

# DOWNLOAD PDF MANUFACTURING, TECHNOLOGY AND ECONOMIC GROWTH

## Chapter 1 : Global Manufacturing Economic Update | NAM

*After analyzing numerous economic and non-economic variables, the author manages to identify a common denominator that was always present when there was growth and absent when there was stagnation. A strong causality linkage is established between this common denominator and growth.*

Reconstruction in Practice Growth of Manufacturing American industry grew phenomenally in the first half of the nineteenth century. A series of tariffs enacted by Congress protected manufacturing, particularly textile milling, from foreign competition. As manufacturing work sites were gradually relocated from the home and small workshop to the factory, the makeup of the labor force changed. The number of artisans and craftsmen declined, and reliance on semiskilled or unskilled workers, including women, to operate machines increased. Just as in agriculture, advances in technology helped boost manufacturing production and increase efficiency. Indeed, the manufacture of such agricultural inventions as the reaper and steel plow became important sectors of the industrial economy. Machines for spinning cotton into thread were developed in Great Britain in the eighteenth century, and how they were built and operated were closely guarded secrets. Although the British prohibited the emigration of anyone with a knowledge of their design, Samuel Slater arrived in the United States from England with the plans in his head. In 1793, he established the first American cotton mill in Rhode Island. Eli Whitney, already famous for the cotton gin, developed machine tools capable of producing parts so precisely that they were interchangeable. Interchangeable parts significantly increased industrial efficiency and cut labor costs. Charles Goodyear developed a process known as vulcanization that made natural rubber stronger. The sewing machine was invented by Elias Howe and improved on a few years later by Isaac Singer. Within twenty years, telegraph lines stretched from coast to coast and ushered in a communications revolution. Combined with improvements in printing, the telegraph was a boon to journalism. The number of daily newspapers in the United States soared from eight in 1800 to nearly four hundred in 1860, and many sold for just a penny. Division of labor meant that a worker performed the task required by one phase of the production, no longer creating the entire product from start to finish. In 1813, the first factory in which spinning and weaving were performed by power machinery all under one roof was established in Waltham, Massachusetts. In Lowell, which was planned and built as a model factory town in 1826, young women made up the majority of the workforce at the mills. The women lived in dormitories or boarding houses provided by the company and worked twelve hours a day, six days a week. Although the women were paid much less than the men, even when doing comparable work, their wages were enough to give them a measure of independence that their mothers and grandmothers never enjoyed. The young women were not a permanent labor force in the mills, however. Most of them worked for only a few years and were gradually replaced by immigrants, mainly Irish men, in the 1840s and 1850s. The cloth produced in New England mills was turned into shirts, pants, and other articles of clothing in smaller factories in New York and Philadelphia. Proximity to raw materials influenced industrial development in other parts of the country. For example, Pittsburgh was a center of the iron industry because it was close to both ore and coal fields, while Cincinnati was an early hub for meatpacking in agricultural Ohio. The development of the factory system produced tensions. Although initially antagonistic toward unskilled workers, the craftsmen often discovered that they were on common ground over such issues as hours, wages, and working conditions. A shorter workday was the principal demand of the early trade unions, and most industries accepted it by the 1850s, with the exception of the New England textile mills.

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## Chapter 2 : Six Reasons Manufacturing is Central to the Economy - Roosevelt Institute

*Manufacturing is the most important cause of economic growth. The growth of manufacturing machinery output, and technological improvements in that machinery, are the main drivers of economic growth. No machinery industries, no sustained, long-term economic growth.*

The rate of growth of GDP per capita is calculated from data on GDP and people for the initial and final periods included in the analysis of the analyst. Determinants of per capita GDP growth[ edit ] In national income accounting, per capita output can be calculated using the following factors: Productivity improving technologies economic history Economic growth has traditionally been attributed to the accumulation of human and physical capital and the increase in productivity and creation of new goods arising from technological innovation. Increases in productivity are the major factor responsible for per capita economic growth – this has been especially evident since the mid-19th century. Most of the economic growth in the 20th century was due to increased output per unit of labor, materials, energy, and land less input per widget. The balance of the growth in output has come from using more inputs. Both of these changes increase output. The increased output included more of the same goods produced previously and new goods and services. During the Second Industrial Revolution, a major factor of productivity growth was the substitution of inanimate power for human and animal labor. Also there was a great increase in power as steam powered electricity generation and internal combustion supplanted limited wind and water power. Other productivity improvements included mechanized agriculture and scientific agriculture including chemical fertilizers and livestock and poultry management, and the Green Revolution. Interchangeable parts made with machine tools powered by electric motors evolved into mass production, which is universally used today. Real food prices fell due to improvements in transportation and trade, mechanized agriculture, fertilizers, scientific farming and the Green Revolution. Great sources of productivity improvement in the late 19th century were railroads, steam ships, horse-pulled reapers and combine harvesters, and steam-powered factories. By the late 19th century both prices and weekly work hours fell because less labor, materials, and energy were required to produce and transport goods. However, real wages rose, allowing workers to improve their diet, buy consumer goods and afford better housing. New goods and services included television, air conditioning and commercial aviation after, creating enough new demand to stabilize the work week. Productivity in the United States grew at an increasing rate throughout the 19th century and was most rapid in the early to middle decades of the 20th century. Demographic changes[ edit ] Demographic factors may influence growth by changing the employment to population ratio and the labor force participation rate. Women with fewer children and better access to market employment tend to join the labor force in higher percentages. There is a reduced demand for child labor and children spend more years in school. The increase in the percentage of women in the labor force in the U. Spending wave Other factors affecting growth[ edit ] Political institutions, property rights, and rule of law[ edit ] See also: These included new laws favorable to the establishment of business, including contract law and laws providing for the protection of private property, and the abolishment of anti-usury laws. Enforcement of contractual rights is necessary for economic development because it determines the rate and direction of investments. When the rule of law is absent or weak, the enforcement of property rights depends on threats of violence, which causes bias against new firms because they can not demonstrate reliability to their customers. Thanks to the underlying homogeneity of its land and people, England was able to achieve a unified legal and fiscal system since the Middle Ages that enabled it to substantially increase the taxes it raised after. Many of these intermediate level institutions relied on informal private-order arrangements that combined with public-order institutions associated with states, to lay the foundations of modern rule of law states. In many urban areas the poor "invade" private or government land to build their houses, so they do not hold title to these properties. Much unregistered property is held in informal form through various property associations and other arrangements. Reasons for extra-legal ownership include excessive bureaucratic red

tape in buying property and building. In some countries it can take over steps and up to 14 years to build on government land. Other causes of extra-legal property are failures to notarize transaction documents or having documents notarized but failing to have them recorded with the official agency. Unregistered businesses and lack of accepted accounting methods are other factors that limit potential capital. Specifically, "democracy increases future GDP by encouraging investment, increasing schooling, inducing economic reforms, improving public goods provision, and reducing social unrest. This is due to endogeneity - forces that drive economic growth also drive entrepreneurship. In other words, the empirical analysis of the impact of entrepreneurship on growth is difficult because of the joint determination of entrepreneurship and economic growth. A few papers use quasi-experimental designs, and have found that entrepreneurship and the density of small businesses indeed have a causal impact on regional growth. Capital is subject to diminishing returns because of the amount that can be effectively invested and because of the growing burden of depreciation. In the development of economic theory the distribution of income was considered to be between labor and the owners of land and capital. New products create demand, which is necessary to offset the decline in employment that occurs through labor saving technology and to a lesser extent employment declines due to savings in energy and materials. Also, the creation of new services has been more important than invention of new goods. The transition from an agricultural economy to manufacturing increased the size of the sector with high output per hour the high-productivity manufacturing sector, while reducing the size of the sector with lower output per hour the lower productivity agricultural sector. Eventually high productivity growth in manufacturing reduced the sector size, as prices fell and employment shrank relative to other sectors. Theories and models [ edit ] Classical growth theory[ edit ] In classical Ricardian economics, the theory of production and the theory of growth are based on the theory or law of variable proportions, whereby increasing either of the factors of production labor or capital, while holding the other constant and assuming no technological change, will increase output, but at a diminishing rate that eventually will approach zero. Criticisms of classical growth theory are that technology, an important factor in economic growth, is held constant and that economies of scale are ignored. In fact, the natural growth rate is the highest attainable growth rate which would bring about the fullest possible employment of the resources existing in the economy. Solowâ€™Swan model[ edit ] This section is about a neoclassical growth model. It is not to be confused with Steady-state economy Main article: Solowâ€™Swan model Robert Solow and Trevor Swan developed what eventually became the main model used in growth economics in the s. Capital accumulates through investment, but its level or stock continually decreases due to depreciation. As a consequence, growth in the model can occur either by increasing the share of GDP invested or through technological progress. As a consequence, with world technology available to all and progressing at a constant rate, all countries have the same steady state rate of growth. Implicitly in this model rich countries are those that have invested a high share of GDP for a long time. Poor countries can become rich by increasing the share of GDP they invest. One important prediction of the model, mostly borne out by the data, is that of conditional convergence; the idea that poor countries will grow faster and catch up with rich countries as long as they have similar investment and saving rates and access to the same technology. The Solowâ€™Swan model is considered an "exogenous" growth model because it does not explain why countries invest different shares of GDP in capital nor why technology improves over time. Instead the rate of investment and the rate of technological progress are exogenous. The value of the model is that it predicts the pattern of economic growth once these two rates are specified. Its failure to explain the determinants of these rates is one of its limitations. Although the rate of investment in the model is exogenous, under certain conditions the model implicitly predicts convergence in the rates of investment across countries. In a global economy with a global financial capital market, financial capital flows to the countries with the highest return on investment. Endogenous growth theory[ edit ] Main article: Endogenous growth theory Unsatisfied with the assumption of exogenous technological progress in the Solowâ€™Swan model, economists worked to "endogenize" i. Unlike physical capital, human capital has increasing rates of return. Research done in this area has focused on what increases human capital e.

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Endogenous growth theory was satisfied with accounting for empirical regularities in the growth process of developed economies over the last hundred years. As a consequence, it was not able to explain the qualitatively different empirical regularities that characterized the growth process over longer time horizons in both developed and less developed economies. Unified growth theories are endogenous growth theories that are consistent with the entire process of development, and in particular the transition from the epoch of Malthusian stagnation that had characterized most of the process of development to the contemporary era of sustained economic growth. In doing so, they make old technologies or products obsolete. This can be seen as an annulment of previous technologies, which makes them obsolete, and "destroys the rents generated by previous innovations. Europeans adopted very different colonization policies in different colonies, with different associated institutions. In places where these colonizers faced high mortality rates e. Thus, although other economists focus on the identity or type of legal system of the colonizers to explain institutions, these authors look at the environmental conditions in the colonies to explain institutions. For instance, former colonies have inherited corrupt governments and geo-political boundaries set by the colonizers that are not properly placed regarding the geographical locations of different ethnic groups, creating internal disputes and conflicts that hinder development. In another example, societies that emerged in colonies without solid native populations established better property rights and incentives for long-term investment than those where native populations were large. Human capital has been included in both neoclassical and endogenous growth models. The most commonly-used measure of human capital is the level average years of school attainment in a country, building upon the data development of Robert Barro and Jong-Wha Lee. One problem with the schooling attainment measure is that the amount of human capital acquired in a year of schooling is not the same at all levels of schooling and is not the same in all countries. This measure also presumes that human capital is only developed in formal schooling, contrary to the extensive evidence that families, neighborhoods, peers, and health also contribute to the development of human capital. He shows that economic growth is not correlated with average scores in more educated countries. Econodynamics Further information on Energy efficiency: A fixed relationship between historical rates of global energy consumption and the historical accumulation of global economic wealth has been observed. These include the great improvements in efficiency of conversion of heat to work, the reuse of heat, the reduction in friction and the transmission of power, especially through electrification. For example, the United Kingdom experienced a 1. It grew to 1., million pounds by A growth rate that averaged 1. The large impact of a relatively small growth rate over a long period of time is due to the power of exponential growth. For example, a growth rate of 2. Thus, a small difference in economic growth rates between countries can result in very different standards of living for their populations if this small difference continues for many years. Quality of life[ edit ] One theory that relates economic growth with quality of life is the "Threshold Hypothesis", which states that economic growth up to a point brings with it an increase in quality of life. But at that point " called the threshold point " further economic growth can bring with it a deterioration in quality of life. Business cycle Economists distinguish between short-run economic changes in production and long-run economic growth. Short-run variation in economic growth is termed the business cycle. Generally, economists attribute the ups and downs in the business cycle to fluctuations in aggregate demand. In contrast, economic growth is concerned with the long-run trend in production due to structural causes such as technological growth and factor accumulation. The neutrality of this section is disputed. Relevant discussion may be found on the talk page. Please do not remove this message until conditions to do so are met.

## Chapter 3 : Technology and Economic Growth

*Technology has affected the economy through direct job creation, contribution to GDP growth, creation of new services and industries, workforce transformation and business innovation. The use of technology has been linked to marketplace transformation, improved living standards and more robust.*

This must be set against a background of a manufacturing decline in the United States of historic dimensions; even without adjusting for inflation, the trade deficit in goods for the United States between and was 7 trillion dollars. A turnaround in the attention of more perceptive economists and a turnaround in manufacturing may be in the works. But before that, the crucial question is: Why is manufacturing so important? Manufacturing is the most important cause of economic growth. The growth of manufacturing machinery output, and technological improvements in that machinery, are the main drivers of economic growth. No machinery industries, no sustained, long-term economic growth. Just consider the explosion of the Internet, iPhones, and the like – all made possible by a small subset of production machinery called semiconductor-making equipment SME, which itself is dependent on other forms of production machinery, such as the machine tools that grind the lenses they use or the alloys of metal the metal-making industries output. These technologies reproduce themselves, as when an SME makes the semiconductors that then go to make more SMEs, or when a machine tool makes the metal components that not only go into other pieces of machinery, such as cars, but are used to produce yet more machine tools. The technological and productive potential of machine tools and SMEs affect each other as well, leading to the explosive economic growth of the last two hundred years. Sign up for weekly ND20 highlights, mind-blowing stats, and event alerts. The dollar is also vulnerable in the long-term. Services are dependent on manufactured goods. Services are mostly the act of using manufactured goods. Finance involves the redirection of surplus resources that the nonfinancial sector of the economy produces, which means that indirectly, even finance is dependent on manufacturing. The cycle of rise and decline usually runs like this: Manufacturing creates jobs. Most jobs, directly or indirectly, depend on manufacturing – and reviving the sector could provide tens of millions of new jobs, eradicating the Great Recession. In , the Japanese manufacturing sector was . Using figures, if the US had the same percentage as Japan, we would have 7 million more high-quality, long-term, well paying jobs. If we were equal with Germany, we would have 10 million more. And according to the Economic Policy Institute , each manufacturing job supports almost three other jobs in the economy. That makes sense, considering the other five reasons that manufacturing is central to the economy. Thus, there are six solid reasons that we need to rebuild the manufacturing sector of the United States. Jon Rynn is the author of the book *Manufacturing Green Prosperity: The power to rebuild the American middle class* , available from Praeger Press. He holds a Ph. The Roosevelt Institute brings together thousands of thinkers and doers – from emerging leaders in every state to Nobel laureate economists. We reimagine the rules that guide our social and economic realities. Follow us on Twitter [rooseveltinst](#) and like us on Facebook.

## Chapter 4 : Top 20 Facts About Manufacturing | NAM

*The Manufacturing Technology Pathways project is partially funded through a grant Center for Economic Growth received from Key Bank. Additional support comes from the Workforce Development Institute of New York, and local manufacturing employers.*

Explore the latest strategic trends, research and analysis At a time of slowed growth and continued volatility, many countries are looking for policies that will stimulate growth and create new jobs. Information communications technology ICT is not only one of the fastest growing industries – directly creating millions of jobs – but it is also an important enabler of innovation and development. The number of mobile subscriptions 6. In this new environment, the competitiveness of economies depends on their ability to leverage new technologies. Here are the five common economic effects of ICT. Direct job creation The ICT sector is, and is expected to remain, one of the largest employers. In Australia, building and running the new super-fast National Broadband Network will support 25, jobs annually. Naturally, the growth in different segments is uneven. In the US, for each job in the high-tech industry, five additional jobs , on average, are created in other sectors. In China, this number can reach 2. The doubling of mobile data use caused by the increase in 3G connections boosts GDP per capita growth rate by 0. The Internet accounts for 3. Most of this effect is driven by e-commerce – people advertising and selling goods online. Emergence of new services and industries Numerous public services have become available online and through mobile phones. The transition to cloud computing is one of the key trends for modernization. ICT has enabled the emergence of a completely new sector: The contractors are often based in emerging economies. Microwork platforms allow entrepreneurs to significantly cut costs and get access to qualified workers. In , oDesk alone had over 3 million registered contractors who performed 1. This trend had spillover effects on other industries, such as online payment systems. ICT has also contributed to the rise of entrepreneurship, making it much easier for self-starters to access best practices, legal and regulatory information, marketing and investment resources. The Internet provides them with new ways of reaching out to customers and competing for market share. Over the past few years, social media has established itself as a powerful marketing tool. ICT tools employed within companies help to streamline business processes and improve efficiency. The unprecedented explosion of connected devices throughout the world has created new ways for businesses to serve their customers.

## Chapter 5 : Manufacturing Growth - Reports - World Economic Forum

*The manufacturing industry can create jobs, economic health and growth at a level such that the services industry will never be able to do. All industries are not created equal. Total Cost of Ownership.*

The impact government policies can have across a number of competitiveness drivers – including trade; financial and tax systems; infrastructure development; labour and workforce productivity; research and innovation; energy and materials costs; intellectual property protection; environmental and other regulations; the tort system; and the cost of capital – are significant. They directly create both advantages and disadvantages for countries, relative to other nations and to companies working within their borders, and relative to other domestic and global competitors. The high level of influence public policy now has on manufacturing competitiveness is highlighted in The Future of Manufacturing report which stated: In this section, the report takes step one on the path to developing a primer for public policy dialogue and collaboration between business and government leaders regarding manufacturing competitiveness and the role of government. It explores public policy through subjective, opinion-based analysis and policy recommendations coming from business leaders, as well as objective, fact-based analysis and country comparisons. In this volume you will find the information described below. From a subjective perspective: Themes Regarding Effective Public Policy: From the CEO interviews and recommendations as well as the input gathered through the workshops conducted around the world, several common and recurring themes emerged regarding what constitutes effective public policy as well as the corollary of what defines problematic policy environments. The report attempts to synthesize all the input and distil the overarching themes of both effective and dysfunctional policy through the lens of business leaders. The six sets of country-level policy recommendations – from chief executives to policy-makers in those countries – were provided by more than 70 executives around the world in face-to-face discussions from August through early January. These represent policy imperatives that they believe would improve the competitiveness of the countries in which they reside or where they have major operations, and thereby their companies and industries. All recommendations have been synthesized from the one-on-one discussions and no attribution has been made to any individual business leader. In addition to the individual country-level recommendation summaries, the report highlights five public policy areas where common recommendations emerged. These five policy areas – and the consistent recommendations which emerged – should be viewed as relevant for policy-makers regardless of country or relative competitive position today. From an objective perspective: Country Policy Comparisons Table: The report compares country-level policies for the six focus countries that serve as the basis for this section and the overall report – Brazil, India and China, all considered emerging economy nations with a significant and growing role in shaping the global manufacturing competitiveness landscape; and the United States, Japan and Germany, the three most dominant developed economy nations from a manufacturing competitiveness perspective. This objective comparison is carried out through a comprehensive Country Policy Comparisons Table, developed through extensive research and a number of collaborative discussions convened by the National Association of Manufacturers. This section also highlights country comparisons in two key policy areas which consistently appeared high on the list of CEO recommendations and have an almost direct and immediate impact on competitiveness: The appendix provides excerpts from the Country Policy Comparisons Table. Comparative Economic and Related Data: Throughout Section 1, the report includes key country-level economic and related data and analysis drawn heavily from the Global Manufacturing Competitiveness Index. The Importance Manufacturing Plays in Economic Development and Job Creation More and more, the factors that influence the competitiveness of countries and companies extend beyond traditional production inputs such as the cost of labour and materials. As stated in The Future of Manufacturing, globalization of manufacturing has been a key driver of higher-value job creation and a rising standard of living for the growing middle class in emerging economies around the world such as China, India,

South Korea, Mexico and Brazil. Developed countries have also benefited from sourcing lower-cost products from emerging economy nations that produce at lower wage rates. Based on this dynamic, the relationship between emerging and developed economy nations has dramatically changed, creating competition as well as co-dependency. But it is not just emerging economy nations that see the benefit of manufacturing and its ability to drive high-value job creation. Developed economy nations, such as Germany and more recently the United States, have also embraced the higher-value job creation powers of advanced manufacturing. Just how much of a positive impact do strong manufacturing sectors have on the economic prosperity for countries and their citizens? While the strength of the relationship seems to be especially true for emerging economies, which have relatively high rankings in manufacturing and real manufacturing compound annual growth rate CAGR, the correlation is also true for developed economies, which have experienced slow manufacturing GDP CAGR and equally slow overall real GDP CAGR. Their extensive examination of manufacturing export trade data of nearly every nation in the world over the past 60 years indicates that as a nation begins to build the knowledge and capabilities necessary to manufacture goods and trade those goods on global markets its path to prosperity begins. Further, Hausmann and Hidalgo show that acquiring more knowledge and producing more complex products, and developing and deploying more advanced manufacturing processes, lead to greater economic prosperity for a country and its citizens. Finally, their research argues that the link between the knowledge networks and capabilities necessary to drive advanced manufacturing and the economic prosperity of a nation is a better predictor of the variation in incomes across countries than any other leading indices. More simply put, manufacturing matters: It is no wonder that government policy-makers have become more active in pulling the levers that might bolster the relative competitiveness of their country. But what really drives the manufacturing competitiveness of a country? And which policy areas may require extra attention from government leaders? The Drivers of Manufacturing Competitiveness for a Nation: A Mosaic of Strengths and Weaknesses In the Global Manufacturing Competitiveness Index, over chief executives of manufacturing organizations were asked to rank 10 key drivers of competitiveness for a nation and 40 sub-drivers using a survey framework first developed in These 10 key drivers significantly overlap with and reinforce the key trends identified in The Future of Manufacturing. In addition, for these chief executives were asked to compare the six target nations the US, Germany, Japan, China, India and Brazil on the 10 key drivers of manufacturing competitiveness for a country. As shown in Figure 4, these chief executives, many of whom participated in the face-to-face interviews, have a nuanced and detailed perspective differentiating the relative strengths and weaknesses of each nation along a series of complex dimensions. The mosaic that emerges clearly demonstrates the advantage Germany, the US and Japan hold relative to talent-driven innovation as well as against most other drivers, with the exception of the cost of labour and materials. Not surprisingly, the survey revealed emerging economy nations hold an advantage with regard to the low cost of labour and materials; however, compared to their developed nation counterparts, they lag far behind when it comes to healthcare systems and legal and regulatory environments. Importantly, what also emerges from the CEO rankings shown in Figure 4 is the transformation that China is undergoing across its competitiveness drivers, clearly separating itself from India and Brazil. Further, the CEO ratings seem to suggest China is becoming more and more a developed nation competitor than its emerging economy counterparts. As China, India and Brazil continue to bolster their advanced manufacturing knowledge over the coming years, fascinating new patterns will emerge. Public policy can and does play a significant role in defining the strengths and weaknesses of a country relative to other countries. And because public policy threads wind through all the drivers that executives believe create competitive advantages or disadvantages for their companies, a significant portion of the various discussions around the world centred on balancing the need for effective government action and public policy without creating bureaucracy, raising structural costs unnecessarily or disrupting markets. In the rest of this section, the basic structure of the Country Policy Comparison Table is laid out. Also, based on the face-to-face CEO interviews and additional supplemental research, the report takes a deeper look into two specific policy areas that business executives deemed

critically important to their ability to compete globally – tax and energy policy. Themes Regarding Effective Public Policy Given the influence of public policy and its importance to business, it is of no surprise that executives participating in the working sessions and one-on-one interviews were both passionate and clear when sharing their perspectives and recommendations on improving government policy to serve as a catalyst for manufacturing growth. A striking observation based on all the interviews and discussions convened in support of this report is that most executives touched on a set of themes that were similar when describing concerns with public policy and outlining their desired state for the future public policy environment. Specifically, executives identified one or more of the following overarching themes in providing their input and recommendations to policy-makers: Consistency, stability and certainty: A consistent and stable policy environment, freed from election cycles, providing longer-term certainty for business investment decisions. As capital investment and workforce hiring decisions have long-term consequences – often to year or more time horizons – establishing policy stability over longer time periods facilitates the setting of business and investment strategies with greater confidence and enhances the ability to commit to stakeholders. Uncertainty was the number one concern mentioned by executives regarding public policy. Many executives said the level of uncertainty regarding the direction of key public policy decisions has reached epic proportions. Globally competitive, fair and enforced: Further, policies should strive to help level the playing field and be rigorously enforced for all global competitors. Policy-makers have a critical role to play regarding the establishment of fair and competitive global markets. Strong enforcement is essential particularly in the areas of intellectual property protection, currency manipulation and trade violations. Policies that result in a competitive disadvantage with other nations impacting an industry sector or the broader business community, e. Developed through dialogue and collaboration: The development of policies based on meaningful dialogue and collaboration between business leaders and policy-makers contributing to more informed and thoughtful policy development, limiting unintended negative consequences. Policies which significantly impact businesses but are established without the benefit of a dialogue and exchange of ideas with business leaders, resulting in either costly or otherwise competitively disadvantageous policy environments, often with unforeseen or unintended consequences. Creates institutional legitimacy, credibility and market confidence: Policy that creates institutional legitimacy – in the court systems, the financial systems and markets, for intellectual property protection, for asset protection, for enforcement, and for fair and consistent consequences of infractions and violations – is essential for advanced economic markets to thrive and grow and to attract investment of capital and talent. Corruption should find no home in free markets. Environments that do not instill confidence for investors regarding government institutions – impacting the banking system, the court system, or legislative or regulatory processes. Government actions which are uncoordinated across responsible agencies or departments and which inadvertently undercut and work against one another. Also unnecessary complexity that adds greatly to the cost of compliance, further inhibits business investment and reduces competitiveness. Financially prudent; balance costs versus benefits: Individual policies and the overall policy bundle must be financially affordable and reasonable for business and society. The costs associated with policies – even those that may be well intentioned and arguably necessary – should not outweigh the benefits. A burdensome high-cost policy or policy environment where the costs to implement and pay for the policy objective outweigh the benefits to society. Additionally, concern was expressed for policies which create a long-term fiscal burden deficit that becomes a drag on business investment and competitiveness. Common policy recommendations essential to growth Figure 5: Comparative Economic and Related Data Source: Our face-to-face CEO interviews provided perspectives from six different developed and emerging economy nations United States, Japan, Germany, China, India and Brazil , each with unique policy frameworks and relative strengths and weaknesses, resulting in six sets of country level recommendations from CEOs to policy-makers in those countries. Throughout these discussions, there were five public policy areas where common themes emerged and consistent recommendations were given from executives around the world. As such, these five policy areas and the consistent recommendations which surfaced should be viewed

as relevant for policy-makers regardless of country or relative competitive position today. Competitive tax policy applied within simplified tax systems: Executives participating in our discussions, regardless of where in the world their companies were located or maintained operations, consistently expressed concern with both business tax policy and complex national tax systems that negatively impact competitiveness. Policy that promotes and protects free and fair trade: Trade was frequently and passionately mentioned by almost all of the executives participating in our discussions. Participants consistently called for policy-makers to increase both the number of free trade agreements and the pace at which new agreements are formed and ratified. While most executives preferred an effective global WTO solution and noted the important objectives of the Doha rounds, many were skeptical that would be accomplished. Executives were equally passionate about trade agreements being fair along multiple dimensions and considerate of broader elements than are normally included, addressing labour practices and working conditions for example. Finally, the subject of trade agreement enforcement was also a common theme. Executives felt effective trade policy must address enforcement of existing agreements. Ensuring a fair and level playing field was equally as important, if not more important, than the number of and speed with which new agreements are forged. Energy policy promoting efficiency, security, strong infrastructure, and low cost: Energy policy was consistently mentioned in our discussions with manufacturing executives around the world – both from a cost perspective and from an energy security, stability of supply perspective. Executives broadly felt that countries that could provide clean and sustainable sources of energy at a competitive cost would offer a significant advantage over other nations. Given rapid growth globally in the demand for energy, rigorous efficiency standards, research in alternative sources of energy, and appropriate and responsible development of current sources of energy were all very important to manufacturing executives. Often, executives further suggested that effective energy policy should also drive opportunities for innovation and economic development.

## Chapter 6 : The Role of Manufacturing in Economic Development | Automation World

*Historically, manufacturing has functioned as the main engine of economic growth and development. However, recent research raises questions concerning the continued importance of the manufacturing sector for economic development.*

In , manufacturing accounted for That is the highest multiplier effect of any economic sector. In addition, for every one worker in manufacturing, there are another four employees hired elsewhere. That approach estimates that manufacturing could account for one-third of GDP and employment. Manufacturers Alliance for Productivity and Innovation The vast majority of manufacturing firms in the United States are quite small. In , there were , firms in the manufacturing sector, with all but 3, firms considered to be small i. In fact, three-quarters of these firms have fewer than 20 employees. Census Bureau, Statistics of U. Businesses Almost two-thirds of manufacturers are organized as pass-through entities. Looking just at manufacturing corporations and partnerships in the most recent data, The remainder are C corporations. Note that this does not include sole proprietorships. If they were included, the percentage of pass-through entities rises to Since the end of the Great Recession, manufacturers have hired an additional 1. Bureau of Economic Analysis and Bureau of Labor Statistics Manufacturers have one of the highest percentages of workers who are eligible for health benefits provided by their employer. Indeed, 92 percent of manufacturing employees were eligible for health insurance benefits in , according to the Kaiser Family Foundation. This is significantly higher than the 79 percent average for all firms. Three are only two other sectors “ government 91 percent and trade, communications and utilities 85 percent that have higher take-up rates. Output per hour for all workers in the manufacturing sector has increased by more than 2. In contrast, productivity is roughly 1. Note that durable goods manufacturers have seen even greater growth, almost tripling its labor productivity over that time frame. To help illustrate the impact to the bottom line of this growth, unit labor costs in the manufacturing sector have fallen 8. Moreover, according to a recent report, 80 percent of manufacturers report a moderate or serious shortage of qualified applicants for skilled and highly-skilled production positions. Deloitte and the Manufacturing Institute Exports support higher-paying jobs for an increasingly educated and diverse workforce. Jobs supported by exports pay, on average, 18 percent more than other jobs. In , for example, U. With that said, a number of economic headwinds have dampened export demand since then, with U. Commerce Department Manufactured goods exports have grown substantially to our largest trading partners since , including to Canada, Mexico and even China. Moreover, free trade agreements are an important tool for opening new markets. Commerce Department Nearly half of all manufactured goods exports went to nations that the U. In , manufacturers in the U. World trade in manufactured goods greatly exceeds that of the U. World Trade Organization Taken alone, manufacturing in the United States would be the ninth-largest economy in the world. Moreover, that figure is likely to continue growing, especially when we consider the number of announced ventures that have yet to come online. Bureau of Economic Analysis U. In , the most recent year with data, manufacturing sectors with the largest employment from foreign multi-nationals included motor vehicles and parts , , chemicals , , machinery , , food , , primary and fabricated metal products , , computer and electronic products , and plastics and rubber products , Given the increases in FDI seen since see 15 , these figures are likely to be higher now. Industrial users consumed Energy Information Administration, Annual Energy Outlook The cost of federal regulations fall disproportionately on manufacturers, particularly those that are smaller. In addition, small manufacturers with less than 50 employees spend 2. Environmental regulations account for 90 percent of the difference in compliance costs between manufacturers and the average firm. Crain and Crain

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## Chapter 7 : Technology Industry Trends | Deloitte US

*At a time of slowed growth and continued volatility, many countries are looking for policies that will stimulate growth and create new jobs. Information communications technology (ICT) is not only one of the fastest growing industries - directly creating millions of jobs - but it is also an.*

The White Paper we are releasing today makes clear how investments in technology drive economic growth, generate new knowledge, create new jobs, build new industries, ensure sustained economic and national security, and improve our quality of life. As you well know, spurring public and private investment in technology has been a key element of my economic strategy. Our country is now on the move. Our economic strategy is working, and our economy is the strongest in the world. We are seeing continued strong economic growth with very low inflation. The budget deficit has been cut nearly in half since I became President and dropped three years in a row for the first time since the Truman Administration. The American people should be proud of their accomplishment. Now is the time to finish the job and balance the budget. But we need to do so in a way that reflects our core national values and lays a foundation for strong private sector growth. That is why my balanced-budget plan maintains vital investments in science and technology. These actions run counter to the purpose of balancing the budget: A pro-growth, balanced budget should never sacrifice U. It is a foolish choice that does not have to be made but that, if made, would have adverse consequences for years to come. For more than years, partnerships among the public and private sectors have kept this nation at the forefront of technological and industrial success. The results -- lasers, personal computers, the Internet, microwave ovens, software, modems, jet aircraft, and satellites, just to name a few -- play an important part in our daily lives and our economy. In the global economy, innovation means jobs, economic growth, and increased living standards. It means opportunity -- and the opportunity for families to prosper. That is why I will fight to promote innovation and why my plan both balances the budget and secures our future. This is the common ground on which American economic progress and quality of life depends. Sincerely, Technology Creates Jobs Congressional Republicans are proposing unprecedented cuts in critical research that the nation needs for future economic growth and job creation, better health, environment, and national security. These cuts would mean lost jobs, lower wages, and a poorer quality of life for all Americans. This commitment has paid rich dividends to the American people, from the development of computing technologies, like the Internet and personal computers, that are changing the way we work, learn, and play; to satellites that are helping us communicate and stay informed; to the delivery of DNA and innovative technologies, like MRI, that are helping us live longer, healthier lives. Economic growth means more jobs and improved living standards. These include as of Biotechnology 79, jobs , Computers , jobs , Communications , jobs , Software , jobs , Aerospace , jobs , Semiconductors , jobs. In , average pay for workers in these and other high-technology industries was 60 percent higher than the average for all American workers. These cuts could not come at a worse time: Investments in technology create high-paying American jobs. To gut or eliminate these investments is tantamount to unilateral disarmament in the battle for global economic competitiveness. Advances in technology have created millions of good new jobs, better health and longer lives, new opportunities for individuals, and enrichment of our lives in ways we would not have been able to imagine half a century ago. Superior technology is the cornerstone of U. Because these investments have paid such rich dividends to the nation, sustaining U. Put simply, investments in science and technology produce real results for the American people. Congressional Republicans propose to cut federal civilian research and development by one-third over the next seven years -- research cuts unmatched in the history of America. These cuts are not necessary to balance the budget, and will in fact undermine the economic prosperity that a balanced budget is designed to ensure. The Clinton Administration has vigorously supported a diverse portfolio of investments in science and technology in pursuit of many national objectives -- defense, environmental protection, health, and education among them. This issues paper focuses on one of several areas that would be disproportionately

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affected by planned Congressional cuts: Investment in Technology Pays Off Investments in research and development are among the highest-payback investments a Nation can make. Many of the products and services we have come to depend on for our way of life in America -- lasers, computers, magnetic resonance imaging MRI , teflon and other advanced materials and composites, communications satellites, jet aircraft, microwave ovens, solar-electric cells, modems, semiconductors, storm windows, human insulin, and others -- are the product of federal science and technology investments made over the past 50 years. These innovations also mean jobs and economic prosperity for America. In just the past 10 years, American employment in the computer and software industries has almost tripled. During the s, however, U. Industry experts credit much of this resurgence to Sematech, a joint industry-government research consortium. Aerospace leads all other industry sectors in net exports. In , the U. Almost unheard of 10 years ago, more than 30, environmental technology and services businesses today employ 1 million Americans in high-growth, high-wage jobs. These savings also decrease U. These are not isolated examples: From satellites, to software, to superconductivity, the government has supported -- and must continue to support -- exploratory research, experimentation and innovation that would be impossible for individual companies or even whole industries to afford. These partnerships in pursuit of innovation enable the private sector to generate newknowledge and adopt novel technologies that ultimately lead to commercial success, increased jobs, and healthier and more productive lives for all Americans. Changing the Way We Live The results of public and private investments in science and technology are deeply embedded in our daily lives and our economy. Here are just a few examples: Discovered not quite 40 years ago and refined through government, industry, and university research, today the laser is one of the most powerful, versatile, and pervasive technologies in our lives. Each day lasers are used by millions of Americans for high quality reproduction of music recorded on compact discs and for fast, efficient checkout in grocery and retail stores. Laser systems carry simultaneously up to 1. Lasers are also used for guidance and navigation, to print documents, for precision measurements, for manufacturing, and throughout industry to perform intricate tasks quickly and accurately. Lasers have become a powerful tool for eye surgery; especially for the one percent of americans who are diabetic and for whom laser surgery has decreased blindness by 60 percent. Today, more than 70 million personal computers are installed in the United States and between one-fifth and one-third of U. Industries as diverse as entertainment, education, communications, medicine, government, and finance rely on computers to provide the goods and services that enhance our lives. These industries use computers for applications from Automated Teller Machines, to airline reservations, to the design and operation of airplanes and automobiles, to medical diagnostic equipment, just to name a few. The development of this important medical tool depended on basic research and technological applications. Nuclear physicists and chemists worked out the fundamental technique of using radio beams and magnetic fields to analyze the chemical structure of biological and other materials. The technique initially was too slow for medical use, but modern electronics and superconducting magnets developed with federal support helped craft the scanners in use today. MRI is a remarkable diagnostic tool that allows us to see into the brain, diagnose diseases, and test drugs for control of the immune system without resorting to surgery or other invasive medical procedures. A Federal Role In Advancing Technology Private businesses are the principal actors in converting technology to profits and jobs, and support much of the research needed to develop new products, processes and technologies. But government has an indispensable role to play in advancing new technology development -- by ensuring a strong base of fundamental science, by providing a business environment that encourages innovation and investment, and in investing in research that is critical to the economy and social needs of the nation, but that cannot attract adequate private support. Joint public and private cooperation in research and development dates back to the birth of the Republic. Half a century later, in , it was a public-private partnership that guided the federal establishment of land-grant universities to improve the practice of agriculture and engineering, and supported further investments after the turn of the century in agricultural extension services and cooperative research. These government investments have made it possible for American farmers to increase productivity a dozen times over, feeding the United States -- and

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much of the rest of the world -- well and profitably. As we move into a new information-age economy, the federal role in advancing technology will be increasingly critical. Only a radical change in the beliefs and behaviors of industry would yield that result. The Administration is committed to these programs. Key Federal partnership programs in technology include: The Technology Reinvestment Project is designed to increase Department of Defense access to affordable, leading-edge technology by leveraging commercial know-how, investments and markets for military use. The Advanced Technology Program aims at developing high-risk, high-payoff enabling technologies that otherwise would not be pursued. Government supplies the catalyst. Industry conceives and executes each project. ATP is accelerating development of electronics, new materials, advanced manufacturing processes, information technology, and other areas critical to future U. Survey data of companies served by the MEP indicate an 8-to-1 payoff on federal investment in terms of increased productivity, better paying jobs, and enhanced competitiveness. The Partnership for a New Generation of Vehicles is an alliance between automobile manufacturers and the government to design and build a vehicle that will be more fuel efficient and better for the environment. Manufacturers are experimenting with alternative engines, new aerodynamic designs, alternative fuels and new materials to build a cleaner and safer car of the future. The Environmental Technology Initiative ETI , a multi-agency program, stimulates private sector investment in innovative environmental technologies that reduce pollution and clean up the environment. For example, one TLC grant in Baltimore to a consortium of business and academia will employ electronic networks to link high-school students with employers in real work environments to strengthen the school-to-work transition in an enterprise zone. Telecommunications Information Infrastructure Assistance Program TIIAP is working to leverage private sector investments in innovative telecommunications applications that demonstrating early, concrete benefits in the areas of health, education, and community development. Today, the United States is undisputed as the leader in the emerging global marketplace, but our lead is neither comfortable nor certain. A recent report by the Office of Science and Technology Policy [3] points out that, while we lead the world in 25 of 27 technologies critical to economic and national security, our lead in virtually every one is stagnant or slipping. By contrast, the growth curve in these same technologies is rising sharply in many other countries. As a percentage of Gross Domestic Product, Japan and Germany consistently out invest the United States in non-defense research and development chart 4 below. The Congressional response to these aggressive moves by other countries has been to propose cutting U.

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## Chapter 8 : Manufacturing - Wikipedia

*Manufacturing the future: The next era of global growth and innovation, a major report from the McKinsey Global Institute, presents a clear view of how manufacturing contributes to the global economy today and how it will probably evolve over the coming decade.*

Discrete Manufacturing , Batch Manufacturing , Cloud Computing The Role of Manufacturing in Economic Development While big trends drive dramatic technological changes, people are the key to channeling technology for maximum competitive advantage. During the last 20 years, globalization has drastically changed the manufacturing world. No longer bound by geography, many companies moved their production elsewhere solely based on the reduction in labor costs. As a result, more-developed countries lost their manufacturing industry, and with it a significant share of jobs. I was forced to use roundabout expressions to avoid using the term MES. The client did not have the slightest idea what it meant. Given that he already had some difficulties managing production processes manually, the idea to entrust the management of production to an IT solution really frightened him. So great was the difficulty to understand and accept the term MES, that the client coined an interesting acronym: Today, times have changed and attitudes in industry are much different. The term MES has become customary to identify the set of solutions used in industrial IT, replicated and implemented in ways that support production management and execution. In a recent book, *Make it in America*, Andrew Liveris, chairman and CEO of the Dow Chemical Company, supports with passion the role that manufacturing production plays in the health of an economy. Workers who are prepared and informed will be at the center of the businesses of the future. They will provide the level of flexibility needed to meet the increasing demand for customized products. It is in this significant mutation that even MES systems themselves are changing with respect to those seen 15 years ago. And this is why MESA introduced the term MOM in the second half of the last decade, embracing in it also the management of processes that regulate and coordinate the operations. In addition to this, there is a profound technological transformation that is affecting the industry. Today, terms like the Internet of Things, Big Data, cloud, mobility and analytics are commonly used, although not always with the correct meaning, to identify the big trends of technological evolution. Given the many misunderstandings surrounding these terms, it is wise to keep the following in mind to help make sense of it all: For more information about Autoware, visit the Autoware profile on the Industrial Automation Exchange. All industries are not created equal. Leave this field blank.

## Chapter 9 : Growth of Manufacturing

*Technology and Productivity Growth "The strong performance of productivity growth in the second half of the s was in fact attributable to accelerating technical change, not to poor measurement or to temporary factors."*

Other challenges include high taxes, high post-Fukushima energy costs, limited access to natural resources, and currency appreciation of the Japanese yen. Still, recent government policy decisions suggest Japan is taking action to maintain its proud manufacturing dynasty and accelerate growth in new advanced manufacturing sectors. High expectations for economic recovery after the earthquake and tsunami are not yet realized and progress seems slow. They also called for regional collaboration to design a new grid system able to manage many sources of power. Executives again urged policy-makers to develop a fully comprehensive energy plan for the country, including a specific approach to nuclear power and considering implications to the workforce currently employed in the sector, as well as the potential innovative breakthroughs that additional research into nuclear energy could deliver. In developing the approach, executives recommended that policy-makers look at all relevant and accurate data, current innovations and proposals in work in national laboratories, and consider all stakeholders, including consumers and manufacturers. Some executives suggested that the combination of the appreciating yen, the aftermath of the natural disasters and attractive opportunities in other markets are already redirecting investment outside of Japan. Executives broadly believed the Bank of Japan needs to do more to ease monetary policy and that the government needs to intervene in foreign exchange markets. Furthermore, executives understood that much is dependent on economic conditions both domestically and internationally, and said the key to addressing the strong yen and deflation are policy measures that increase domestic demand, such as deregulation and increased participation in international economic partnerships. Executives also said the government needs to lead the way in developing a globally competitive tax system that allows Japan to attract foreign investment that helps to create employment and expands personal incomes. On the topic of social security, executives believed that the government needs a plan to identify new sources of funding and to allow the treasury to cover a larger share of social security costs. Executives looked again for policy-maker leadership in opening overseas markets and reducing tariff and non-tariff barriers. In general, executives called for swift and decisive action to move ahead with trade negotiations that are currently planned or in progress. For example, executives said the proposed Free-Trade Area of the Asia Pacific would eventually form, and as a result the government should, as soon as possible, begin negotiations to participate in the Trans-Pacific Partnership. Each of these consumer markets is highly attractive to the executives interviewed, most of whom are anticipating growing demand in China and South-East Asia. In addition, executives said the government should discontinue the practice of giving subsidies to less successful industries, as the practice is seen as neither helpful nor sustainable. Instead, executives said the government should reinforce strong industries that have high export potential for their products to overseas markets. Executives wanted to see policy-makers making clear and comprehensive policy that identifies sectors with promising manufacturing capabilities in Japan and provides the support those sectors need to flourish and grow. Examples included high-quality and safe food and agriculture; pharmaceuticals; and infrastructure development beyond selling equipment, instead providing overall system management and operations leadership to emerging markets in particular. They said that to operate effectively, businesses and policy-makers alike must address the new workforce dynamics – a priority on work-life balance and corporate responsibility; imperatives to move towards greater workplace and work hour diversity; and the falling birth rate and ageing population in Japan. Overall, executives pushed for a more flexible set of labour standards. They noted specific concern with current practices that pay subsidies to companies to retain workers when unemployment is high, believing that this lessens competitiveness in Japan. Many executives called for a policy environment that facilitates diverse employment arrangements that can react to changing corporate activity. Finally, participants in the discussions said the government should encourage greater

workplace diversity and provide more support for families with young children, to encourage increased work-life balance. Promote vocational training and development of outstanding innovators Overall, the executives interviewed believe that Japan faces challenges related to developing skilled talent, particularly given the ageing workforce and what is perceived as inadequate university training to prepare students for manufacturing jobs. Executives noted that any such blueprint of future talents should be reflected in the national education curriculum and be supported with stable funding. This workforce should include individuals who are not only technologically innovative and have the technical savvy to deliver a high-quality product efficiently and on time, but are also capable of operating in a global context with a diverse workforce and have excellent communication and leadership skills. Specifically, executives cited the need for workers who can speak more than one language and are willing to work internationally. Collaboration between schools, government and industry was cited as key to creating innovative, global thinkers. For many interviewed, it is not sufficient to have a small number of employees that are innovative and think about innovation in purely technical terms; the entire employee population must be empowered to innovate and think about the broad range of innovations, from highly advanced to more humble developments in product, process, working style and values. They also called for the development of more policies devoted to vocational training, some citing the German Meister apprentice process as particularly attractive. Finally, executives expressed concern that young people do not have sufficient opportunities to develop leadership and management skills, due in part to the educational system and in part to the delayed retirement of the ageing working population. This may ultimately inhibit development of the workforce of the future. Executives believed that policy-makers and business leaders should collaborate to provide youth with leadership experiences as well as a sense of confidence that the country is heading in the right direction and that the manufacturing sector offers exciting employment opportunities. Executives were seeking government support to help respond to the pressure to accelerate innovations and sustain this competitive advantage, particularly in sectors where Japan already has a strong base. While Japan currently has a high investment to GDP ratio, most of the funding comes from the private sector. The Innovation Network Corporation of Japan was cited as an example of a public-private partnership that funds and provides managerial support to new, promising innovations and technologies. Amid growing expectations of citizens and industry regarding the new government, close attention should be paid to the implementation of the policy.