer policy a boon to their competitiveness, as these policies increase royalty revenues and provide incentives for further investments in research and development.

The United States also has a strong tradition of technology transfer and adoption. As early as 1945, Vannevar Bush emphasized the importance of basic research to a strong economy in “Science: The Endless Frontier,” an influential report prepared for President Franklin D. Roosevelt.⁷⁹ And in 1980, the U.S. Congress passed the landmark Bayh-Dole Act⁸⁰, a key piece of legislation enabling technology transfer. In this law, Congress determined that private (not government) ownership of inventions, motivated by the prospect of financial gain, would

lead to commercialization of federally funded inventions. In 2002, *The Economist* declared that the Bayh-Dole Act was probably the most inspired piece of legislation in America over the past half-century. The article further stated: "More than anything, this single policy measure helped to reverse America's precipitous slide into industrial irrelevance".⁸¹ Today, U.S. academic institutions, including the national laboratories, have become focal points for economic

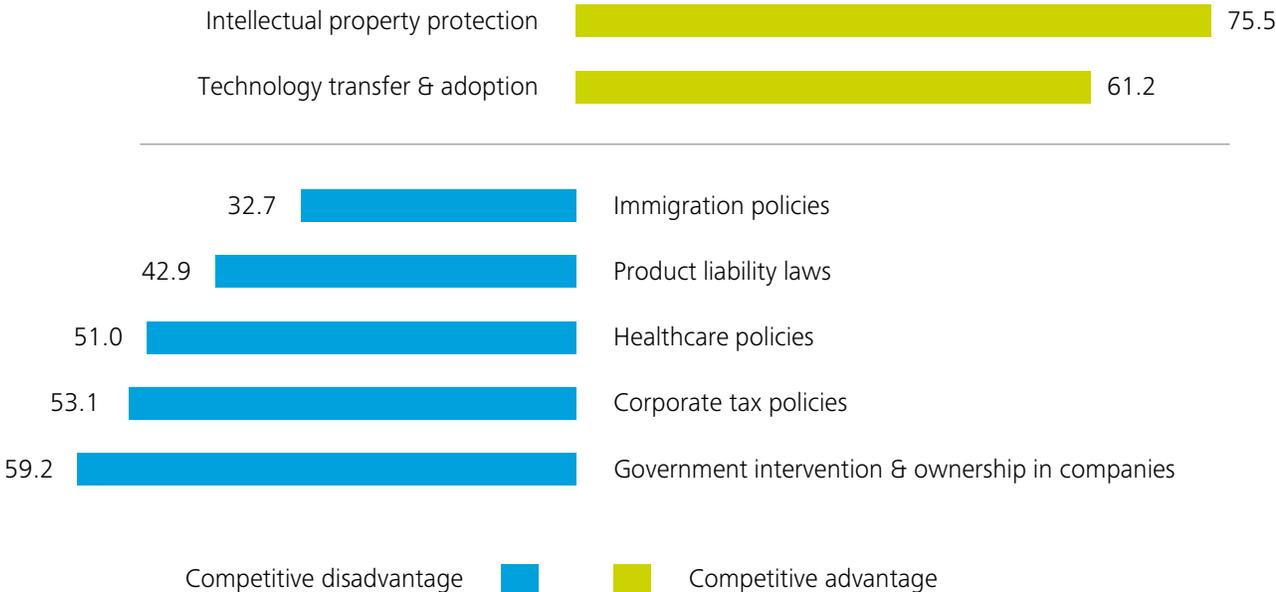
development. Most U.S. universities have established technology transfer programs and partnerships with corporations to jointly fund research and commercialization of next-generation technologies.

The America COMPETES Act also confirms U.S. support of research and development. The goal of the act is to keep basic research budgets of key science agencies on a 10-year doubling path by

Figure 2c: Policy advantages and disadvantages for US

U.S. policy

(percent indicating advantage or disadvantage)



Neutral policies

- Infrastructure development
- Science technology and innovation
- Central bank and economic policies
- Anti-trust laws and regulations
- Economic development
- Sustainability policies
- Employee education & assistance
- Trade policies
- Safety & health regulations
- Environmental policies
- Energy policies
- Labor laws and regulations
- Foreign direct investment.

Source: Deloitte and US Council on Competitiveness - 2010 Global Manufacturing Competitiveness Index ©Deloitte Touche Tohmatsu, 2010

reauthorizing programs in key U.S. departments: the U.S. Department of Energy's Office of Science, the single largest supporter of research in the physical sciences in the U.S.; the National Science Foundation, which supports fundamental research and education in all non-medical fields of science and engineering; and the Core Programs of the National Institute of Standards and Technology, which conducts research to advance the nation's technology infrastructure in support of American industry.⁸² President Obama has also proposed a goal for the United States to invest more than three percent of GDP in public and private research and development. Another program, Improving America's Science, Technology, Engineering and Math (STEM), also demonstrates a key educational priority for the U.S. government.⁸³

The focus on revitalizing science and technology research using the COMPETES act, continued emphasis on commercialization and transfer of technologies from national laboratories and research institutions—supported by a strong IPR regime—and emphasis on STEM education is expected to provide the United States with the necessary impetus to hold on to its hallowed position as an innovative nation. These are some of elements that likely caused U.S. executives participating in this study to identify these policy areas as providing strong competitive advantage.

Government financial intervention and ownership in companies

Government financial intervention and ownership in companies was at the top of the list of policy disadvantages identified by U.S. manufacturing executives surveyed. It is interesting to note that the U.S. government did intervene to bail out some high-profile manufacturing companies as well as many banks and insurance companies during the economic crisis. However, on average, executives do not consider it to be a policy trend that benefits

business over the long term. The debate around “too big to fail” had strong arguments on both sides of the issue. Critics have argued that such help rewards failure and penalizes success, hinders competition, creates unfair disadvantage to an ailing company's competitors and their shareholders, and creates a cycle, further leading the government deeper into private business.⁸⁴

Supporters of aid argue that the United States cannot afford the failure of a company whose impact would send the country and likely the world into economic depression and result in the unemployment of tens of thousands of workers. While further government bailouts and intervention is not foreseen at this time, it was still identified as a key policy disadvantage by senior U.S. manufacturing executives.

Tax

Non-production expenses add almost 18 percent to U.S. manufacturers' costs relative to its major trading partners. Thus a domestic manufacturer, on an average, spends 18 percent more on taxes, natural gas, employee benefits, torts, and pollution abatement than a foreign competitor making a similar product. Although the burden still remains high, it is sobering to note that the gap closed from 31.7 percent in just two years.^{85,86}

The United States now has the second-highest corporate tax rate among its major trading partners, only lesser than that of Japan. Critics of U.S. corporate tax policy argue that tax rates have remained virtually unchanged for the past two decades, while major competitors have made efforts to lower theirs.⁸⁷ They further argue that high-tax environments discourage capital investments and erode competitiveness. “Current policy debates in Washington are focused on raising taxes and reinforcing the current system rather than on developing new approaches to business taxation. The tax increase proposals put forward by the

Obama administration reflect ideas that have been discussed since the 1960's and have been unacceptable to the U.S. Congress in the past.⁸⁸ This continuing debate over proposed patches to the current system means that businesses, both domestic and international, perceive the U.S. tax code as inherently unstable and unreliable. The result is that incentives are effective in shaping short-term behavior but blunted in their long-term impact".⁸⁹ Thus, executives that are critical of the U.S. tax system consider the current tax burden to be an impediment to the competitiveness of their companies operating within the United States. While there are certainly many complex and detailed arguments that can be made on both sides of the U.S. tax policy debate, this perception of a burdensome tax system can explain why U.S. manufacturing executives may have identified tax policy as a disadvantage.

Healthcare

U.S. manufacturers have long argued that rising healthcare costs were a huge burden for their businesses. However, executives in the United States who responded to this study were doing so just as the recently passed Patient Protection and Affordable Care Act (PPACA) was being debated in the U. S. legislature. For this reason, it is not clear whether they were commenting on the state of U.S. healthcare at the time—just prior to the passage of PPACA—or the future of healthcare policies that would be in place after the legislation was enacted. Even so, PPACA's cost and impact remains uncertain, despite intended and unintended results that may have been forecasted. But with its dramatic reforms to the health insurance and delivery systems, PPACA essentially establishes a "new normal" for all stakeholders, and employers and consumers will need to adjust health-related activity and spending.⁹⁰

Despite its changes to the system, the healthcare bill is not perceived as a panacea by many industry

organizations. For example, the National Association of Manufacturers (NAM) President John Engler said that the passage of the PPACA and the "Reconciliation Act of 2010" (H.R. 4872) is "going to increase costs and make it difficult for manufacturers to continue to offer generous health benefits." Furthermore, Engler believes the legislation will stifle manufacturers' ability to grow and create jobs while competing in a challenging global economy.⁹¹

The fact remains that manufacturers believe it will become increasingly difficult for them to compete with companies in countries with lower healthcare costs. The reform legislation that was enacted to help address these concerns impacts every company and will have far-reaching implications and potentially unforeseen consequences.⁹² What is certain, however, is that the status quo in healthcare was no longer sustainable and change was needed. Businesses, government, and the healthcare industry in the United States will now need to work together to resolve issues arising from the legislation for the benefit of all involved.

Product liability

Over the past several decades litigation involving defective products has brought about significant changes in the way manufacturers conduct business and in the way consumer products are regulated. A number of consumer advocates, engineers, public health and safety experts, legal scholars, government agencies, and economists have concluded that product liability laws have played a role in improving product safety. Yet, marginally, U.S. executives participating in this study considered product liability laws in the United States to be creating more of a competitive disadvantage for their businesses than either an advantage or having a neutral impact. This may be borne out by recent research that shows the case for product liability is weak. Empirical studies of several commonly sold products fail to find conclusive evidence on the effect of product liability

on the frequency of product accidents. On many occasions, the costs associated with product liability can offset the potential benefits. For example, transferring a dollar to a victim of a product accident via the liability system requires more than a dollar on average in legal expenses. Also, even in the absence of product liability, companies may be driven by market forces to enhance product safety as sales may fall if products harm consumers. Thus, stringent product liability laws may not be required for products where the market forces are relatively strong and may be necessary for products where market forces are weak.⁹⁴

Immigration

The lowest-ranked policy disadvantage identified by U.S. executives, but one that nonetheless marginally made the list of disadvantages, was related to immigration. Immigration policy has long-lasting effects on a country's competitiveness, security, and productivity. For the United States, which has an unprecedented number of immigrants, policies in this area definitely have to balance multiple objectives, such as protecting the country's current and future economic interests, and promote long-standing social goals while at the same time improving the government's ability to enforce the rule of the law and ensure national security.

Immigration always has two opposing forces working for and against it: its necessity to keep up the pace of job creation, filling skill-gaps where required on the one hand, and its potential negative impact in terms of driving down wages, limiting work opportunities for certain sections of the native-born population, and straining social support systems on the other hand. Past studies have suggested that immigrants are expected to contribute significantly to the net increase of workers in the United States.⁹⁵ Moreover, the immigrant population constitutes the workforce for both high-skilled as well as low-skilled jobs. The

science and engineering fields, for example, have a high concentration of immigrants in the United States. At the same time, 11 out of 15 occupations projected to have the largest absolute job growth in the future require less than a bachelor's degree. Around 40 percent of the immigrant populations who are high school graduates constitute the above job categories.⁹⁶

Business leaders, often in the manufacturing sector, that are critics of U.S. immigration policy tend to focus on the obstacles they see created by current policies that limit the vast quantities of researchers, scientists, engineers, and skilled workers required to help them compete on the basis of affordable, talent-driven innovation. They see the U.S. system as one that makes it easy to enter the country to take advantage of the world-class U.S. higher education system but just as easy to leave. And often exit is forced on some of the highest talent and most sought-after individuals due to limited quotas for visas, work permits, and the like.

Despite the economic benefits that immigrant populations bring in, there is widespread belief that immigrants take away jobs from American workers. There is no conclusive evidence regarding the effects of immigrants on job opportunities of native-born Americans, but, in some sectors of the economy, immigration can have a negative impact on job opportunities and wage scales of native-born workers.^{97,98} But as skill requirements in manufacturing increases, as well as opportunities for service jobs tightly linked to manufacturing enterprises and their ecosystems, the impact of immigration on U.S. manufacturing competitiveness in the years to come may be assessed in a different light.

Manufacturing competitiveness in the 21st century

A new competitive landscape

The 2010 Global Manufacturing Competitiveness Index provides a glimpse of what competitiveness looks like now and in the future. The responses of the executives who participated in the study not only provide perspectives on what drives competitiveness but also supply what could be termed a blueprint for advancing competitiveness for both businesses and nations.

Talent, specifically talent that drives innovation, trumps all when it comes to global competitiveness at manufacturing companies—well ahead of factors that have more traditionally been associated with competitive manufacturing. Having a steady supply of highly skilled workers, scientists, researchers, and engineers is seen as the top driver of the manufacturing competitiveness of nations.

However, the need for lower costs still remains vitally important. Competitive costs for labor, materials, and energy—key factors of production—are still deemed critical to a nation's manufacturing competitiveness. Structural costs as well—those associated with taxes, legal, regulatory and compliance, labor, environment, health, and safety—must all be competitive so as not to place a company or a nation at a disadvantage. Manufacturing executives participating in this study made it clear through their responses that nations with lower costs will continue to be attractive locations for manufacturing and will have a competitive edge, all things being equal.

But while lower costs may get a nation to the table as a viable global manufacturing competitor, these findings drive home the point that having a capacity for innovation driven by a plentiful and talented workforce at all levels is what will ultimately differentiate the long-term winners in this race. This assertion is amply demonstrated by developing nations'—China, India, and Korea—ascension to the top spot in the index. Unlike their less successful emerging market counterparts, they entered the

competitive game through lower-cost labor, but rapidly moved up the manufacturing value chain toward high-end and highly technical products.

Energy also emerged as key, both from a cost and availability standpoint as well as a driver of sustainability agendas. These agendas must successfully intersect environmental, sustainability, and energy policy implementation with the innovation and technology development and deployment that will drive new products and new markets and job creation in the 21st century. Sustainability in the manufacturing sector could very well be the catalyst for a manufacturing renaissance in the United States, Japan, and Germany, whose index values imply a steady erosion in manufacturing competitiveness. And the sustainability agenda will provide a significant opportunity for emerging economy nations to become significant, and, perhaps, dominant, in the 21st century competitive battle that is underway.

The competitive paradox

Amid the struggle to remain competitive that is revealed through the responses of manufacturing executives in this study, another striking finding has been uncovered—that of a competitive paradox. Western nations with more democratic, social, and environmental policies are on the decline whereas emerging markets with their large government infusions for manufacturing are on the rise. Within these nascent countries, some manufacturers are even government owned. It is clear that a new model is emerging. Instead of competing supply chain to supply chain, governments, especially in emerging markets, are aggressively and cohesively competing with nations to get to the top of the manufacturing pyramid.

And while declining nations on the GMCI are using conventional world-class manufacturing practices, they are outsourcing their core manufacturing strength—a key link in the innovation equation

of research-design-manufacture-after sales. These factors are synergistic—and with the manufacturing step missing, much know-how is taken out of the equation. It appears that China, India, and Korea are aware of this and pressing their competitive advantage. As for industrialized countries, there is an urgent need to address the larger issues of manufacturing and the supply chains that are built on complex and often incoherent and fragmented patchworks of social, political, and economic systems. As such, there will be a growing tension between free-market capitalism and state-run enterprises, especially when security frictions are involved.

But whatever economic or political system a country is built upon, the fact remains that manufacturing will play a key role in its prosperity. Economies based primarily on services will be second tier; and services not built largely on the back of a vibrant manufacturing sector and the breadth and depth of the ecosystem that grows from manufacturing will not lift or sustain a nation's economy. But manufacturers cannot go it alone. Governments must play their part by developing policy and national manufacturing strategies that are collaborative, integrated, focused, and effective.

New paradigms, new positioning

The epicenter for manufacturing continues to shift to emerging markets and Asia in particular. What had been the world order in the second half of the late 20th century is giving rise to new manufacturing paradigms. But even with the rise of China, India, and Korea and the overall competitive repositioning of nations, the United States, Germany, and Japan are still formidable and very competitive.

It is becoming clearer, though, that for nations competing to gain the prosperity and wealth-building a strong manufacturing industry brings, changes are taking on an exponential rather than a linear dimension. Decisions and actions are being made daily in a non-stop, 24-hour-a-day, seven-day-a-week stream of constant movement. And those decisions and actions taken today, and over the next five years, by both governments and businesses, will dramatically alter the competitive picture 10, 20, and 30 years from now.

As such, leading manufacturing businesses are competing fiercely in open markets to create and sustain the most competitive manufacturing enterprises they can. For them, the world is wide-open and full of possibilities, whether they are in developed nations or emerging markets. Policy-makers must fully engage, therefore, so they don't miss the chance to capture these same opportunities. For nations hoping to achieve supremacy in manufacturing, there is no one answer. But new thinking, assertive strategies, and decisive actions that foster and accelerate the capacity for innovation while creating a stable and competitive cost environment that attracts investment and encourages success will likely differentiate the winners from the losers.

Appendix

Appendix Table A1: Components of competitiveness drivers

Rank	Component	Drivers	Score (Component)
1	Quality and availability of labor force	Talent-driven innovation	10.00
5	Quality and availability of scientists, researchers and engineers	Talent-driven innovation	8.85
6	Capacity for manufacturing innovation	Talent-driven innovation	8.82
2	Cost competitiveness of materials	Cost of labor and materials	9.06
3	Cost competitiveness of labor	Cost of labor and materials	9.05
21	Availability of raw materials	Cost of labor and materials	4.90
47	Cost competitiveness of energy	Energy cost and policies	8.23
15	Energy policies	Energy cost and policies	6.40
4	Health of economic and financial system	Economic, trade, financial and tax systems	8.96
8	Tax system	Economic, trade, financial and tax systems	7.45
11	Trade Policy	Economic, trade, financial and tax systems	7.08
18	Central bank and economic policies	Economic, trade, financial and tax systems	5.55
9	Quality of physical infrastructure	Quality of physical infrastructure	7.15
16	Government's emphasis on investments in manufacturing	Government's investments in mfg and innovation	6.28
13	Government's investments in science, technology and engineering	Government's investments in mfg and innovation	6.96
10	Legal and regulatory environment	Legal and regulatory system	7.13
14	Regulatory compliance costs	Legal and regulatory system	6.48
12	Labor laws and regulations	Legal and regulatory system	7.05
19	Intellectual property protection and enforcement	Legal and regulatory system	5.24
17	Availability of local qualified supplier base	Supplier network	5.91
20	Size of local market	Local business dynamics	5.24
22	Intensity of local competition	Local business dynamics	2.79
23	Quality and availability of healthcare	Quality and availability of healthcare	1.81
24	Collaboration between public and private sector	-	1.41
25	Antitrust laws and regulations	-	1.00

Source: Deloitte and US Council on Competitiveness - 2010 Global Manufacturing Competitiveness Index
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The 2010 Global Competitiveness in Manufacturing CEO Survey is part of a broader initiative to learn firsthand how manufacturing CEOs view competitiveness around the world. One aim was to garner the perspectives of key decision makers into a single index—one that captures their collective knowledge and insights regarding the relative manufacturing competitiveness of nations now and in the future. A second objective was to better understand the important drivers that contribute to country competitiveness and the role government policies play in supporting or advancing a manufacturing agenda. The survey was divided into three sections:

1. Business confidence and current environment
2. Manufacturing competitiveness
3. Demographics.

Section 1 asked executives about the impact of developments in the financial markets on their companies' performance, their expectations regarding the trade and investment environment, their expected economic scenarios over the near term, and the time frames in which they anticipate that their company and overall industry will recover from the economic downturn.

In *section 2*, the survey asked executives to rate the relative importance of components that drive the competitiveness of a country's manufacturing sector and then asked them to rank 26 countries on their overall manufacturing competitiveness today and five years from now. Respondents were also questioned about which government policies and regulations they view as either an advantage or disadvantage to their companies' competitiveness in their home country.

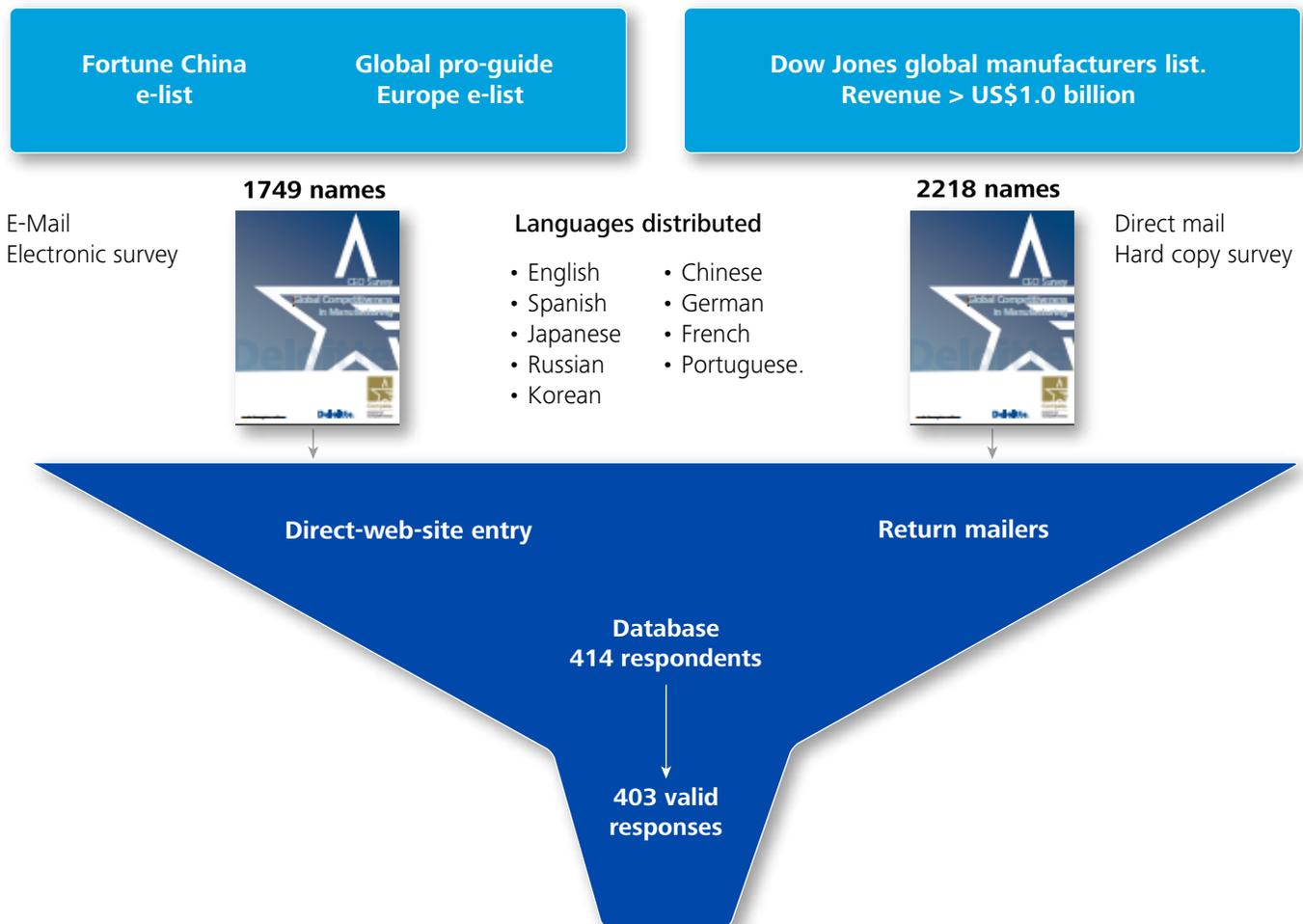
Section 3 profiled the respondents' companies, including location of their headquarters and business units, total annual global revenues (in US\$), global profitability over the past three years, the primary industry their companies belong to, and the industry that provides the greatest source of revenues for their company.

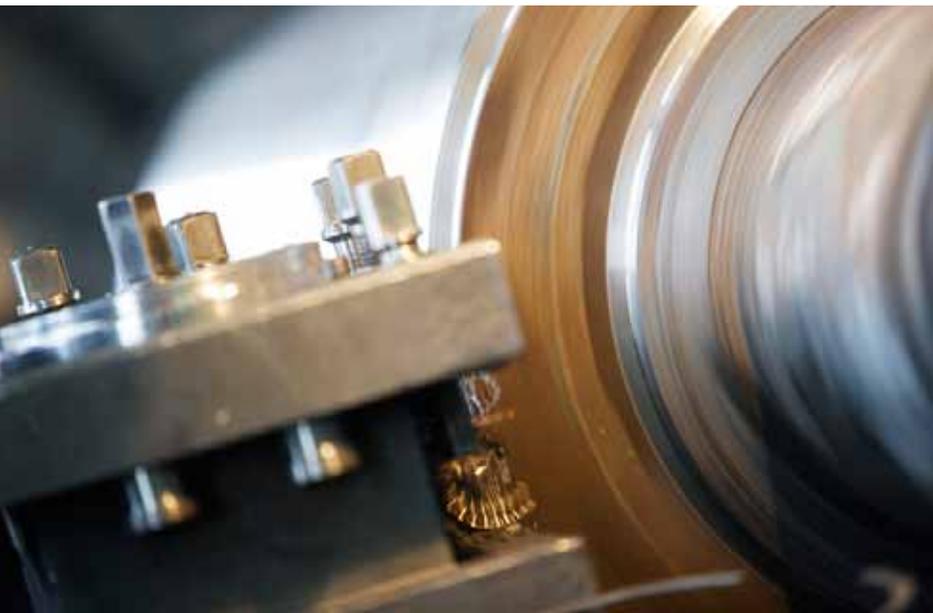


Survey administration and respondents

The Global Competitiveness in Manufacturing CEO Survey instrument was developed in conjunction with subject-area experts at leading companies, Deloitte, the Council on Competitiveness, and Clemson University. Executives surveyed were obtained from three sources: Dow Jones Global Manufacturers, Global Pro-Guide Europe, and Fortune China (see Appendix Figure B1).

Appendix Figure B1: Methodology – Survey distribution





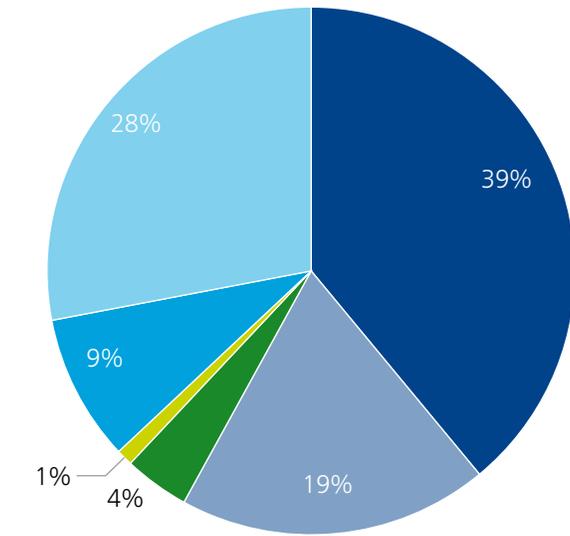
The final survey instrument was translated (and cross-translated) into nine languages and administered through two channels—direct mail and online. This process yielded 414 useable surveys, of which 403 were deemed valid for analysis. Eleven surveys were dropped as they were received from predominantly service organizations.

The respondents' profiles are provided in Appendix Figures B2 and B3. About 39 percent of the respondents are from Asia; 28 percent from the United States and Canada; 19 percent from Europe; 9 percent from Mexico and South America; 4 percent from Australia; and 1 percent from Africa (see Figure B2). The executives also represented companies spanning a wide range of revenues, from less than US\$100 million to over US\$10 billion annually. Consistent with the relatively high percentage of respondents from the developing countries of Asia, South America, and Africa, about 50 percent had company revenues less than US\$100 million. On the other end of the spectrum, about 27 percent reported revenues greater than US\$1 billion.

The respondents represented 23 different industry sectors, which were broadly classified as aerospace and defense, automotive, consumer products, industrial products, pharmaceutical, process, and technology (see Figure B3). Respondents were all senior executives, with the majority (47 percent) holding corporate titles of chairman, CEO, or president; about 38 percent were general managers or high-level directors.

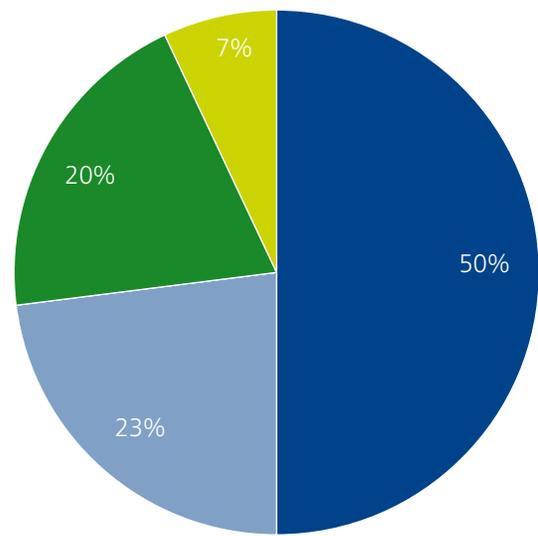
Appendix B2: Profile of respondents by region and revenue size

Respondents by region



- Asia
- Australia
- Mexico and South America
- Europe
- Africa
- USA & Canada

Respondents by revenue size

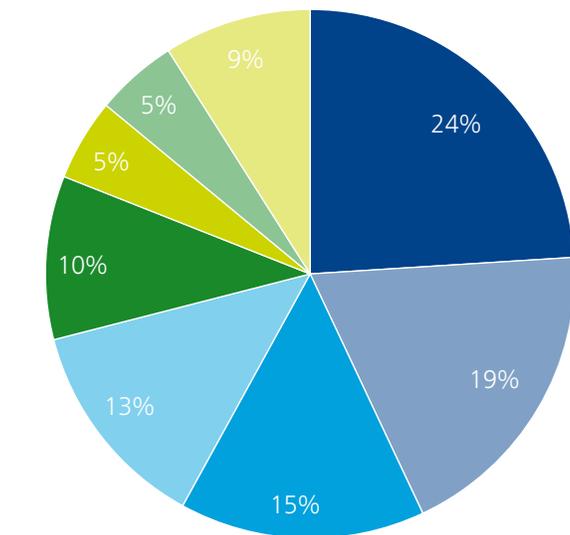


- Less than 100 million USD
- 1 billion to 10 billion USD
- 100 million to 1 billion USD
- Greater than 10 billion USD

Source: Deloitte and US Council on Competitiveness - 2010 Global Manufacturing Competitiveness Index
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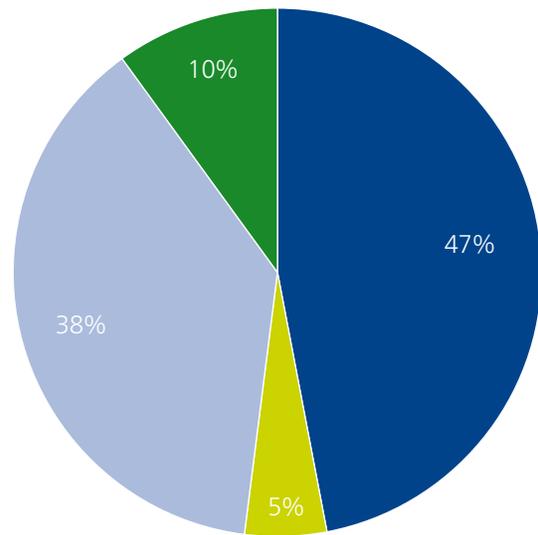
Appendix B3: Profile of respondents by manufacturing sector and title

Respondents by sector



- Process
- Automotive
- Technology
- Pharmaceutical
- Industrial products
- Consumer products
- Aerospace and defense
- Other

Respondents by title



- Chairman, CEO & President
- COO & CFO
- GM, VP, Managing Director, Director
- Other

Source: Deloitte and US Council on Competitiveness - 2010 Global Manufacturing Competitiveness Index
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Weighting heuristics

The executives surveyed are from companies with different firm sizes and with varied presence in different countries and geographic regions. In determining the weights for the 2010 Global Manufacturing Competitiveness Index, respondents were directly asked to rate the competitiveness of 26 countries. Prior research also showed firm size to be an important factor for firms' overseas production decisions.^{99,100} Therefore, a weighting scheme was considered that accounted for both global experience and firm size. Hence, the heuristic applied different weights to companies according to a proxy measure of their overall global experience. Companies with more global experience, as demonstrated through physical presence with operations, sales and/or distribution in multiple geographic regions, were deemed to have more global experience and received a higher weight for their responses (see Appendix Figure C1). Thus, a manufacturer's physical presence was considered a reasonable demonstration of global experience and resulted in a higher global experience weight. Those manufacturers with presence in only one region received the lowest global experience weight, whereas presence in four regions received the highest weight.

Out of the 403 respondents, company-identifying information was available for 274, with information about the firm's physical presence in different geographic regions available for 201. Using secondary sources, the presence across geographic regions for these 201 respondents was documented. A company that has presence in 4 regions received a weight of 1; a presence in 3 regions, a weight of 0.75; a presence in 2 regions, a weight of 0.50; and a presence in only 1 region, a weight of 0.25. For the remaining 180 respondents, for whom the company names were not available, the weight which is closest to the average weight of the revenue category to which those companies belong was used (see Appendix Figure C2). The resulting global experience weights were used to calculate the 2010 Global Manufacturing Competitiveness Index overall for each country—now and in five years—and for the components and drivers of manufacturing.

Appendix C1: Weighting of responses for degree of global experience

- A weighting system was applied to the responses to adjust for the differences in the perspectives of companies and executives with different degrees of global experience
- Companies with more global experience, as demonstrated through presence with manufacturing operations and sales, service and distribution offices in multiple geographic regions, were deemed to have more global experience and received a higher weight for their responses.
- Prior research also found company size to correlate strongly with manufacturing operations in multiple regions. Larger manufacturers as measured by total annual revenue tended to have physical presence in multiple geographic regions
- As a result, the larger more globally experienced manufacturing organizations had a higher impact in defining the index rankings for both the most competitive countries as well as the key drivers and components of manufacturing competitiveness
- The impact of applying this weighting also resulted in less variation from region-to-region regarding both the drivers and components of manufacturing competitiveness and the country ranking/index of most competitive countries, suggesting that large globally experienced organizations have a more common perspective with each other, regardless of the location of their headquarters, than they do with their less experienced and often smaller counterparts located in their home countries.

Four geographic regions are: Asia, Europe, Mexico and South America, United States and Canada

Presence in geographic regions	Weight
1	0.25
2	0.50
3	0.75
4	1.00



Weights were calculated for all 201 respondents who provided names of their companies and whose details of locations in different geographic regions were available from public sources of information.

For the remaining 180 respondents whose company names or location information was not available, we used the weight which is closest to the average weight of the firm revenue size group to which those companies belonged. Twenty-three respondents that did not provide either name or revenue and were dropped from the index calculation.

Appendix C2: Distribution of respondents by global presence and revenue size

Presence in regions	Less than 100 million USD	100 million to 500 million USD	500 million to 1 billion USD	1 billion to 5 billion USD	5 billion to 10 billion USD	10 billion and above USD
1	50	14	8	11	3	6
2	7	9	5	7	3	1
3	4	2	3	7	4	5
4	2	1	7	15	4	23
Total	63	26	23	40	14	35

Source: Deloitte and US Council on Competitiveness - 2010 Global Manufacturing Competitiveness Index
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Note: This table shows distribution of 201 respondents for which company name and location information were available. The four regions considered for our analysis are Asia, Europe, USA and Canada, Mexico and South America.

2010 Global Manufacturing Competitiveness Index development

The survey responses on importance of drivers for manufacturing competitiveness and the current and future ratings of countries in terms of manufacturing competitiveness were collected using 10-point, self-anchoring scales, with “1” equaling relatively not important/not competitive and “10” equaling relatively more important/extremely competitive.

For respondents who chose to answer from a parent-company perspective, the location of the parent company headquarters was used; and for those, who responded from the business unit perspective, the business unit location for the purpose of the analysis was considered.

Variation in ratings by geographic regions were also tested for; and it was concluded that raw ratings had a cultural bias, as respondents from Asia, Mexico, and South America tended to rate higher than respondents from Europe, the United States and Canada. Thus, the raw data was normalized following the steps 1 and 2 of the methodology shown on the next page. The steps followed for calculating the importance score of various components of manufacturing competitiveness, after the normalization procedure are explained in steps 2 to 5. Step 6 illustrates the final step of computing the competitiveness score for the drivers, which are derived from the individual component scores. See Appendix Figure C3 as an example for the computation of the GMCI country index, which is derived from a similar computational heuristic.

Below are the details for the procedure used to develop the component and driver indices:

Step 1: For each country and each firm-size category, which is captured through the proxy variable of a firm's annual revenues, the overall mean rating was calculated across all observations over the 25 components of manufacturing competitiveness (see Figure A1). The computation is as follows: Let "i" represent the responding country, where executive is located (i=1...30) and "j" represent firm-size category (j= 1...5). Next μ_{ij} is computed as the overall mean of all the components of manufacturing competitiveness for the responding country "i" and firm-size category "j." Similarly, calculations were made for the standard deviation, s_{ij} , also based on the 25 components of manufacturing competitiveness for each responding country "i" and firm-size category "j."

Step 2: Next the data was normalized by computing a standard Z score for each respondent "k":

$$Z_k = (X_{k,m} - \mu_{ij}) / s_{ij}$$

where "m" represents a specific component of manufacturing competitiveness (m=1 to 25).

Step 3: Multiply the Z_k score of each respondent by the global experience weight to obtain the experience weighted z score:

$$Z_{k,wk} = w_k \times Z_k$$

where "wk" is the global experience weight assigned to each respondent, as depicted in Figure C1.

Step 4: Then for each component of manufacturing competitiveness, a normalized, weighted score,

CM_m = sum of Z_{k,wk} over all respondents was calculated.

Step 5: Next, convert CM_m obtained in step (4) into a 1 to 10 scale to get a scaled component score (SCSm), as follows:

$$SCS_m = 1 + 9 * ((CM_m - \min(CM)) / ((\max(CM) - \min(CM))),$$

where min (CM) is the minimum of all the CM_m scores over "m" components of manufacturing competitiveness, where "m" =1...25; and max(CM) is the maximum all the CM_m scores over 'm' components of manufacturing competitiveness, where "m"=1...25.

Step 6: Finally, the final competitiveness driver score was obtained by taking the average of all SCSm, which constitutes each driver (see appendix figure A1 for a list of drivers and their defining components).

A similar approach was followed until Step 5 for calculating the current and future manufacturing competitiveness indices (GMCI) of countries that were rated by the executives, where instead of scores of components of manufacturing competitiveness, a GMCI for each country was obtained. Thus, "m" will represent each rated country (m=1...26), CM_m will be the normalized and weighted score for each country, and SCSm will represent the *scaled country score* (see appendix C3).

Appendix C3: Index creation methodology - A GMCI computation example

Raw rating of countires

Argentina	Brazil	Canada	Mexico	United States	Belgium	Czech	France
3	3	2	2	4	3		2
7	7	6	7	6	7	7	6
2	6	4	5	5	4	6	5
1	10	10	10		7	1	6
6	7	2	5	7	3	3	6
6	7	9	8	10	7	6	10
5	8	6	7	7			
4	6	6	5	8	5	4	6
4	6	8	7	10	5	4	7



Input for normalization by responding country and firm size

Col 1 Responding country	Col 2 Firm size category	Col 3 Mean rating of all countries by each responding country and firm size category	Col 4 Standard deviation of all country ratings by each responding country and firm size category
Mexico	1	6.609	2.373
Mexico	1	6.609	2.373
Mexico	1	6.609	2.373
Mexico	1	6.609	2.373
Mexico	4	6.269	1.485
Mexico	5	4.962	2.537
USA	1	5.317	1.913
USA	1	5.317	1.913
USA	1	5.317	1.913
USA	1	5.317	1.913
USA	2	7.200	0.816
USA	2	7.200	0.816
USA	3	5.675	1.634
USA	3	5.675	1.634
USA	3	5.675	1.634
USA	3	5.675	1.634
USA	3	5.675	1.634
USA	4	5.468	2.234

Source: Deloitte and US Council on Competitiveness - 2010 Global Manufacturing Competitiveness Index ©Deloitte Touche Tohmatsu, 2010

Appendix C3: Index creation methodology - A GMCI computation example...continued

Scores converted to 1-10 scale to give the GMCI index

Argentina	Brazil	Canada	Mexico	United states	Belgium	Czech
1.03	5.41	4.11	4.84	5.84	1.18	4.38

Average normalized, weighted scores (CM_m)

Argentina	Brazil	Canada	Mexico	United states	Belgium	Czech
-0.314	0.142	0.007	0.084	0.187	-0.298	0.035

Normalized, experience weighted Z score for each country ($Z_{k\ wk}$)

Argentina	Brazil	Canada	Mexico	United states	Belgium	Czech
-0.17	0.04	0.25	-0.27	0.25	0.15	0.04
-0.27		0.25	-0.17	0.25	0.04	0.04
-0.49	0.36	0.04	-0.17	-0.38	-0.27	0.25
-1.94	0.59	0.16	-0.68	0.59	-2.36	-0.68
-2.20	0.49	0.49	-0.85	-0.18	-0.85	-0.85
-1.17	-0.77	-0.38	0.80	1.20	-0.77	1.59
-0.04	-0.04	-0.17	0.09	-0.17	-0.17	-0.17
0.09	0.35	0.35	0.35	-0.30	-0.30	-0.30
-0.04	0.35	-0.04	0.48		-0.17	0.35
-0.52	-0.12	0.27	-0.52	0.66	-0.52	-0.91

(Raw data - Mean(Col 3)) /std dev (Col 4)

X

Company global experience weight (W_k)

Calculation of policy scores

The policy advantages and disadvantages were determined for the United States, China, and Europe. These questions were collected using five-point, self-anchoring scales, where scale “1” equaled significant disadvantage; and “5” equaled significant advantage.

For calculating the policy scores for the United States, China, and Europe, respectively, the steps mentioned below were followed:

Step 1: Calculate an overall mean rating across $n=20$ policy variables in the survey for the specific country (e.g., U.S.)

Step 2: For each respondent, calculate mean difference scores for each policy variable, which is the difference between each of the raw rating scores and the overall mean rating scores in Step 1.

Step 3: For each policy variable, take the average of the mean difference scores for each respondent obtained in step 2, PS_i , where ‘i’ is a policy variable.

Step 4: Convert the average mean difference scores to a 1 to 5 scale using the formula below to get the scaled policy score:

$$SPS_i = 1 + 4 * ((PS_i - \min(PS)) / ((\max(PS) - \min(PS))))$$

where $\min(PS)$ is the minimum of all the PS_i scores over the “n” policy variables, where n equals 1...20; and $\max(PS)$ is the maximum of all the PS_i scores over “n” policy variables, where n equals 1...20

The policy variables with scores above four were considered, based on the calculation in step four above, as having relative advantage to the manufacturers; and those between one and two, as having relative disadvantage to manufacturers.



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2010 Global Manufacturing Competitiveness Index study

The 2010 Global Manufacturing Competitiveness Index study is an initiative led by The U.S. Council on Competitiveness and Deloitte Touche Tohmatsu to learn how CEOs view the competitiveness of the manufacturing industry in different countries around the world. A global CEO survey, which generated responses from 403 CEOs and senior executives, offers perspectives on the most important factors that drive manufacturing industry competitiveness. The global survey results also helped to create a unique Global Manufacturing Competitiveness Index ranking the relative manufacturing industry competitiveness of countries and reflect how executives perceive this may change over the next five years. The in-depth study seeks to define excellence in manufacturing and draw out the implications for manufacturers in terms of the competencies required to develop and sustain an edge in a new competitive landscape. CEOs and executives were also asked to provide their views of the global economic conditions and government actions that can bolster competitiveness in the manufacturing industry.

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