Intraw

International Raw Materials Observatory

Fostering international raw materials cooperation

United States of America

Contextual analysis of the reference countries

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Abstract

The principal objectives of the INTRAW project (http://intraw.eu) are the mapping of best practices and boosting of cooperation opportunities related to raw materials between the EU and 5 technologically advanced non-EU countries (Australia, Canada, Japan, South Africa and the United States). Each of these five "Reference Countries" is subject to similar global challenges. This report presents the contextual analysis of the United States of America (USA) in order to explain the country´s historical economic development during the 20th and 21st century in general, and in relation to development of primary raw materials in particular. Three reports focussing specifically on: raw materials research and innovation; education and outreach; and industry and trade in the Reference Countries will be the next outputs from the project to be published. These will underpin the development of a better understanding of the achievements made in these 5 countries in relation to raw materials research & innovation, educational and skills programmes, trade, exploration, exploitation, processing, recycling and substitution.

Author

Diego Murguia (MinPol).

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1. Introduction

1.1 General

One objective of INTRAW is to characterise the contextual environment of the 5 Reference Countries for the project (Australia, Canada, Japan, South Africa and the United States) in relation to raw materials research & innovation, educational and skills programmes, trade, exploration, exploitation, processing, recycling and substitution. This, together with the mapping of corresponding policies and practices for each of these domains, will facilitate the comparative evaluation and cross impact analysis of the raw materials domains between the Reference countries and the EU.

1.2 Introduction to Contextual Analysis (WP1, Task 1.1)

The objective of Task 1.1 of the INTRAW project is to map the contextual environment of the reference countries (Australia, Canada, Japan, South Africa and the United States of America) against the contextual environment in the EU, leading to a better understanding of the achievements made in these countries in relation to *raw materials research & innovation, educational and skills programmes, trade, exploration, exploitation, processing, recycling and substitution*. This WP will also map the corresponding policies and practices of each of these domains. The data will be centrally processed, which will facilitate the comparative evaluation and cross impact analysis of the raw materials domains in each of the Reference countries and the EU.

1.3 Scope of this report

This report is the **Country Report for the United States of America (USA), prepared as part of Task 1.1: *"Contextual analysis of the Reference Countries"*.** It is part of the deliverable for Work Package 1 of the INTRAW project (D1.2). This report on the contextual analysis for the USA is presented in 4 main sections after this introduction:

- **Chapter 2:** An Executive Summary
- **Chapter 3:** A historical overview on raw materials
- **Chapters 4 to 8:** Analysis of the contextual environment, covering 49 explanatory factors, grouped into five main categories:
  - Geo & Environmental (6 factors – Chapter 4);
  - Socio-Cultural (11 factors – Chapter 5);
  - Economic (14 factors – Chapter 6);
  - Political and Legal (14 factors – Chapter 7); and
  - Technological (4 factors – Chapter 8).
- **Chapter 9:** Conclusions.

The description of the analysis of the contextual environment in each of the main sections, Chapters 4 to 8, first describes general economic growth and change drivers associated with each of the explanatory factors, and then draws out findings that are specific to the non-energy raw materials sector. The conclusions section follows a similar pattern, with a general overview followed by conclusions specific to raw materials, arranged under the headings "*Industry and trade*", "*Education and outreach*", and "*Research and innovation*" thus integrating three sides of the 'knowledge triangle': higher education, research and business, that are reflected in the themes of the sector specific reports being prepared as deliverables from WPs 1.2[1], 1.3[2] and 1.4[3].

The report is supported by three appendices:

- **Appendix A1:**
  Presentation of the method employed to construct a multi-factor matrix and associated radar charts. The multi-factor matrix and radar charts were the tools used to carry out initial organisation and analysis of the information collected and to inform discussions within

1 Transactional analysis on Research and Innovation
2 Transactional analysis on Education and Outreach
3 Transactional analysis on Industry and Trade

the work package team and with members of the expert panel. They are considered as *work-in-progress input* and are included here for completeness.

- **Appendix A2:**
  Presentation of summary findings *via* the "multi-factor matrix" and five- and 12- axis "radar charts", and preliminary discussion of the comparative importance of the explanatory factors based on the analysis.
- **Appendix A3:**
  Presents the references quoted in this document.

2. Executive summary

The United States of America (USA) has become one of the most economically developed countries in the world: nowadays it is among the world´s largest economies alongside China and the European Union (EU). Its domestic market represents the largest consumer market, the country features as the world´s largest investor, it is the world´s major consumer of natural resources and historically cumulative greenhouse gases emitter, and remains one of the leading countries in technology and innovation. Such pre-eminence of the USA in the world economy accelerated in the very early decades of the 20th century when the USA economy overtook that of the United Kingdom and continued during the 21st century driven by seven key inflection points:

i. The Great Depression,
ii. the New Deal and World War II (WWII),
iii. the launch of the Great Society (1964-65),
iv. the Great Inflation period (1965-1982, including the two Oil Embargos),
v. the Cold War peak (1960-1985),
vi. the Reagan Administration (1981-1989) and
vii. the recent Great Recession (2007-2010).

The Great Depression was a severe economic crisis which acted as watershed in the USA and world history. The economic depression originated in the USA after the fall in the stock prices causing unemployment levels to peak in the early 1930s and brought attention towards the importance of the financial system for the USA economy. Roosevelt´s subsequent New Deal legislation restored economic growth in the USA economy, and vastly expanded the role of the federal government in the free-market economy, establishing a close relationship with the private sector. WWII was also of key importance for the USA to reinforce its global leadership in economic, military and political realms. During the 1960s, the launch of the Great Society program was an inflection point in social development as it was focused on eradicating extreme poverty, racial injustice and considerably increased the access to health for many USA citizens (launch of Medicare and Medicaid programs). The Great Inflation period is also considered an inflection point as it was during those years that the global monetary system established in Bretton Woods was abandoned, and it was a period when the rules that today guide the monetary policies of the Fed and other central banks around the world were established. Moreover, it was a period when two OPEC oil embargoes quadrupled the price of oil in the USA, severely impacting the industry and creating structural challenges to the stability of the national economy while drawing attention towards the growing foreign dependency on oil.

The Cold War is another inflection point as it triggered the development of the strategic reserves, both in oil and in mineral commodities and spurred on a temporary boom in USA domestic production, with positive impacts on economic growth and mainly military-oriented and government-funded technological development. This was most pronounced in the late 1950's and early 1960's. The sixth inflection point was the Reagan Administration based on supply-side economics which reduced taxes, tightening the money supply but increasing deficit government spending associated with the Cold War. This dramatically increased the US national debt. The more recent Great Recession following the housing bubble burst in mid-2007 was also a turning point in USA policy as the government again strongly intervened in the free-market economy by rescuing banks, mortgage lenders and by conducting fiscal and monetary expansions and export promotion policies to stimulate economic growth.

Since 1854 the USA economy managed to overcome more than 30 cycles of

economic expansion and contraction; this was achieved predominantly by a combination of technological, economic and socio-cultural factors. Investments in technology and industrial innovation have been led since early in the country by the private sector, but during the Cold War federal spending founded around two-thirds of R&D associated with the Cold War. This was an era of copious innovation in leading-edge technology in the military-industrial complex which explains much of the later advances observed recently in high-tech products. From the mid-1970s onwards, the USA federal government started investing more seriously in federally supported research in government institutes, universities and investment in the private sector research and a more science-based system of innovation. Even though the USA does not have a coordinated national system of innovation, it has a strong R&D culture in private corporations and publicly-funded institutions; it also leads the world ranking in business expenditure in R&D, has a strong tradition of university-industry research collaboration (e.g. Stanford and the Silicon Valley) and counts with some of the most innovative firms and technologic clusters in the world. This university-industry partnership has been regarded as one of the contributors to successful USA innovation and growth in the last decades.

The flourishing of these technology initiatives has been possible due to the size of a large and affluent population (high spending power of households) with high demand levels and a particular affinity towards the consumption of innovative and technology products.

Likewise, a well-educated workforce in high-quality universities has been the precondition for successful managerial talents and high levels of creativity. Tertiary education in the USA is closely associated with earning levels under the belief that higher education levels lead to higher earnings.

Another underlying explanatory factor has to do with the American capitalist culture characterized by deep beliefs in individualism, a competitive behaviour and a success-orientation which has led to risk-taking attitudes and entrepreneurship as values deeply embedded in the society. Such values have sparked the questioning of established ways and the pursuit of innovation through its history, leading competition in innovation within and among firms, both as a competition and also as a collaboration process.

The examination of the role of the domestic endowment of natural and mineral resources leads to the conclusion that such wealth (e.g. coal, wood) was highly important in the early phases of the USA industrialization, but then the economy began a transformation process towards a knowledge and services-based economy in which the availability of domestic resources became less important.

From the 1950s onwards the USA became a net importer of energy and non-energy minerals which allowed the developing of a competitive manufacturing sector and has since sustained its oil-based economy on oil and natural gas imports which the country has financed via exports of advanced products and services. Finally, in this respect, the roles of trade and trade policies, of infrastructure for the transportation of goods have also been of crucial importance to allow the flow of energy and resources supporting the knowledge economy.

Focusing on the non-energy minerals industry, the industry managed to develop well because of a **rich mineral endowment, a long and continued history of exploration (e.g. gold rush in California) and discovery of mineral deposits** driven by a growing domestic demand for mineral resources (e.g. for construction, for the technology and military industry, for R&D, etc.). A critical factor enabling such development was the availability of geoscience data facilitated by the U.S. Geological Survey (established in 1879) and the state geological surveys. It must be noted that for all factors considered, but particularly for minerals policy and regulation, state governance is quite influential, in some cases even more than federal.

Likewise, the long-standing and well-developed mining industry in the USA expanded due to a **politically and institutionally stable** framework with a high respect for the rule of law and security of

tenure, attractive to mining investments from domestic and international sources. The U.S. has had stable mineral laws for over 100 years and a well-defined protection of property rights. A given location will be subject to multiple layers of laws, but in general, most have been stable. Recently, environmental legislation has provided increasing details on mitigation and prevention requirements, and often local and state laws are more onerous that federal laws.

Other factors which have been of importance include:

- **Ownership of mineral rights:** the separation of mineral and land rights is considered one of the key catalysts now and historically for efficient mineral development in the USA;
- **Availability of risk finance:** finance markets in the U.S. tend to be very liquid with ready access to global capital;
- **Fiscal policies ensuring tax stability:** in general, taxes on resources have not been confiscatory, but can vary widely across jurisdictions. The USA has the unique situation where it taxes USA corporations for foreign earnings, and thus repatriation of funds is a current major political issue and inhibitor for the involvement of U.S. corporations in mining concerns overseas;
- **Skilled workforce:** the USA has a solid, well-educated general workforce, and a large (though ageing) workforce in the geosciences. The mining specific workforce is much more limited and has been declining for generations as the size of the necessary mining labour pool has shrunk, but this could be solved with hiring of non-U.S. professionals;
- **Services industry:** The USA has a very robust service industry in engineering support and technology. Much of it is not specifically focused on mining applications, but in many cases dual use is possible;
- **Social license – mining culture:** The social license to operate is a non-official permit awarded locally by communities; yet, the nation-wide overall perception is that the USA does not view itself as a mining country anymore and the public view of mine operations is generally negative, mostly because of ongoing impacts from abandoned mines from the 19th and early 20th centuries. The social license issue is paramount for new operations and is an ongoing challenge and some parts of the country are more open to mineral development than others.

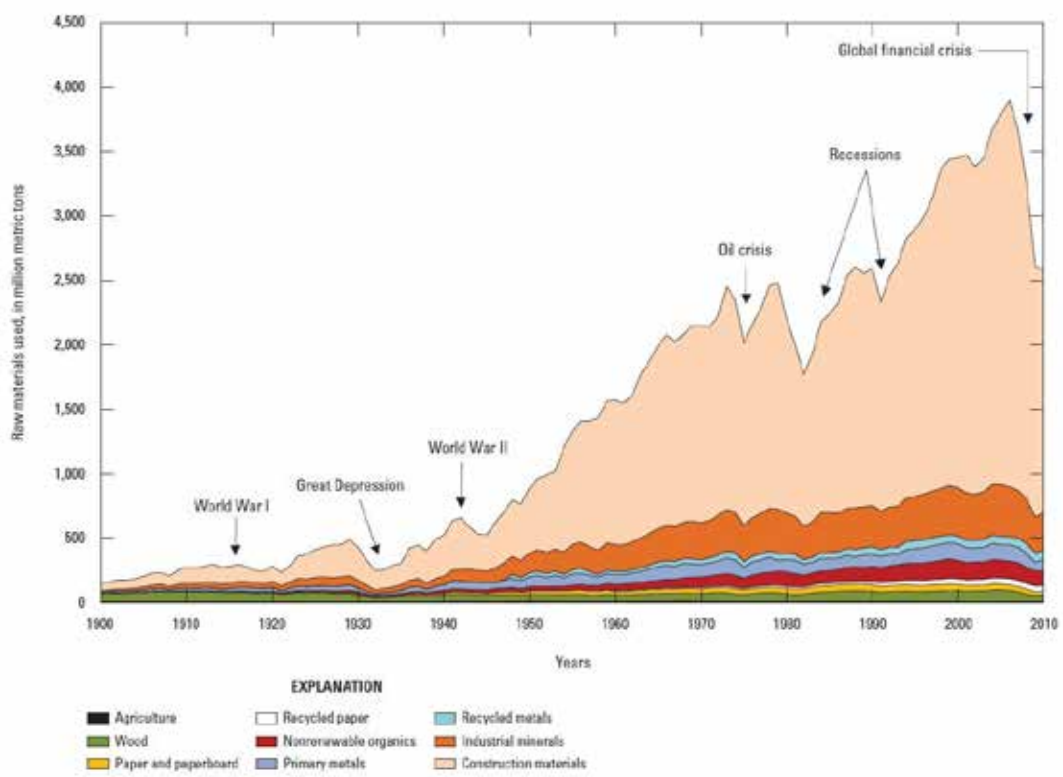
Permitting time and costs are also considered to be very important factors enabling or detracting mining investments. Currently the USA does not rank high or look attractive for mining investments due to long permitting times (10 – 12 years on average). Other less important factors include access to reliable transport infrastructure and access to land, energy and water.

Even though the domestic USA mining industry is currently lagging behind Australia or Canada, for instance in spending and promoting innovation, it still ranks relatively high in the mining investments rankings. Mining is an important sector for the American economy and has a substantial volume of cumulative knowledge and experience which may enable an improvement in its competitiveness.

3. Historical overview on raw materials

The USA has a territory favourably endowed with raw materials (energy and non-energy minerals) which has steadily provided the material base for the domestic industry, economy and market to grow. Since early in the 20th century the types and quantities of raw materials demanded and processed by the USA manufacturing industries and consumers have changed. ***Figure 1*** below shows that, with the exception of petroleum (not included in the figure), overall material resource use of raw non-energy minerals, especially construction materials, have had a high importance in the economic development of the country. The continued long-term growth in material use reflects ongoing growth of an affluent population with resource-intensive consumption patterns, punctuated periodically with decreases during major economic downturns and military events. These punctuating events include WWI, the Great Depression of the 1930s, WWII and the post-war expansion, the two oil crises in the 1970s, recessions in the 1980s and early 1990s and the Great Recession in 2007.

Figure 1: USA raw materials put into use (1900-2010).



Source: Matos, (2012). Excludes food, fuels and materials embedded in imported goods.

Construction is a major driver of demand for mineral materials and ores in the USA. As evidenced in ***Figure 1***, the stone and sand and gravel category represents the largest tonnage used throughout the 20th century which was enabled by technology improvements and innovations. The noticeable increase in use from 1945 through the early 1970s resulted from the construction of the interstate highway system (built to meet national security needs to be able to move armed forces around the country) and the post-war construction boom. More than 80% of these materials were used in cement concrete, bituminous (asphalt) concrete and the

loose aggregate associated with roads, buildings and railroad beds (Morse and Glover, 2000).

Over the span of the 20th century the demand for metals and minerals in the USA grew from a little over 160 million tons to about 3.3 billion tons. During the period which followed the Civil War (1861-1865), the USA moved rapidly from an agrarian to a coal-based industrial regime which produced iron and steel as major products. Iron and steel production grew considerably in the period 1870-1929 when the USA reached a share of 50% of the world´s production (Gierlinger and Krausmann, 2012). Western expansionism drove the growing railroad network, settlement, cultivation and mineral exploration. In this period, the USA became a dominant economic power in the world based on the exploitation of its abundant natural resources, emerging even as a net exporter of them.

The Great Depression (1930s) had a substantial impact on the physical and monetary economy. After New Deal policies and the massive industrial mobilization necessitated by the events of WWII, economic growth resumed and there was a rapid transition from a coal-based to an oil-based economy driven by mass production and consumption. The period between WWII and the oil crises in the 1970s involved a rapid physical growth in the use of materials and energy (Gierlinger and Krausmann, 2012). This growth in resource use led the USA to become a net importing economy. Around 1950 the USA became a net importer of minerals (Lindert, 2000), rubber and forest pro-

Figure 2: USA net import reliance of mineral commodities (2015).

Commodity	Percent	Major import sources (2010–13)[2]
ARSENIC	100	Morocco, China, Belgium
ASBESTOS	100	Brazil, Canada
BAUXITE	100	Jamaica, Brazil, Guinea, Australia
CESIUM	100	Canada
FLUORSPAR	100	Mexico, China, South Africa, Mongolia
GRAPHITE (natural)	100	China, Mexico, Canada, Brazil
INDIUM	100	China, Canada, Belgium, Japan
IODINE	100	Chile, Japan
MANGANESE	100	South Africa, Gabon, Australia, Georgia
MICA, sheet (natural)	100	India, China
NIOBIUM (columbium)	100	Brazil, Canada
QUARTZ CRYSTAL (industrial)	100	China, Japan, Romania, United Kingdom
RUBIDIUM	100	Canada
SCANDIUM	100	China
STRONTIUM	100	Mexico, Germany, China
TANTALUM	100	China, Germany, Kazakhstan, Russia
THALLIUM	100	Germany, Russia
THORIUM	100	India, France
VANADIUM	100	Czech Rep., Canada, Rep. of Korea, Austria
GALLIUM	99	Germany, United Kingdom, China, Ukraine
GEMSTONES	97	Israel, India, Belgium, South Africa
GERMANIUM	95	China, Belgium, Russia, Canada
BISMUTH	94	China, Belgium, Peru, United Kingdom
TITANIUM MINERAL CONCENTRATES	91	South Africa, Australia, Canada, Mozambique
DIAMOND (dust grit, and powder)	86	China, Ireland, Rep. of Korea, Romania
PLATINUM	85	Germany, South Africa, United Kingdom, Canada
ANTIMONY	84	China, Belgium, Mexico, Bolivia
POTASH	84	Canada, Russia, Israel, Chile
GARNET (industrial)	83	Australia, India, China
RHENIUM	83	Chile, Poland, United Kingdom
STONE (dimension)	83	China, Brazil, Italy, Turkey
ZINC	81	Canada, Mexico, Peru
BARITE	79	China, India, Morocco, Mexico
SILICON CARBIDE (crude)	77	China, South Africa, Netherlands, Romania
COBALT	76	China, Norway, Russia, Finland
TIN	74	Peru, Bolivia, Indonesia, Malaysia
CHROMIUM	72	South Africa, Kazakhstan, Russia, Mexico
PALLADIUM	65	Russia, South Africa, United Kingdom, Norway
PEAT	64	Canada
SILVER	63	Mexico, Canada, Poland, Peru
RARE EARTHS[3]	59	China, France, Japan, Estonia
NICKEL	54	Canada, Russia, Australia, Norway
TITANIUM (sponge)	51	Japan, Kazakhstan, China

Source: USGS (2015)

ducts (Palo et al., 2012) and in 1958 the USA turned from a net exporter of fossil energy carriers to a net importer, and by 1973 already 20% of all fossil energy carriers and one-quarter of all petroleum and natural gas was imported. Net imports of ores and metals began to increase in the late 1940s with imports of non-metallic minerals rapidly rising in the 1970s. Currently the USA, which is inhabited by 5% of the world´s population, is the world´s largest economy and consumer of natural resources using roughly 20% of the global primary energy supply and 15% of all extracted materials (Gierlinger and Krausmann, 2012). The USA economy consumes a large proportion of the global resource base via imports and remains a net importer of energy and of many non-energy mineral commodities (***Figure 2***).

4. Geo and environmental factors

4.1 Geographical situation

The United States is the 3rd largest country in the world (CIA, 2015c) and has benefited greatly from fertile soils, plentiful freshwater, forests and waterways. The geography of the USA is dominated by the American Midwest, the world's largest contiguous piece of farmland among the most productive in the world, as well as the Greater Mississippi Basin and the Intracoastal Waterway. Moreover, the Atlantic Coast of the USA possesses more major ports than the rest of the Western Hemisphere combined (Stratfor, 2011). The USA has benefited from physical isolation and long distances as two vast oceans separate the country from Asian and European powers while lakes and forests separate the population centres in Canada from those in the USA and provided forest products. For instance, during the early industrialization in the late 19th and early 20th centuries, the USA, like Canada and Australia, had a broad geographic expanse over which mineral resources were discovered and developed and had large internal (or adjacent) markets protected by high transportation costs and their own trade barriers (Power, 2002). Also, during WWII its isolation was of help to avoid invasion by the enemy. This large area with abundant resources and the isolation has been determined to be important in explaining the economic development of the country (Stratfor, 2011).

4.2 Natural & mineral resources

The natural resource richness of North America was the big driver from British colonization – it was the source of Britain´s raw materials from around 1650 to 1780. Early since the nation´s foundation, the USA has historically been a country rich in natural and mineral resources, has had a diverse and rapidly growing population, a dynamic economy and a growing transportation network. All these factors have been acknowledged as important in explaining the economic development of the Nation. Yet, it is recognized that the country´s early rapid industrial expansion (e.g. in the period 1879-1940) is strongly linked to the intensive use and exploitation of the abundant natural resources (energy and mineral resources) (Barbier, 2005) with the USA dominating world production of nearly all economically important minerals before World War I (Clay, 2008). This was the result of a number of factors that enabled rapid exploration and exploitation including an accommodating legal environment, incentives, public knowledge infrastructure (geological surveys), mining education at universities, an ethos for exploration and large investments in transportation, geological knowledge and the technologies of extraction, refining and utilization. Different to other countries endowed with minerals, mineral development was an integral part of the national economic development process (Kelly, 2002; Power, 2002; Wright and Czelusta, 2003).

However, even though the domestic endowment of natural resources kept playing an important role in the economic growth of the USA economy after World War II, the progressive unification of world commodity markets (through transportation cost reduction and removal of trade barriers) largely cut the link between domestic resources and domestic industries (Wright, 1990). For this reason, the foreign trade of the USA expanded rapidly after the outbreak of WWII. Nowadays other factors are considered more important than natural resources wealth in determining how natural resources affect economies and growth, e.g. institutions and policies (Mehlum et al., 2006; Wright and Czelusta, 2004), strength of the governance system, etc.

With regard to minerals, the USA has a historically diverse and relatively rich mineral endowment. It is one of the world's leading producers of petroleum and, since recently, the world´s largest producer of natural gas (BGR, 2013; CIA, 2015a). This is due mainly to the exploration and development activity of unconventional gas

in several of the nation´s shale formations which has been booming since 2003 and drove natural gas reserves to a record high in 2013 (U.S. EIA, 2014), leading the country to rank 4th in the world in natural gas proven reserves (CIA, 2015b). The USA is also a major coal exporter and houses the world´s largest hard coal reserves and ranks 4th in lignite reserves (BGR, 2014). Most of the operating mines are located in the Western part of the country (***Figure 3***). In terms of the share of world mineral production (2013) the USA accounted for 6% copper, 23% for molybdenum, 5% for rare earths, 5% for zinc, 8% of gold, 4% silver, 26% bentonite (world leader), 14% of salt (2nd after China), 12% of steam coal, 8% of lignite, 19% of natural gas, 10.9% of petroleum (2nd after Saudi Arabia) (Reichl et al., 2015).

Figure 3: Major USA minerals´ mines (2013).

Source: USGS

In relation to mineral reserves, the USA hosts the world's largest diatomite, gypsum, helium, and second largest of molybdenum (USGS, 2015). The USA is focused on stable supply, independent of location – domestic or foreign. If need be, the U.S. has shown it will utilize its domestic resources to ensure stable supply – such as the reopening of Mountain Pass to address the issue of rare earth elements (REE) exports from China.

4.3 Water resources

Access to water is critical to production in a number of economic sectors. It serves as an essential input in agriculture, and is used to extract energy and mineral resources from the earth, refine petroleum and chemicals, roll steel, and produce uncounted other goods.

In 2005, water withdrawals from groundwater and surface water totalled approximately 410 billion gallons. Around 80% was surface water with more than 85% being fresh and 15% saline water. Use allocation was: 49% for thermoelectric uses, 31% for irrigation, 11% for public supply, 4% for industrial supply, and 1% for mining and other minor uses (U.S. EPA, 2013). For 2005, total irrigation withdrawals were about 128,000 million gallons per day (Mgal/d). The majority of withdrawals (85%) and irrigated acres (74%) were in the 17 conterminous Western States. Regarding quality impact, there exist several pollution cases from historic metal mines (mostly cop-

per) associated with acid mine drainage, metals leaching or accidental releases of toxic materials (Gestring, 2012).

The USA is considered a water-rich country on a global scale (FAO, 2003), with Americans having one of the largest per capita water consumption rates in the world. This has been of importance for the development of a competitive industry. Yet water availability is uneven in the country; many areas being naturally dry (Arizona, New Mexico, Nevada, etc.). This has been managed by tapping into groundwater supplies. But many aquifers, including the largest, Ogallala, are showing signs of severe depletion, due to over-exploitation (WWF, 2006). In contrast to the Eastern states and Alaska, which have large water availability, the southwestern part of the USA, an area of mining and extensive metals operations, is a water-stressed region (particularly groundwater) which poses challenges for irrigation and livestock, major users of water. Yet, mining operations use less than 1% of the water (Ackerman and Stanton, 2011) and this has not become a problem during the USA history and economic development, though it may become a problem in the future, e.g. due to climate change issues (ICMM, 2013).

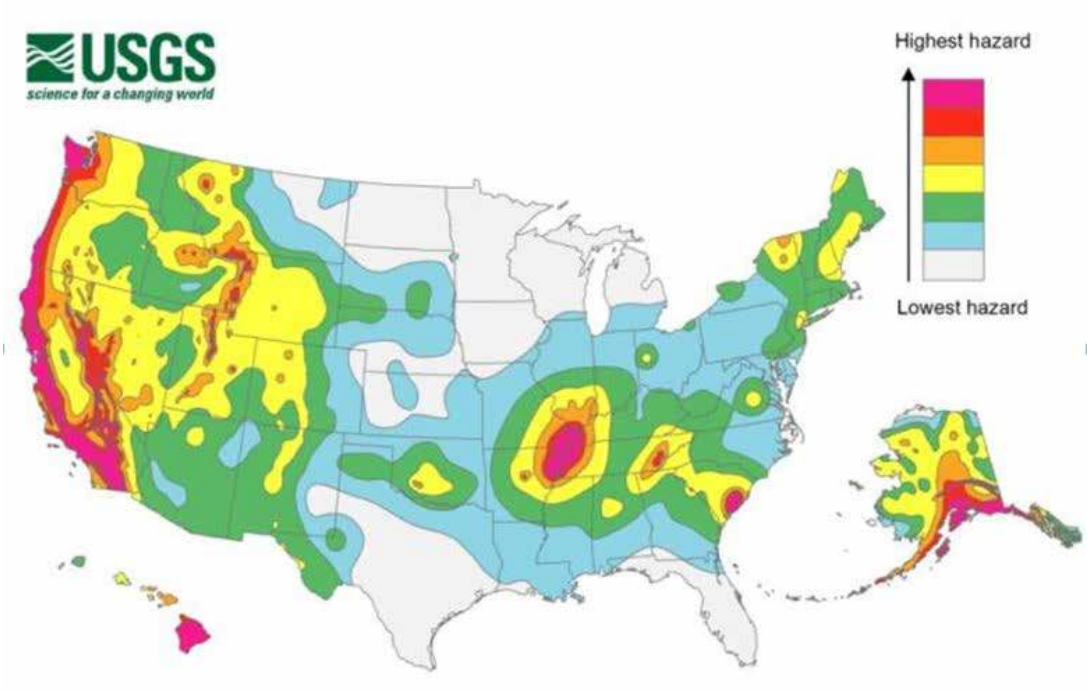
4.4 Climate

The contiguous USA is characterized by a highly diverse climate with large spatial variations. The great latitudinal range of this region leads to a very wide range in temperatures. In addition to the latitudinal range, several geographic factors contribute to this variability. Likewise, the country experiences a wide range of extreme weather events (drought, floods, winter storms, tornados, heat and cold waves, hurricanes) that affect human society, ecosystems, and infrastructure (Kunkel et al., 2013). Extreme rainfall and flooding events pose the highest risks to mining. At the macro level it is estimated that over 30% of the USA GDP is directly or indirectly affected by weather and climate (Allianz Global Corporate & Specialty, 2013). Since 1988 there has been at least one extreme climate event per year causing at least USD 1 billion in damages (Kunkel et al., 2013). Yet, despite a long history of extreme events of different kinds, the country has steadily advanced its economic development.

4.5 Geological Factors

There are over 160 USA volcanoes that have erupted in the past 10,000 years

Figure 4: National seismic hazard map (2014).



Source: USGS, (2014)

causing severe short-term economic losses (e.g. 1989-1990 Redoubt Volcano eruptions amounted to USD 160 million), but also profits during reconstruction. The USGS monitors most of the volcanoes and the public has access to such information on its website. The National Seismic Hazard Maps shows the probability of earthquake ground motions.

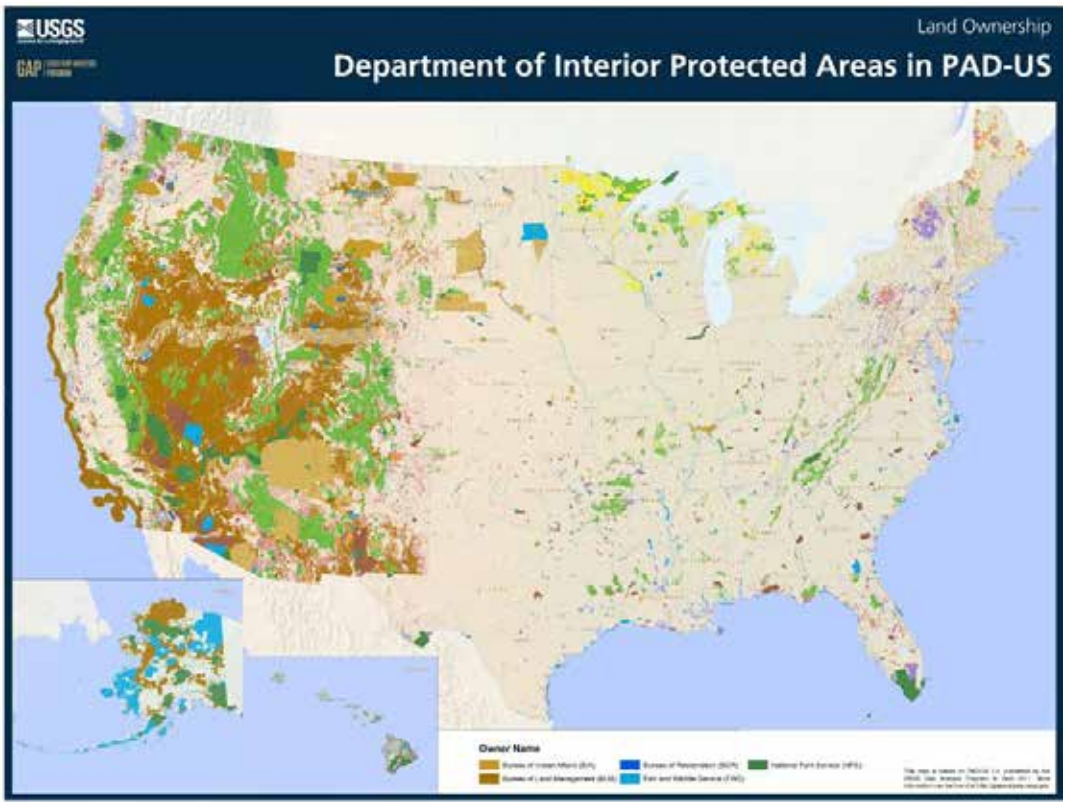
Despite numerous regular earthquakes, the economic development and urbanization has continued. Earthquakes pose a risk to mining operations as they can cause major damage to facilities. Yet, the mining industry is aware of these risks and operations have been kept active. Actually, landslides in mines may also cause small earthquakes themselves as recently evidenced by the massive landslide at the Bingham Canyon copper mine in 2013 (Pankow et al., 2014). Despite the risks created by earthquakes, they have had little importance in influencing the economic development of the country.

4.6 Ecologically Sensitive Areas

Protected Areas are lands dedicated to the preservation of biological diversity and to other natural, recreation and cultural uses, and managed for these purposes through legal or other effective means. Protected areas are a good proxy for areas that may represent a challenge for mining operations given their special ecological sensitivity or unusual sensitivity due to other aspects, e.g. land belonging to indigenous groups. As shown in Figure 5 most of the protected areas are in the Western part of the country, associated with the large amount of public lands available in this sector used as national parks, administered by the Bureau of Indian Affairs and the Bureau of Land Management.

Ecosystem protection in the USA may become grounds for incompatible land use for large-scale mining projects. An example is given by the Pebble project, the largest undeveloped copper and gold mine in the world. The project to mine the Pebble deposit in Alaska was halted in 2013 due to complaints claiming the project posed high environmental pollution risks in a wilderness area, one of the top producing wild Pacific salmon system in the world (Wild Salmon Center, 2015).

Figure 5: Map of protected areas in the USA.



Source: USGS National Gap Analysis Program – Protected Areas Database.

5. Socio-cultural factors

5.1 Historical Background

The most influential socio-economic events of the 20th century have been the Great Depression (1930s), World War II, the Great Society (1964-65), the Great Inflation (1965-1982), the Cold War, the Reagan Administration (1981-89) and the Great Recession (2007-2010).

At the peak of the Great Depression (1930s), unemployment was nearly 25% of the workforce as hundreds of banks failed and hundreds of millions of deposits were lost. The "New Deal" program was launched to rebuild the USA's economy by providing people with employment through government-sponsored work projects. The Public Works Administration ran programs to build public buildings, infrastructure, and affordable housing by e.g. promoting the resource extraction and construction sector, with coal playing a major role as energy provider. In addition, the Social Security system was established to provide nominal unemployment insurance. In short, the New Deal vastly expanded the role of the federal government in the USA economy and a close relationship with the private sector was established.

The strong interrelationship between the government and the ever-expanding industrial sector helped establish the USA as the economic superpower of the world going into the Cold War. During this time, the USA was the world´s largest economy and central banker´s valued the North American currency so much that the USA dollar (USD) became the world's reserve currency in August 1944. Thus, by being the reserve currency, the USA can borrow money at a much cheaper rate than any other country. Since 1944, all foreign currencies have been compared against the USA dollar. Gross National Product increased by 50% from 1941 until 1945 and unemployment hit its lowest point at 1.2%. In the mid-1960s, President Johnson launched the "Great Society" program, which focused on eradicating extreme poverty (e.g. health access through Medicare, Medicaid) and racial injustice. However, this programme combined with escalation in Vietnam and the Space Race to put a man on the moon before the U.S.S.R., made other countries realise that the country was printing more money without having the hard assets. President Nixon ended the link between USA currency and gold on August 15, 1971; immediately the price of gold skyrocketed. Since then, the U.S has run a deficit.

The Great Inflation (1965-1982) was the defining macroeconomic event of the second half of the 20th century. During those years, the global monetary system established in Bretton Woods was abandoned (on August 15, 1971), and there were four economic recessions, two severe energy shortages and implementation of wage and price controls. But most importantly it was a period when the rules that today guide the monetary policies of the Fed and other central banks around the world were established (Bryan, 2013).

The Cold War was another inflection point as it triggered the development of the strategic reserves, both in oil and in mineral commodities, and spurred on a temporary boom in USA domestic production, with positive impacts on economic growth and government-funded, technological development, especially in the military.

The Reagan Administration implemented many conservative economic liberalization measures including the reduction of the federal income tax and capital gains tax, reducing government regulation and government spending but considerably increasing military (deficit) spending. Although economic growth resumed (in part due to young boomers pouring into the labour force, settling down and starting families), such measures were costly with an increasing annual budgetary deficit and considerable increases in the national debt. As a result, the USA passed from being the world´s largest international creditor to the world´s largest debtor nation (in absolute terms) (Weisman, 2004).

During the 1990s, with the end of the Cold War, government spending decreased, the USA demobilized armed forces and spending was reallocated to peacetime purposes ("Peace Dividends"). In that decade, the economy was driven by new technologies (knowledge-intensive) and the Internet. In addition, the rapid liberalizing of global trade and growth in the BRICS helped foster continued economic growth in the USA throughout the 1990s and 2000s. The global financial crisis and the Great Recession in 2007 led unemployment rates to near the post-WWII high in the 1980s and have left the country in a slow, but steady expansion and recovery (Center on Budget and Policy Priorities, 2015). All in all, there have been over thirty cycles of expansions and recessions of the USA Economy since 1854 (NBER, 2010).

During all such cycles, natural resources endowments played a significant role in the economic development of the USA, particularly crucial during the early industrialization in the early 20th century (e.g. coal-based industry) and during the high economic growth era after WWII (e.g. transition to an oil-based economy). Mining output rose from about 1% of the national income in 1860 and peaked in 1920 around 3.5% but later on declined during the 20th century. Thus, mining alone was never a significant stimulant to economic development, "mining was linked to an overall transformation in business, financial organization, education, research and knowledge development, human capital accumulation and infrastructure expansion" (Power, 2002:4). The domestic raw material supply was transformed into over $2.4 trillion in goods and services, represented about 15% of GDP (NMA 2011).

The industry was supported by well-developed and stable political institutions that respect the rule of law, markets and private enterprise and was encouraged by a culture of entrepreneurship and risk-taking. Thus, the USA economy transitioned from a domestic, natural resources-based one to a knowledge-based economy in which endowments like human capital, knowledge, innovation capacity and good institutions explain as much, if not more, the comparative advantages of a country like the USA as traditional endowments like land or labour (Ferranty et al., 2002). The key component of a knowledge-economy is a greater reliance on intellectual capabilities than on physical inputs or natural resources (Powell and Snellman, 2004). In this transition, public and private policy has a large role in building up these endowments like investments in quality education, developing the national innovation system, including the promotion of information and communications technologies, and good governance institutions (effective property rights, rule of law, security, transparency, etc.) (Ferranty et al., 2002). Yet, although mining is almost a forgotten industry in the USA to the general public, it still keeps playing an important role and the USA remains the world´s leading mining country when measured by production value (MacDonald, 2002). A key element of US policy on minerals is that policy is about ensuring free movement and access to a global market of minerals. As an example, when China changed its policy on access to REE, the USA took steps towards resuming domestic production. However, as long as overseas sources are accessible, the USA will keep its minerals in the ground.

5.2 Human geography

5.2.1 Demographics

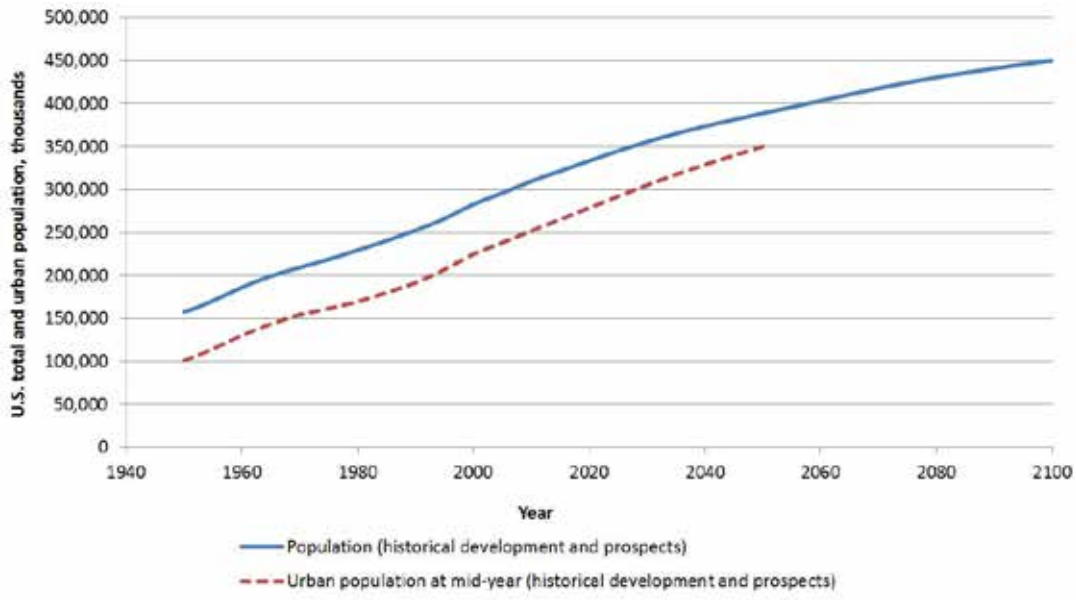
Inhabited by over 320 million people (about 4.5% of the world´s population) (United Nations, 2015), the USA is the 3rd most populous country in the world after China and India. The period in history with the most dramatic demographic transition took place between 1800 and 1940: in 1800 the average woman had 7 children, and 94% of the population lived in rural areas; by 1940 the average woman birthed 2 kids, and 43% of the people lived in the country. This was mainly result of technological progress in agriculture and manufacturing (Greenwood and Seshadri, 2002). After the World War II, 1946 was a year marking the beginning of a baby boom with 3.4 million births (called informally "boomers"), the highest in the history. In 1947 another 3.8 million babies were born, a process maintained

until 1964 (by then there were around 76 million boomers) and which involved automobiles, cities and suburbs growing and the population urbanizing. By 1950 the USA population had already doubled the population in 1900 (estimated at 76 millions) (U.S. Census Bureau, 2000) and the percentage of urban population was already of 64% (compared to a 39.6% in 1900).

In the next 65 years after 1950, the population kept growing at an average annual rate of 1.1% and doubled its 1950 level already by 2007. Projections show that the USA population will continue to grow more slowly (than in the past) and may reach 388 million persons (according to the United Nations estimations) by 2050; in contrast, the U.S. Census Bureau estimate a population of 440 million by then (Shrestha and Heisler, 2011).

In any case such growth is the highest amongst industrialized countries. Such population growth is driven by declining

Figure 6: USA´s total and urban population. Historical development and prospects.



Source: United Nations, (2015) (estimates, medium variant for prospects)

mortality rates, fertility levels around the replacement level and trends in net international migration where more migrants move into the USA than those leaving (Shapner, 2007).

During history, internal (regionalism) and external migration and mobility have been very important issues in terms of workforce, e.g. for the raw materials industry, population growth, redistribution of political power, racial and ethnic minorities, religions and other cultural institutions. A wave of massive internal migration in the USA took place during the mid-19th century from the eastern toward the western states; after WWII migration to suburbs became of importance as well as the population shift to California and the West. Also, after WWII the migration of African Americans from the South to Northern urban centres counts as one of the largest unforced migrations in human history. During the last 30 years internal migration has fallen noticeably, yet, it remains higher than that within most other developed countries (Molloy et al., 2011). In contrast, external immigration towards the USA has expanded and gained in strength. Currently the U.S. Census Bureau projects that the net international migration will become the primary driver of the population growth in the next decades. Between 2014 and 2060 the USA native population is expected to increase by 62 million and the foreign-born one is projected to grow from 42 million to 78 million. Currently immigrants account for a 13% of the total population and this percentage is expected to reach a 18.8% by 2060 (Colby and Ortman, 2015).

The USA population is already predominantly urban with 81% residing in cities and suburbs as of 2014. This percentage is expected to keep growing as metropolitan areas continue their urban sprawl, particularly in coastal counties which are growing in population density and will keep concentrating population along the USA coastlines (FEMA, 2011).

5.2.2 Ethnic composition

Immigration has been an important component of population growth in the USA and this has driven the formation of a racially, ethnically and linguistically diverse population. During the colonial era blacks from West Africa came to dominate the migrant stream, outnumbering whites in most years from 1700 to 1760 (McDonald, 2007). During the years 1820-1920 a wave of European immigration took place accompanied by other minorities like the Chinese, e.g. driven by events like the California Gold Rush. European immigration was accelerated from the 1890s (e.g. due to the reduction in transatlantic journeys from 44 days in 1850 to 5 days in 1897) and by 1920 more than 4 million had entered the country. As a result, in 1900, only one in eight residents of the USA claimed non-European origins; today three in ten do.

The Immigration and Nationality Act of 1965 produced substantial changes in the origin of immigrants as it abolished the previous Immigration Act of 1924 (National Origins system) which regulated quotas of white immigrants and aimed to reduce the overall number of unskilled immigrants, to allow families to re-unite, and to prevent immigration from changing the ethnic distribution of the population. It also included the Asian Exclusion Act which banned East Asians, Arabs and Indians from legally immigrating. By the new Act of 1965 the immigration structure was changed. European immigration declined considerably and increased from South and East Asia and from Mexico, Central America and the Caribbean region. Currently the census officially recognizes six ethnic and racial categories: White American, Native American and Alaska Native, Asian American, Black or African American, Native Hawaiian and Other Pacific Islander, and starting in 2010, people of two or more races. "There are two minimum categories for data on ethnicity: «Hispanic or Latino» and «Not Hispanic or Latino.» The concept of race reflects self-identification by people according to the race or races with which they most closely identify" (U.S. Census Bureau, 2015a).

Currently (2014 data), the "White American" or "Non-Hispanic white alone" ethnicity (197.9 million) represents 62% of the USA population and the "Hispanic" represents the largest minority with 17.4% (55.4 million, concentrated in California). It is then followed by Black or African American with 13% (45.7 million) and Asians totalling 6% (20.3 million) (U.S. Census Bureau, 2015b). Trends show that the population as a whole is becoming more and more racially and ethnically diverse with the percentage minority increasing from almost 33% in 2004 to almost 38% in 2014. Moreover, recent results found that for the first time in USA history, more than 50% of children under age five are minorities (race or ethnic group) (U.S. Census Bureau, 2015b).

Immigration has been recognized in the USA as an important factor to achieve economic growth and prosperity because they contribute to the creation of business, jobs, develop new ideas and make substantial contributions to USA firms´ competitiveness, particularly in the technology-intensive and service industries (Aguilar, 2013; Anderson and Platzer, 2006; Bellows, 2011; Peri, 2010). An indicator of the immigrants' contribution to the economy is given by the wages and salaries they earn, as well as the income of immigrant-owned businesses, as a share of all wages, salaries, and business income in the U.S: their share of total output was about 14.7% over 2009–2011 (Costa et al., 2014).

5.2.3 Language

The United States does not have a national official language; nevertheless, English (specifically American English) is the primary language used for official purposes and it has official status in 31 of the 50 states (CIA, 2015c). The diversity of languages spoken by immigrants throu-

ghout USA history exceeds the 381 codes by the U.S. Census Bureau. The languages most frequently spoken other than English have been Spanish, French, Italian or German (Ryan, 2013) with documents in urban areas printed often in English and Spanish and in some cases Vietnamese and Chinese. Although Spanish is widely used in the country, it is not used as a core for commerce and government, which happens in English.

5.2.4 Religion

Influenced by the diversity in the beliefs of immigrants, religion in the USA is characterized by a diversity of religious beliefs and practices (pluralism), with a strong influence of Protestants in the foundation of the Nation. There is no official state religion and the Constitution forbids the government from interfering with the establishment and exercise of religious practices. Religion is considered a personal value.

Currently, 70% of the population is self-identified as Christian, 46.5% Protestant and 20.8% Roman Catholic. Trends show that Christians are declining as a share of the population while other faiths are growing (The Pew Research Center, 2015) . In comparison to other countries, the USA looks more religious than normally expected as measured by either beliefs or church attendance (Barro and Mitchell, 2004) with a majority of Americans reporting that religion plays a «very important» role in their lives, a proportion unique among developed countries (The Pew Research Center, 2002).

Although religion is an important dimension of culture, economists to date have paid little attention to its role in economic growth. Research has found that there is a correlation between religious belief/ observance and economic activity, and that belief systems will always impact on the way society operates including in the sphere of industrial performance. Results show a strong correlation between economic growth and certain shifts in beliefs though only in developing countries (Barro and McCleary, 2003). For the USA research has also determined that religious affiliation has an impact on the costs and benefits of interrelated decisions that people make in their lives affecting economic behaviour and that religiosity also affects economic outcomes, partly because religious involvement in the USA has generally beneficial effects on health and well-being (Lehrer, 2004).

5.2.5 Cultural Norms, Values & Conflicts

A central tenet of American values is of individual freedom and self-reliance. These were values held from the earliest days of European settlement, where most immigrants travelled seeking freedom of religion and the opportunity of building a new life away from the structures of their past life in Europe and without a debtors prison in the USA. Given they were building a society from a largely undeveloped land, immigrants had to work hard to survive. Captain John Smith was famous for his biblical basis for this in Jamestown, stating that the person who does not work will not eat. These beliefs are among the most important cultural values even today. Being a nation of immigrants who took a major risk to move from their native country, the USA has also a strong culture of risk-taking and entrepreneurship, a cultural fact that has sparked questioning established ways of doing things and pursuing innovation (Atkinson, 2014).

According to Hofstede´s model, the USA scores low in power distance, namely, people feel entitled to a certain amount of power and do not accept easily an unequal power distribution. This low score is combined with a high score on individualism that derives from the American premise of "liberty and justice for all", hierarchy in organizations, informal communication and information sharing between managers and employees, and a society favouring people to look after themselves and their immediate families without relying on authorities for support (The Hofstede Centre, 2015).

Another cultural characteristic of the USA society is that it is driven by competition, achievement and success. In this sense, the American society, influenced by individualism, is permeated by the competitive behaviour in school, work and play that people should strive "to

be the best they can be", with being able to show one´s success as the great motivator. Likewise, mentalities are characterised by a "can-do" attitude creating dynamism in society and the fact that typically Americans "live to work" so that they can obtain monetary rewards and attain a higher status (The Hofstede Centre, 2015). Status is earned in the USA based upon what an individual does, an emphasis that can be traced back to the Calvinist belief that the each individual is equal in the eyes of God and can accomplish whatever is desired if he or she is willing to work hard (Weaver, 1997).

Yet, this individualistic competition has been translated into "coopetition" and cooperation, for instance in the innovation sector, with groups working together to drive it. While in the 1970s almost all innovation winners came from corporations acting on their own, more recently "the winners" are partnerships involving business and government, including federal laboratories and federally-funded universities; this culture of collaboration has been considered key for the success of places such as Silicon Valley or Boston´s Route 128 (Atkinson, 2014).

With regards to long-term orientation, US society appears to maintain time-honoured traditions and norms while viewing societal change with suspicion. This is exemplified by Americans being prone to analyse new information to check whether it is true or false, and the way that American businesses measure their performance on a short-term basis (which in turn plays against long-term investments in the majority of investments in innovation). Finally, US society scores high in the indulgence dimensions, which is reflected in contradictory attitudes and behaviour such as work hard and play hard, the fact that the USA are waging a long-standing "war against drugs" despite drug addiction being higher than in other wealthy countries (The Hofstede Centre, 2015).

5.2.6 Civil society & environmental awareness

A critical component of the social fabric of the USA is constructed of the civil society component, through which non-profit organizations operate. A wide range of activities are dominated in the country by the over 1.5 million registered non-profit organizations, including educational, charitable, civic, social welfare, and environmental efforts. The American civil rights movements (including the Afro-American one aiming to end racial segregation and discrimination against black Americans) gained prominence from the mid-1950s and during the 1960s which had big gains like the Civil Rights Act of 1964, the Immigration and Nationality Services Act (1965) and the Fair Housing Act (1968), banning discrimination in housing.

The rise of the modern environmental movement in the USA can be traced to several widely publicized events in the 1960s and the 1970s. Much of the movement was inspired by Rachel Carson's book Silent Spring in 1962, which brought about the first public debates on the increased use of chemicals and their impact on the environment and human populations. Public awareness and concerns continued to expand with additional environmental events, such as the 1969 Santa Barbara oil spill and the Cuyahoga River fire in the same year, as well as the Love Canal toxic dumping pollution event in 1976 that lead to the passing of Superfund legislation for major hazardous waste clean-up needs.

The Clean Water Act of 1972 is the basic framework legislation on water regulations and the Clean Air Act of 1970 focuses on the control of air pollution. One of the more significant aspects of the law is the ability for the Environmental Protection Agency (U.S. EPA) to establish air quality standards to protect public health and welfare. The U.S. EPA is a federal government agency established by President R. Nixon in 1970 with a strong participation in the regulation of environmental affairs in the country.

Today the environmental movement in the country is active at the national, local, and international levels. Local efforts often include protection and preservation of communal environmental spaces and mitigation of development impacts. On the national level, there are many prominent NGOs that lobby for national environmental legislation. Internationally, NGOs and the American government

also play an important role in international discussions on the environment (Gordon, 2012). An environmental ethic has enabled market-driven solutions to a number of environmental issues. For example, even though the United States never signed on to Kyoto, price-driven efficiencies for energy drove the country to be the only major country to actually meet the Kyoto goals, even without explicit policies to meet those goals.

With regards to the non-energy mining industry, an active civil society has increasingly brought the industry under much scrutiny, conditioning the "social license to operate". Nowadays, the USA overall does not view itself as a mining country anymore and much of the public view of mine operations is generally negative, mostly because of ongoing impacts from abandoned mines from the 19th and early 20th centuries. The USA has a historical legacy of many abandoned mines and mineral prospects and their related environmental and health impacts. This has been a major problem for developers gaining the social license to operate in the last 30 years.

Specific regulations regarding closure vary by jurisdiction, but in many cases, companies are required to deposit a bond for the entire cost of reclamation before beginning operations. Also, operators are held liable for environmental, health, and safety impacts of their operations. Because of the diversity of requirements and local situations, approaches to dealing with closure are varied. The social license issue is paramount for new operations and is an ongoing challenge. However, some states are more open to mineral development, such as Nevada and parts of Arizona or Alaska. Like in real estate development, "location, location, location" is a key component of building a mine.

5.3 Education

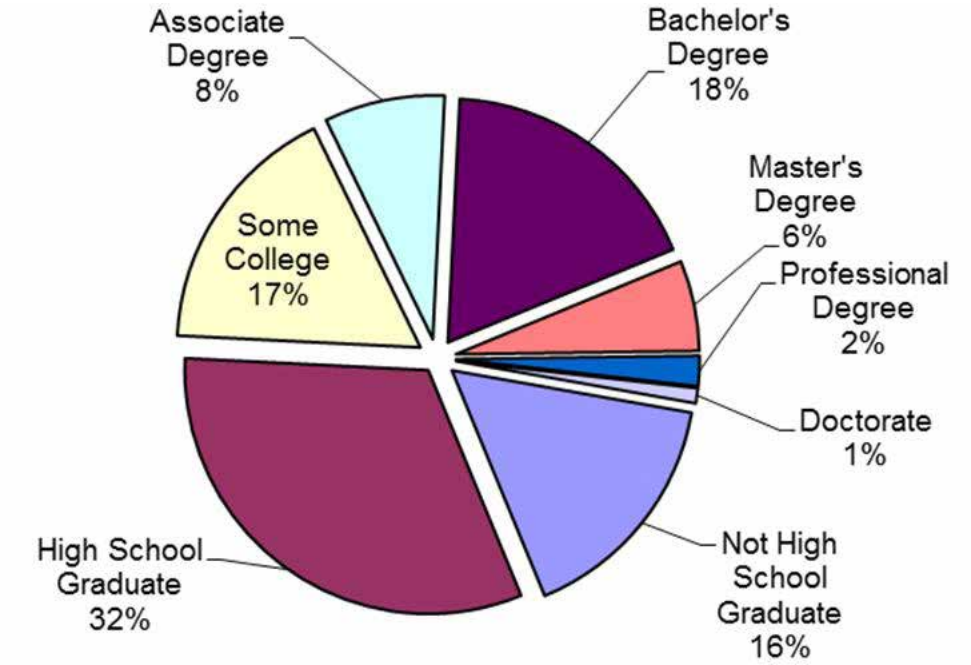
5.3.1 Education system

Early since the Nation was created, the USA has invested in improving the educational attainment of the population. One major step to increase school attendance took place between 1852 and 1918, a period in which all states and territories, enacted compulsory school attendance laws. Currently, although compulsory schooling laws differ to some degree by state, most states require that children attend school between the ages of 6 and 16 (Jeynes, 2007). The 12 years following the kindergarten year (K-12) are usually organized under what is known as the '6-3-3 plan' where grades 1 to 6 are in elementary (primary) school, grades 7 to 9 in junior high or middle school and grades 10 to 12 in a (senior) high school. Public education in the USA is universally available at the K-12 level. K-12 public school curricula, budgets, and policies are set through state and local school boards, who have jurisdiction over individual school districts. Compared to many other nations, the performance of USA K-12 students on internationally comparable standardized tests like PISA and TIMMS is generally lacking but the system does appear to do a better job in encouraging independence and creative thinking which plays a supportive role in USA innovation and entrepreneurship (Atkinson, 2014).

The proportion of young people enrolled in school remained relatively low in the last half of the 19th century. Although enrolment rates fluctuated, roughly half of all 5- to 19-year-olds enrolled in school. Following the Civil War, enrolment rates for blacks rose rapidly from 10% in 1870 to 34% in 1880. The beginning of the 20th century brought sustained increases in enrolment rates for both white and minority children. The overall enrolment rates for 5- to 19-year-olds rose from 51% in 1900 to 75% in 1940. Enrolment rates continued to rise in the post-war period for all. By the early 1970s, enrolment rates for both whites and blacks had risen to about 90% and these rates have remained relatively stable since then. Currently the educational attainment of the USA population is similar to that of many other industrialized countries with the vast majority of the population having completed secondary education and a rising number of college graduates that outnumber high school dropouts.

This level of investment in education in

Figure 7: Highest Level of Education Attained by Persons 25 Years and Older.



Source: U.S. Department of Education and NCES (2003)

the USA population is also reflected by the fact that more than 40% of the population aged 55-64 have tertiary education, a proportion among) OECD members only seen in Canada or Israel (OECD, 2014a). Not only high educational attainment levels are required, but quality education is essential to economic growth as it has been shown that individual earnings are systematically related to cognitive skills and the distribution of skills appears closely related to the distribution of income (Hanushek and Wößmann, 2007).

The USA has a long tradition of business schools at universities and houses at least seven of the top ten business schools in the world (Financial Times, 2015) with (full-time) tuition fees per year ascending to around USD 60,000. In general, the literature shows that education in the USA is directly related to earnings. It has been recently shown that the level of education matters more in the USA in relation to earnings and in comparison to other countries. Across the OECD, over 27% of adults who have not completed upper secondary education earn less than half of the national median; in the USA, 48 % of adults in this group do. On the other hand, among adults who have completed a university-level education, 31% earn more than twice the median, versus the OECD average of 28% (OECD, 2014b). In the USA direct costs such as tuition fees are the highest across OECD countries. A student pursuing higher education invests about USD 61,000 in direct costs and USD 45,000 in foregone earnings. The OECD averages are around USD 11,000 (direct costs) and USD 40,000 (foregone earnings) (OECD, 2014b). Therefore, around two-thirds of USA students graduating (from college and university) owed in 2013 on average USD 28,000 in federal and private loans (Reed and Cochrane, 2014) and the national student debt reached the USD 1 trillion mark in 2011 (Chopra, 2012).

The literature acknowledges that rising educational attainment in the USA (or investment in human capital) over time does not guarantee improved economic conditions (Hanushek and Wößmann, 2007) or imply a direct relationship between education and economic growth. But it has contributed greatly to increases in the economic productivity and standard of living in the USA (Berger and Fisher, 2013; The Brookings Institution, 2010). Education raises people´s productivity, creativity, promotes entrepreneurship and technological advances (Ozturk, 2008) and it has been claimed that investment in higher education may

be more growth-enhancing in the USA or Europe than in the past or than in developing countries (Aghion et al., 2009).

5.3.2 Education infrastructure

Private schools account for about 24% of all elementary and secondary schools, 10% of all students and 12% of all teachers in the country. In addition, a growing number (about 2%) of USA students ages 5–17 receive their education through home-schooling. Additionally, vocational and technical education is being offered at the secondary, postsecondary and adult education levels. At the secondary school level, most public schools, and many private and charter schools, offer one or more vocational education programs and/or courses. Some states have well-developed vocational education programs with apprenticeships or work-based learning opportunities. The number of tertiary education public institutions (4 and 2-year) totals 1,699 and those private (4 and 2-year) 2,241. The USA ranks 36th in the world under the category "Quality of primary education" in the Global Competitiveness Index 2014 and ranks 90th under the "Primary education enrolment, net %" indicator of the same publication (World Economic Forum, 2014).

5.4 Health

5.4.1 Health system

The USA has no single nationwide system of universal health insurance coverage. Health care facilities and services in the USA are largely owned and operated by the private sector, and the government provides insurance only to certain groups. About 84% of the population is covered by either public (26%) or private (70%) health insurance. The two major types of public health insurance, both of which began in 1966 are Medicare and Medicaid. Medicare is a uniform national public health insurance program for aged and disabled individuals covering around 13% of the population and Medicaid (healthcare for the poor), jointly financed by the federal and state governments covers approximately 12% of the population (Ridic et al., 2012). With the passing of the 2010 Affordable Care Act around 14 million adults gained health insurance coverage since the beginning of open enrolment in 2013; yet the uninsured rate (low-income working families) reached 12.9% of the population in January 2015 (Obamacare, 2015), either because costs are too high or because they are unemployed (Kaiser Family Foundation, 2014).

The USA spends two-and-a-half times more than the OECD average health expenditure per person, i.e. health expenditure per capita (public expenditure nowadays around 17% of GDP and private) in the USA is the highest by far among the OECD nations (OECD, 2014c) and in the world. Main differences accounting for these higher costs involve a higher hospital and nursing homes spending, the spending on ambulatory care providers (physicians, specialists, dentists) is much higher than in other OECD countries and the fact that USA health prices are higher than in other OECD countries (OECD, 2011). Over time, people have been spending more on health care. They have been spending so much that the healthcare spending is responsible for a boost in the growth of the economy (Kasperkevic, 2014).

With regards to the health status, in 2011, life expectancy in the USA stood at 78.8 years, 1.5 years less than the OECD average of 80.2 years, with a gap widening in this respect between the USA and leading OECD countries. This slower progress in life expectancy is claimed to be due to gaps in health insurance coverage and proper primary care and poor living conditions for a significant proportion of the USA population (OECD, 2014d). The USA health system is very good at preventive care and on waiting times for specialist care, and exceeds the number of nurses per capita in comparison to OECD average (OECD, 2014d). The infant mortality rate (2013) reaches a number of 6 (per 1,000 live births) which is similar to that of Canada (5) but higher than Australia (3) or Japan (2). Despite the high spending in health care, the USA underperforms other industrialized nations on issues such as health outcomes, equity, quality, and healthy lives (Davis et al., 2014). Likewise, the number of doctors and hospital beds per capita and obesity rates are higher

than OECD (OECD, 2014d).

5.4.2 Health infrastructure

The USA´s public health system is a complex network of people, systems, and organizations working at the local, state, and national levels. Both the public and private sectors have key roles in public health. The USA has more than 3,000 county and city health departments, more than 3,000 local boards of health, 59 State and territorial health departments, Tribal health departments, more than 160,000 public and private laboratories, and a series of Federal health and environmental agencies that set national standards and provide funding, training, scientific guidance, and technical support (CDC, 2001).

6. Economic factors

6.1 Economic Geography

6.1.1 Economic structure

In the early 20th century the USA economy moved rapidly from an agricultural to an industrial base. Since the end of World War II and during the 1950's and 1960's it began a shift towards a service economy (Matos and Wagner, 1998) and steadily increased its trade and financial openness. Currently the USA economy is dominated by the tertiary sector comprising 77.7% of the GDP (industry at 20.7%, agriculture at 1.6%) (CIA, 2015c). Finance, insurance, real estate, rental, leasing, health care, social assistance, professional, business and educational services account for more than 40% of GDP (Trading Economics, 2015a). Currently, the structure of the American economy is evolving, driven mainly by technology. USA firms are at or near the vanguard in technological advances, especially in computing and related applications, pharmaceutical development, and in medical, aerospace, and military equipment. The country is home to the largest and most influential financial markets in the world including major stock and commodities exchanges like NASDAQ, NYSE, AMEX, CME, and PHLX. The NYSE alone is more than three times larger than any other stock market in the world. Besides, the USA has the largest consumer market in the world (as measured by the household final consumption expenditure) (OECD, 2009).

With regard to the availability of risk finance for the mining industry, financing is acquired on the market, and finance markets in the USA tend to be very liquid, with ready access to global capital. There is nominal investment by the federal government into mining (although not as much as in oil and gas) and this is usually delivered as specific tax credits and other tax incentives, not direct investments.

6.1.2 Industrial Geography

The USA is considered one of the world´s preeminent industrial powers. It had the world´s largest manufacturing sector measured by its value-added until 2010 when it was surpassed by China (Baily and Bosworth, 2014). From the mid-nineteenth century until the 1960s, manufacturing was predominantly concentrated in the USA manufacturing belt, a relatively small part of the Northeast and the eastern part of the Midwest (Krugman, 1991). This was of importance in terms of economies of scale (e.g. dense rail network) and clustering back in the 1960s, but then industrial activity relocated towards the Sun Belt, overseas or Mexico. The manufacturing sector is nowadays recovering in the USA because transport fuel is expensive, USA natural gas prices have gone down (due to the fracking boom) and because the USA labour market has gained in efficiency and productivity growth. Local economies in which the manufacturing sector accounts for a relatively noteworthy share of earnings and employment are found throughout the USA, though they are concentrated in the Midwest and the South (Bond, 2013).

Currently, manufacturing is not the preeminent industry of the country, but shares its importance with other technology and knowledge-based industries. The USA´s 50 advanced industries comprise manufacturing (iron and steel, industrial machinery, motor vehicles and parts, aerospace electronics, food processing, consumer goods, petroleum and coal products, semiconductors and other electronic components, medical equipment and supply, etc.), energy (oil and gas extraction, metal ore mining, electric power generation) and services (telecommunications, computer systems design, medical and diagnostic laboratories, etc.). The USA has a very robust service industry in engineering support and technology. Much of it is not specifically focused on mining applications, but in many cases dual use

is possible. Import of contractors is generally not a major issue.

As of 2013 such industries employed 12.3 million USA workers (around a 9% of total USA employment) and 17% of all USA GDP which is more than any sector alone including healthcare, finance or real estate. Such advanced industries tend to cluster in large metropolitan areas: the 100 largest metro areas contain 70% of all USA advanced industries jobs (Muro et al., 2015). "Some metropolitan areas, such as Grand Rapids, MI; Portland, OR; and Wichita focus heavily on advanced manufacturing pursuits such as automotive, semiconductor, or aerospace manufacturing, respectively, while metros like Bakersfield, CA and Oklahoma City exhibit strong energy specializations. By contrast, services such as computer systems design, software, and research and development predominate in metropolitan areas like Boston, San Francisco, and Washington. For their part, San Jose, Detroit, and Seattle exhibit depth and balance across multiple advanced industry categories" (Muro et al., 2015: 5). Yet, the number of extremely dense concentrations of advanced industry activity has declined. Top-performing high-tech clusters exist in Silicon Valley (the world´s preeminent high-tech cluster), Seattle, Cambridge, Washington, Los Angeles and Dallas (DeVol et al., 2009).

6.1.3 Commercial Geography

During its modern history, the USA has relied heavily on imports of raw materials and the export of finished goods. Around 1950, the USA became a net importer of minerals (Lindert, 2000) and in 1958 the USA turned from a net exporter of fossil energy carriers to a net importer, and by 1973 already 20% of all fossil energy carriers and one-quarter of all petroleum and natural gas was imported. It is also the largest exporter in the world for commercial services (The Economist, 2012a) and the third largest for merchandise after China and the EU (CIA, 2015d). Total trade (exports and imports) accounted for 30% of USA GDP in 2013.

The USA has been running consistent trade deficits since 1976 due to high imports of oil and consumer products. In recent years, the biggest trade deficits were with China, Japan, Germany and Mexico. Balance of Trade in the United States averaged negative USD 12,949.4 million from 1950 until 2015, reaching an all-time high of USD 1,946 million in June of 1975 and a record low of negative USD 67,823 million in August of 2006.

USA top trade partners are (for exports and imports) in the North American Free Trade Agreement (NAFTA) being Canada Mexico, followed by China, the EU and Japan. The United States is the world's third biggest exporter, yet exports account only for 13% of GDP, with main exports being: capital goods (39% of total exports) and industrial supplies (28 %). The USA is the world's second biggest importer with main imports being: capital goods (29 %) and consumer goods (26%), followed by industrial supplies (24%);

Figure 8: USA´s balance of trade (USD million, 1950-2015).

Source: Trading Economics (2015b) based on U.S. Census Bureau

automotive vehicles, parts and engines (15%). Shipments from China represent 19% of the total imports followed by Canada (14.5%), Mexico (12%), Japan (6%), and Germany (5%) (Trading Economics, 2015c).

The USA has 14 free trade agreements in force with 20 countries. The country is also in negotiation of a regional, Asia-Pacific trade agreement, known as the Trans-Pacific Partnership (TPP) Agreement and the Transatlantic Trade and Investment Partnership (T-TIP) with the European Union (USTR, 2015).

6.1.4 Agricultural Geography

The country is the third largest agricultural producer in the world behind China and India. Agriculture is a vital part of the economy and society. According to the census of agriculture in 2012, there were 2.1 million farms in the country covering an area of 914 million acres and an average of 434 acres per farm (U.S. Department of Agriculture, 2014). Farmers are also one of the major political lobbyists in the country as they are primarily responsible for the country's food demands, as well as a major export industry with more than US$150 billion of agricultural products exported in 2014. The agricultural products include wheat, corn, other grains, fruits, vegetables, cotton; beef, pork, poultry, dairy products, fish and forest products. Agricultural activity is concentrated in the Great Plains in the centre of the country.

6.2 Key Economic Figures

6.2.1 Economic diversity

During the second half of the 20th century, USA´s economy has become more specialized with the service sector becoming of high importance, particularly for the creation of jobs. The sector has been both the largest and the fastest growing component of the USA economy. Several decades back, the service sector accounted for about 60% of USA output and employment; currently, the service sector's share of the country's economy has risen to roughly 80%, 84% if employment creation is considered (Haksever and Render, 2013).

6.2.2 Economic output

During the 20th century, the USA economy experienced its first inflection point (or structural break) during the 1930s with the great economic depression, which had worldwide effects, at least in the capitalist economic system. The fall of stock prices caused over 10,000 banks to go bankrupt in the period 1929-1933, industrial production decreased substantially and around 25% of the workforce was unemployed, with rates much higher in some cities. The most long-lasting effect of the Great Depression was the change in the role of the federal government influencing the economy which, among other measures, took over responsibility for the elderly with the creation of social security and provided the involuntarily unemployed with unemployment compensation (Smiley, 2008). F.D. Roosevelt´s "New Deal" involved a series of government-led economic measures (legislation) designed to prevent crashes in the future (e.g. Glass-Steagall Act of 1932) and reinvigorate the economy. Yet, it was only during WWII that the economic depression finally ended, with the American industry revitalized by the war.

After World War II the GDP growth rate in the USA averaged 3.26% ranging from 1947 – 2015. Its highest point was in 1950 at 16.9% (post-war economic boom) and its lowest point in 1958 at minus 10% (due to the recession of 1958). Total output for the USA economy in 2014 was USD 17.46 trillion representing 16% of the world's total output, only slightly outnumbered by China, at USD 17.63 trillion and the European Union, at USD17.61 trillion (CIA, 2015c).

The second structural break of the USA economy took place during the period of 1970-1975 caused by the global oil prices crisis. The period 1970-1973 is considered an era of considerable macroeconomic turmoil featuring the abandonment of the Bretton Woods exchange rate system in 1971 followed by an erratic monetary policy and the first oil price shock in 1973. This last year is considered a structural break point for the gross national product in the sense that the growth rate slowed persistently afterwards (McNown and Seip, 2011). The oil energy crises in 1973

and 1979 increased oil costs and sapped USA growth. The first crisis was an Arab oil embargo that began in 1973 and lasted about five months. During this period, crude oil prices quadrupled to a plateau that held until the Iranian revolution brought a second energy crisis in 1979 which tripled the cost of oil (Bryan, 2013).

Figure 9: USA´s GDP growth rate (percent, 1947-2015).

Source: Trading Economics (2015), based on U.S. Bureau of Economic Analysis

The longest economic expansion of the post-war era started in 1984, a period known as the second Great Moderation (1984-2007). This was an era of sustained moderate economic growth interrupted by "Black Monday" (October 19, 1987), when stocks markets around the world crashed, a mild recession in 1990-1991, growth resuming until 2000 (despite the dot-com bubble), unemployment reaching nearly 4% while the inflation remained under 3%, the lowest in the last forty years. In the first years of the 21st century the USA economy slowed down and the GDP growth rate contracted, all of which was tackled by the U.S. Fed by aggressively reducing interest rates searching for an economic recovery (Kozmetsky and Yue, 2005).

The third structural break in the modern USA history took place during the recent financial crisis of the years 2008-2009. The USA housing market, which boomed during the 2000s (driven by boomers entering their peak earning-, investing- and home-buying years), is seen by many as the root cause of the financial crisis. Since the late 1990s house prices had been growing in response to persistently low interest rates (determined by Greenspan as Chairman of the Fed) and generous lending and speculation. Greenspan and the Securities Exchange Commission have been criticized for keeping interest rates low for too long, thus allowing banks to borrow more and more without limits, which drove to a market downturn that could not be managed (Lee, 2009). The bursting of the house bubble in addition to other simultaneous crashes triggered the credit crisis (Marshall, 2009). The economic recovery only began in June 2009 and is still going. The US government largely intervened in the economy (i.e. increased federal spending) to resume economic growth by taking extraordinary measures to rescue (bail out) Fannie Mae and Freddie Mac mortgage lender giants, the largest banks (e.g. Bear Stearns), and the insurance company AIG, one of the world´s largest.

6.2.3 Labour costs, mobility & employment

Over the second half of the 20th century, labour costs in the USA have been growing, particularly after 1976 as the productivity in the USA grew at a slower rate than in any other industrial country except the United Kingdom.

The increasingly technology-driven and services-based economy in the country has been leading to the gradual development of a «two-tier labour market» in which highly skilled workers command growing and competitive compensation

and lower-skilled works have seen fewer opportunities and stagnant wage growth. Advanced industries also provide extremely high-quality economic opportunities for workers (Muro et al., 2015). Over the past twenty years, the USA economy saw some parts of the tradable sector (manufacturing) grow in value added and employment (e.g. the finance, insurance, and computer systems design industries) whereas others grew in value added but declined in employment (e.g. the electronics and auto industries) (Spence and Hlatshwayo, 2011).

Historical unemployment rates peaked during the Great Depression (estimated at slightly over 20% during 1930-1933) and then gradually declined to 15% by 1940.

Figure 10: USA´s labour costs (index points). 1950-2015.

Source: Trading Economics (2015e) based on U.S. Bureau of Labor Statistics

Figure 11: USA historic unemployment rate (percentage, 1950-2015).

Source: Trading economics based on U.S. Bureau of Labor Statistics

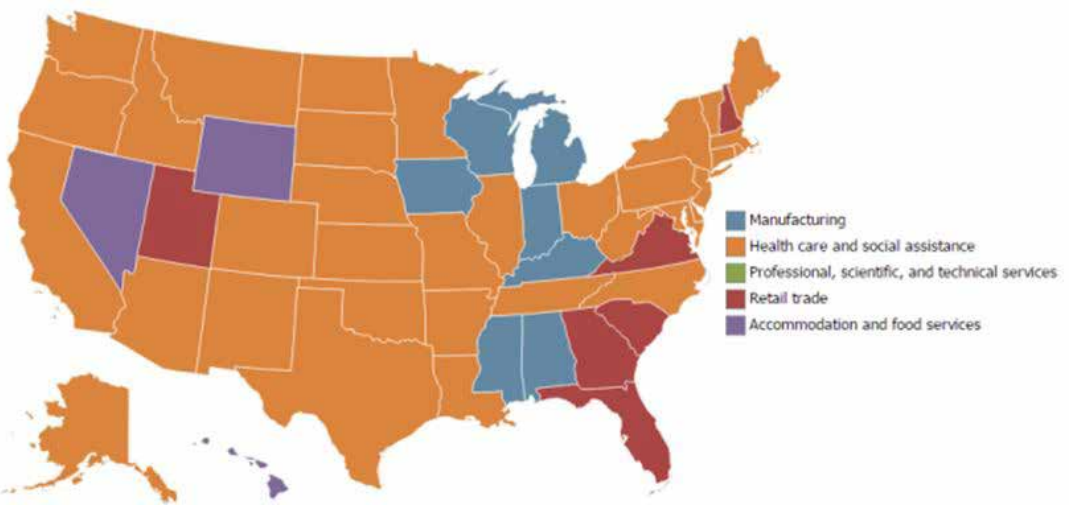
With WWII, unemployment declined considerably and then it was kept below the 8% between 1950 and the mid-1970s when they increased considerably during the Great Inflation period reaching 14% in 1980. They decreased subsequently to a level below 6% by 1990 and only increase considerably again during the Great Recession of 2007. From then on the USA economy has been recovering and the unemployment rate has been going down. In 1990, the manufacturing industry was the leading employer in most of the country's states, followed by retail trade. Currently, besides government-based jobs, health care and social assistance was the dominant industry in 34 states.

Between 1990 and 2008 the number of jobs increased by 27.3 million, most of them created in the non-tradable sector

(government, health care, retail, accommodation/food service and construction) and fewer in the tradable sector (manufacturing) (Spence and Hlatshwayo, 2011).

USA´s mining directly and indirectly generated just over 1.9 million jobs (37% in coal mining, 8% in metal ore mining and 44% in non-metallic) and a total income exceeding US$118 billion (40% in coal mining, 19% in metal ore mining and 41% in non-metallic) in 2012. Mining contribution to GDP was US$225 billion with the coal and non-metallic sector having highest contribution (37% and 38%) (National Mining Association, 2012). The USA has a solid, well-educated general workforce and a large workforce in the geosciences (around 300,000 geoscientists). However, there are serious concerns about the future availability of American geoscientists workforce: the U.S. Bureau of Labor Statistics projects an overall 19% increase in all geoscience-related occupations between 2006 and 2016, which is 9% faster than the growth rate for all U.S. occupations. However, the supply of new geoscience graduates to the workforce does not meet current demands, much less the projected increase in demand over the coming years. An additional concern is the aging geoscientists workforce, with approximately 50% of geoscience professionals within 10-15 years of retirement (Gonzales and Keane, 2010). If the mining specific workforce is considered, this is much more limited and has been declining for generations as the size of the necessary mining labour pool has shrunk. The USA is down to 13 mining-focused university programs and faces imminent loss of critical skills (e.g. underground ventilation). However, import of skilled labour is not overly difficult, especially on a contracting basis.

Figure 12: Major industries with highest employment, by state 2013.



Source: U.S. Bureau of Labor Statistics

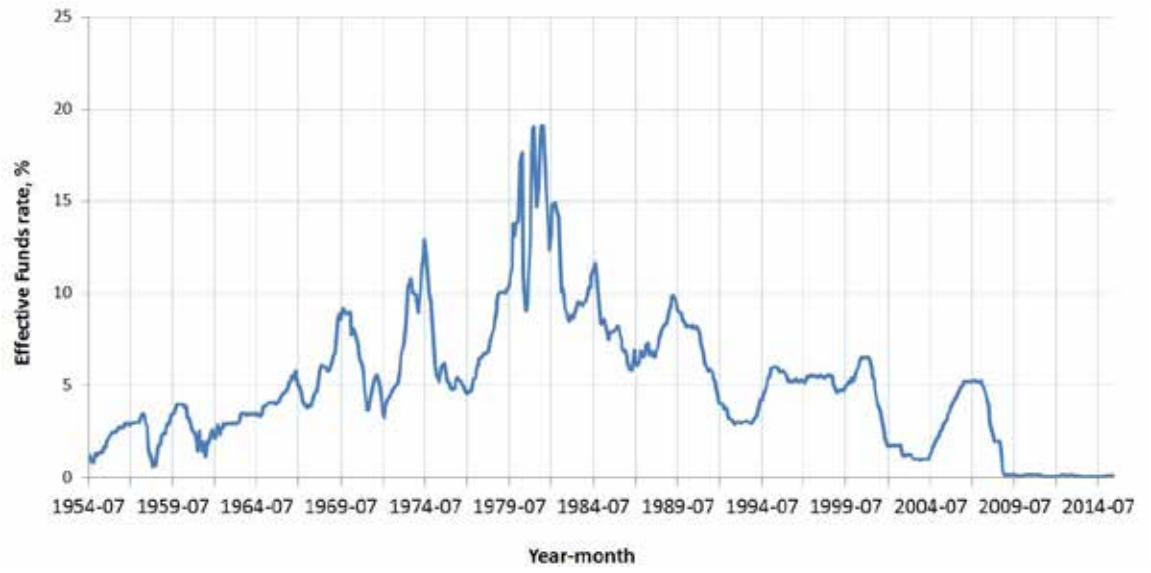
6.2.4 Interest rates

The central bank of the USA is the Federal Reserve System, or the «Fed». By law, the Federal Reserve (created in 1913) is an independent agency that conducts monetary policy to achieve maximum employment, stable prices, and moderate long-term interest rates. Main tools of monetary policy are open market operations, discount rates and reserve requirements. When reference is made to the country's interest rate this often refers to the Federal Funds Rate, also known as the Fed Funds Target Rate, which is the interest rate at which depository institutions lend balances (funds) held at the Federal Reserve to other depository institutions overnight. These real rates change daily, but are usually close to the target rate desired by the Federal Reserve, and are known as the Fed Funds Effective Rate. The federal funds rate is one of the

most influential interest rates in the USA economy, since it affects monetary and financial conditions, which in turn induces a chain reaction on essential aspects of the USA economy such as employment, growth and inflation. Lower interest rates usually spur the economy by making corporate and consumer borrowing easier. Higher interest rates are intended to slow down the economy by making borrowing harder (Pope, 2000). However, the Fed also acts on the discount and prime rates and on inflation by lowering or raising interest rates.

During WWII, the Fed and the U.S. Treasury played an important role in financing military expenditure. The Fed focused on supporting war financing while minimizing inflationary consequences (Richardson, 2013). Just as it had during WWI, during WWII, the Fed pegged interest rates at a low level in order to facilitate the financing of government debt. During the post-war years the Fed maintained an important role by adjusting interest rates according to the economic situation. The rate reached peaks in 1979 and 1980 at almost 20% as a means to fight the high inflations during Nixon´s "stagflation" period and Reagan´s deficit spending period. Ever since, effective rates have been kept below 10%.

Figure 13: USA Historical Effective Federal Funds Rate (monthly, 1954-2015).



Source: Federal Reserve, (2015a)

In 2007, the financial crisis was a period of global financial strains which was the most intense since the Great Depression. The FED took extraordinary actions against the financial crisis to help stabilize the country's economy and financial system. Major actions included the purchase of Bear Sterns by JP Morgan to avert bankruptcy and risking the entire financial system and economy; and the reduction of the level of short-term interest rates to near zero since December 2008 (Federal Reserve, 2015b). For that, the FED brokered the Bear Stearns´s sale to JP Morgan creating the Maiden Lane LLC to buy USD 30 billion of investments (toxic assets) that JP Morgan was unwilling to take over. The same procedures were applied to support the USD 182 billion AIG rescue (Wagner, 2010). Since December 16, 2008, the U.S. Fed has kept its benchmark interest rate at a range between zero and one-quarter percent.

6.2.5 Inflation rates

After WWII, a high inflation period took place during the early 1950s and then inflation was kept relatively low until 1964 when it began ratcheting upward during a period known as the Great Inflation period (1965-1982). This is known as the defining macroeconomic event of the

second half of the 20th century because during this time the Bretton Woods global monetary system was abandoned, there were four economic recessions, two energy shortages (oil crises) and an unprecedented peacetime implementation of wage and price controls (Bryan, 2013).

The abandonment of the Bretton Woods system (providing a fixed rate of exchange between foreign currencies and the USA dollar and linking the USA dollar to gold reserves) was prompted as inflation drifted higher during the latter half of the 1960s and many USA dollars were increasingly converted to gold which led President Nixon to abandon the system in 1971.

With the aims of reducing inflation, the Nixon administration introduced mandatory wage and price controls over three phases between 1971 and 1974; similar wage-price controls had been enforced before during WWI and WWII (with the aim of diverting resources for military purposes) and during the Korean war. The controls imposed by Nixon only temporarily slowed the rise in prices while exacerbating shortages, particularly for food and energy. Price controls were then lifted but the USA remained in a "stagflation" period (high inflation, stagnant economic growth and high unemployment). By 1980 inflation peaked at more than 14%, and it was halted by Paul Volcker´s Fed Chairman raising interest rates and triggering a recession. Inflation eventually declined to average only 3.5% in the latter half of the 1980s during a time of recession. Since the early 1990s, inflation has been kept at a level lower than 5% only surpassing it slightly during the Great Recession.

Figure 14: USA historic inflation rate (%, unadjusted CPI, yearly basis, 1950-2015).

Source: Trading Economics, (2015d)

6.2.6 Customer liquidation and spending power

Already eight years after the credit crisis and the Great Recession and while indicators like unemployment, foreclosure and credit card debt show a slow but steady decline, the percentage of households which are "liquid asset poor" has not declined. "Liquid asset poor" for a family of four is defined as savings of less than three times monthly income at the poverty level (US$5,887 according to Mcwhinnie, 2014). The USA domestic market constitutes the third largest in the world as measured by its GDP (purchasing power parity) behind China and the EU (2014) (CIA, 2015e) and it is the world´s largest consumer market (by household final consumption expenditure) (OECD, 2009). The USA consumers have a special affinity towards technology products, which is shown for instance, with the country ranking 2nd in the world in the "Availability of latest technologies" indicator (World Economic Forum, 2014).

6.2.7 Foreign investment

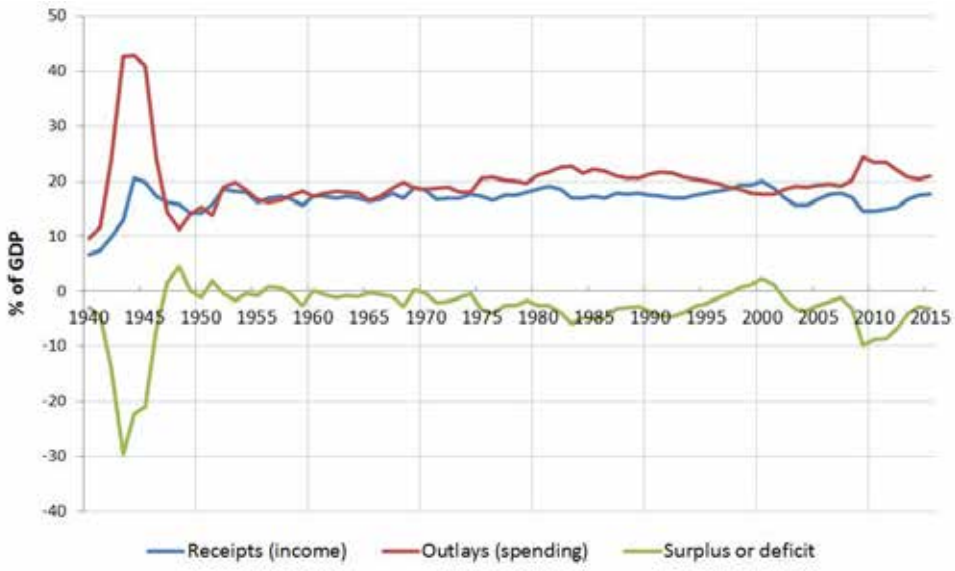
Investments in both domestic and foreign businesses are a major source

of economic growth and job creation and, despite the challenge presented by emerging economies, the country remains the most heavily invested-into country in the world, with the stock of direct foreign investments at home worth US$2.824 trillion as of 2012. The USA is also still the largest investor in the world, investing US$4.768 trillion abroad as of 2012 (Economy Watch, 2013).

6.2.8 Public finance situation

Historically the USA federal government annual budget has been characterized by a higher degree of spending than the income or revenue received (receipts). Since 1940 only rarely the balance was market by an annual surplus. The only periods when this took place are during the early post-war period (1945-1957), and then during the dot-com bubble (1998-2001) (***Figure 15***). The Treasury Department issues treasury bills, notes and bonds to compensate for the difference. As a result, the USA´s national debt, which encompasses the total accumulated debts over time for all levels of government, has been increasing over time, particular accelerating during Reagan Administration in the 1980s, during the 2000s, and more recently during the Great Recession due to the government bail outs to mortgage lenders, banks and insurance companies. Federal government expenditure has been around 20% of GDP, but if states and local expenditures are included government spending increased and was maintained around 30% of GDP and reached levels around 40% of GDP (USGovernmentSpending, 2015).

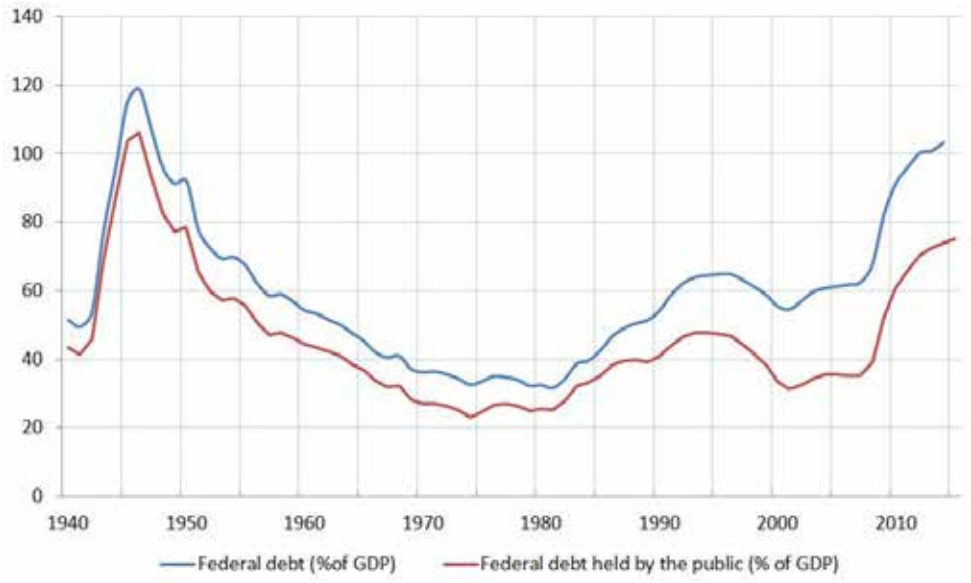
Figure 15: USA historical federal government receipts, outlays and balance (1940-2015).



Source: Office of Management and Budget (2015)

By December 2014 the national debt had passed the USD 18 trillion and it is the largest in the world for a single country. Of it, over 70% belongs to the public debt which is owed to the people, businesses (investors), the Fed and foreign governments who bought Treasury bills, notes and bonds, with the rest owed to the government itself (called intragovernment debt). The share of the national debt held by foreign countries (mainly China and Japan) is around a 33%. The ratio of debt to GDP may decrease as a result of a government surplus or growth of GDP and inflation. In recent decades, however, aging demographics and rising healthcare costs led to concern about the sustainability of the federal government's fiscal policies. The national debt as a percentage of the GDP has increased in the last decades and has slightly surpassed the 100% since 2012 which is a percentage much lower than Japan (world´s largest with 240%), Greece (161%) or Italy (112%) but higher than Canada (86%), South Africa (39%) or Australia (28%).

Figure 16: USA federal debt as a percentage of GDP (1940-2015).



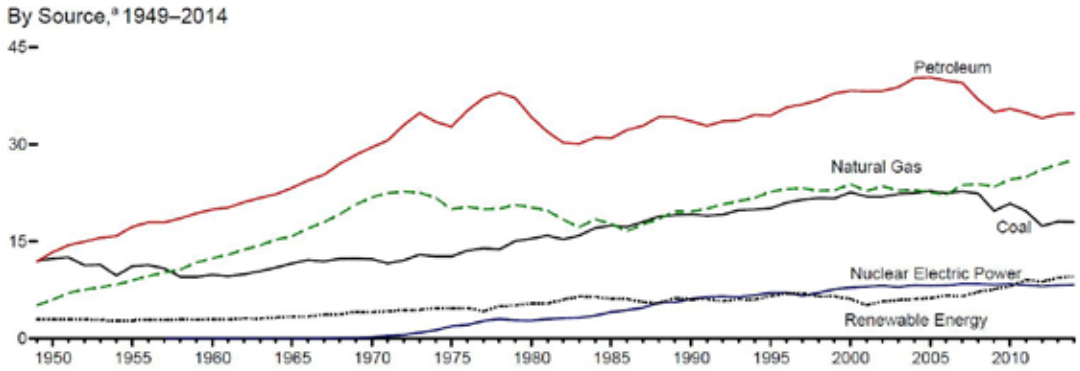
Source: Office of Management and Budget (2015)

6.3 Energy & Infrastructure

6.3.1 Energy system, consumption & access

The major source of primary energy consumed in the USA is petroleum (crude oil and petroleum products), followed by natural gas and coal (***Figure 17***). The country has historically been dependent on foreign oil imports, particularly due to the decline in domestic production from 1970 until around 2012 when production started growing again (***Figure 18***). The USA rate of dependence on foreign petroleum grew dramatically from the 1960s onwards, reaching 36% in 1973. More recently, it has been declining since peaking in 2005 (60%); in 2012 it was about 40% of the total petroleum consumed (EIA, 2013).

Figure 17: Primary energy consumption (quadrillion Btu).

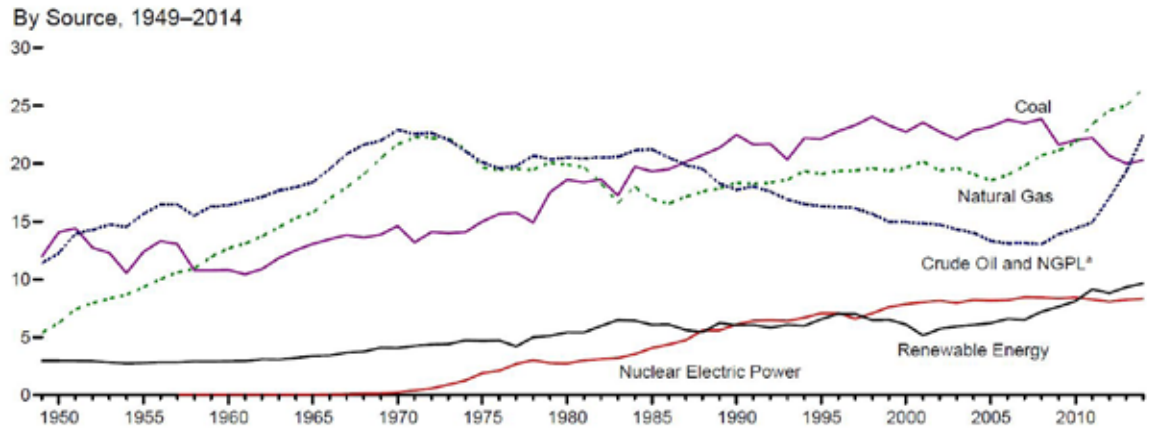


Source: Energy Information Administration, (2015)

The crude oil and natural gas industry together contribute to more than US$1 trillion annually (8% of the GDP) and support 9.8 million jobs in 2011. The increase in the oil and natural gas production is due to the fracking boom (rapid expansion of USA shale oil production) since around 2003: since then the output from oil fracking has tripled, driving oil and natural gas prices down and consequently driving industrial energy costs also down. In contrast, domestic coal production has recently declined. Since 2005 the natural gas net imports have declined but remain around 70 billion cubic feet (May 2015).

Coal was a major source of primary energy in the 1950s (at 35%, almost equal to oil) but its share has declined to about 20% a decade later and has remained the same since. It is used almost exclusively for electricity generation. There are more than 14,000 operations mine for coal, metal ores and non-metallic minerals in the USA (National Mining Association, 2012).

Figure 18: Primary energy production (quadrillion Btu).



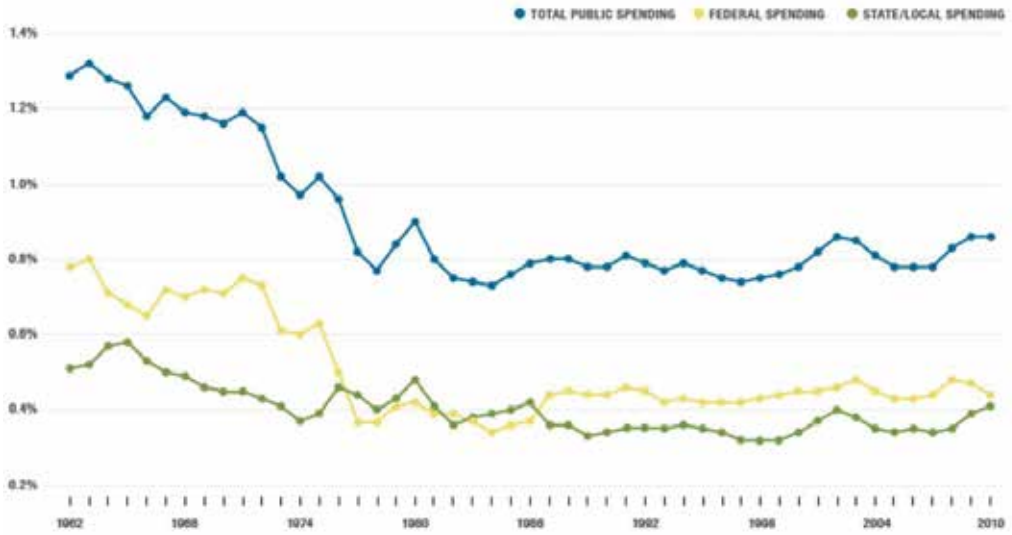
Source: Energy Information Administration, (2015)

6.3.2 Transport infrastructure

A high quality transportation network is recognized as vital for the good performance of any economy. In the USA the investments in transportation such as the Erie Canal in 1807 or the Interstate Highway System in the 1950s are acknowledged to have been essential conditions for the economic growth, productivity increase and the development of the domestic market for goods and services (National Economic Council, 2014). From the 1960s until the mid-1970s the investment on transportation infrastructure was near a 1% of GDP but from the 1980s onward it stagnated (Markovich, 2014).

During the 1980s, 1990s and 2000s it moved around a 0.8% of the GDP, which is similar to the trends of spending in inland transport infrastructure shown by OECD countries for a similar period (1995-2011) (OECD, 2013). The USA ports handle more than 2 billion tons of domestic and import/export cargo annually. Most of the

Figure 19: Transportation funding as a share of GDP. 1962-2010.



Source: Markovich, (2014)

wheat, soybean and rice are exported via ports while natural resources such as coal and forest products also compete well in the international markets because of the efficient ports (AAPA, 2015).

7. Political and legal factors

7.1 Political factors

7.1.1 Administrative structure

The USA is a federal system of 50 autonomous states, each with unique constitutions, statutes, and governments, with a three-branch system of government with executive, legislative, and judicial branches. States are responsible for all areas of society that are not explicitly granted to the federal government through the Constitution. Issues such as foreign affairs and interstate commerce are strictly federal issues. For purposes of the federal judicial system, Congress has divided the country into judicial districts. There are 94 federal judicial districts divided into twelve regional circuits nationwide each with its own Court of Appeals, including at least one district in each state, as well as the District of Columbia and Puerto Rico.

To gain a mining permit in the USA a company needs to acquire several environmental permits, which depend on the specifics of the site and location, i.e. permitting is completely dependent on the locality that a property is in. Federal, state, and local permits for mine operations, wastewater management, rehabilitation, etc. can be imposed at all levels. Many localities understaff their permitting offices and permits are subject to public hearing in many cases, which can lead to long delays in issuing and/or court hearings to see through the completion of permitting. Of all developed nations the USA is considered in a recent study by SNL the one with the worst permitting procedures with unexpected and often unnecessary delays in obtaining mining permits. In other words, the USA has an inefficient permitting system which requires multiple permits and multiple agency involvement, involvement of other stakeholders, including local indigenous groups, the general public and NGOs, which makes an average of seven to 10 years to secure the permits needed to commence mining operations. In comparison, Canada or Australia average two-year's time (SNL Metals & Mining, 2015).

7.1.2 Governmental stability & transparency

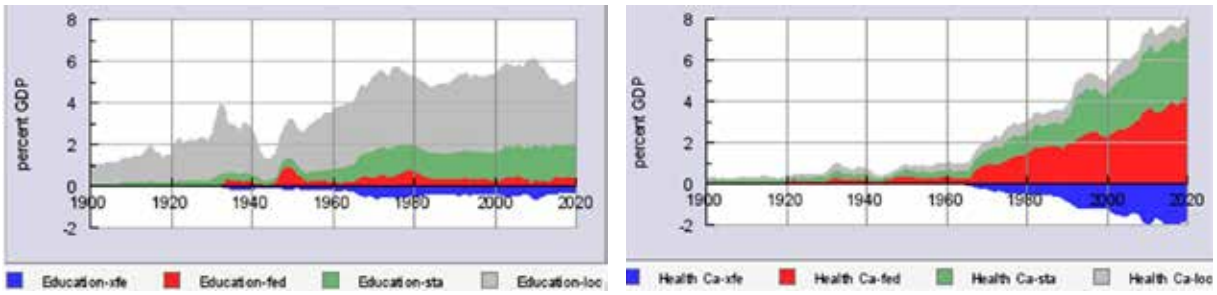
The seamless tradition of transition from one presidential administration to the next has allowed the country a vision of stability and has supported business and consumer confidence (KPMG, 2011). The country has a corruption perception index of 74 in 2014 (up from 73 from the previous years) which is ranked 17th in the world (Transparency International, 2015). It is behind its neighbour Canada and Japan but ahead of many countries in the world as well as the European Union. According to the World Economic Forum, transparency related to government policy making in the USA has a score of 4.4 in 2013/2014 (on a scale of 1-7 where 1 is extremely difficult and 7 is extremely easy). Canada, Japan, Scandinavia countries and the UK all have higher scores than the USA but generally, the other countries of the EU generally share the same score with the USA.

7.1.3 Fiscal policies

The USA is a federal democratic republic with autonomous state and local governments. Taxes are imposed in the USA at each of these levels. These include taxes on income, payroll, property, sales, capital gains, dividends, imports, as well as various fees. The taxes collected by the government (2010, federal, state and municipal) totalled 24.8% of GDP. Tax regimes are very different among states and are often used to promote specific industries in each state.

The USA has one of the world's highest corporate income tax rates (35%). It also has a very complex set of deductions and credits designed to influence the behaviour of all taxpayers, including mining companies. Corporations are taxed based on their taxable income independent from their shareholders (they are subjected to tax on dividends received).

Figure 20: USA´s education and health care spending (1900-2020).



Source: USGovernmentSpending, (2015)

On the other hand, partnerships are not subject to income tax, but their partners calculate their taxes by including their shares of partnership items. One unique property of USA tax law is that is imposed income taxes on both resident and expat citizens for income earned outside of the USA. According to the International Tax Competiveness Index, the USA ranked 32nd out of the 34 OECD countries. The main reasons behind the low score were due to an uncompetitive tax code caused by a high corporate income tax; it does not have a territorial tax system which would exempt foreign profits earned, and because of the high and progressive individual income tax (combined top rate of 46.3%) (Pomerleau and Lundeen, 2014).

In general, taxes on resources have not been confiscatory, but can vary widely across jurisdictions. The USA has the unique situation where it taxes American corporations for foreign earnings, and thus repatriation of funds is a current major political issue and inhibitor for mining concerns to become or be USA´s corporations.

7.1.4 Government spending priorities & allocation

The USA is a free market economy, where private individuals and business firms make most of the decisions, and the federal, state, and local governments buy needed goods and services predominantly in the private marketplace. The people of the country rely on the government to address matters the private economy overlooks or represent a public good, from education to protecting the environment. During the 20th century defence spending increased substantially only during the WWI and WWII but then remained stable fluctuating between 3% and 5% of the GDP. In contrast spending on education has expanded considerably, from a one percent in 1900 to peak at 6% in 2010, particularly driven by local expenditures for the schooling system and also by the G.I. Bill (1944) covering education expenses for war veterans. Spending in health care also expanded particularly after the passing of the Medicare and Medicaid programs (mandatory spending) in the mid-1960s which has increased health care spending to around 7% of GDP. The other important expenditure is social security, unemployment and labour.

During fiscal 2015, the government federal spending was USD 3.8 trillion (21% of GDP) and it was destined: 64% to mandatory spending (social security and Medicare), 29% to discretionary spending and 6% to debt interest. Of the discretionary spending, 53% was allocated to military, 6% to education, 6% to health care, among other minor uses.

7.1.5 National Security

Since the 1790s USA defence spending has spiked associated to war events: to nearly 12% during the Civil War, at 22% during WWI and 41% during WWII, 15% during the Korean War, and 10% in 1968 with the Vietnam War. During the Cold War era spending on defence and space technology fluctuated between 10% and 6% of GDP. Post-Cold War defence budgets then contracted and have remained around 3% to 5% of GDP with surges in the 1980s and 2000s ("War on Terror") and 2010. National defence represents

an even larger share of economic activity in the Central Plains. The region is home to some of the country's largest military installations, a number of private defence contractors, and a large number of reservists and National Guardsmen (Wilkerson, 2009). With regards to raw materials, the USA had a National Defence Stockpile created in 1939 under the Strategic and Critical Materials Stock Piling Act. Stockpiled materials included ores, base metals, precious metals, minerals and agricultural products. After the end of the Cold War, the Department of Defence determined that the material was in excess and since 1993 Congress has authorized disposal of over 99% of the material. Industrial practice of inventory control has changed from stockpiling to a just-in-time or sense-and-respond system for managing supply chains (National Research Council (U.S.), 2008). In contrast, the USA still maintains the Strategic Petroleum Reserve which is the world´s largest supply of emergency crude oil.

7.1.6 Safety & crime

Crime rates in the USA were high during the 1970s and early 1990s and since then there has been a decline (Truman and Planty, 2012).

7.1.7 Trade policies

Since the 1930s, the USA and its trading partners have reduced or removed barriers to trade, tariffs have been lowered or eliminated on nearly all products and average tariff rates for the USA declined from 18.4% in 1934 to 1.3% in 2007. An initial set of multilateral trade rules was negotiated in 1947 with the USA as a founding partner of the General Agreement on Tariffs and Trade (GATT), which remained the primary set of rules for nearly 50 years until the negotiation of the Uruguay Round Agreement and the establishment of the WTO in 1995. There is near unanimity in the literature that trade liberalization has broadly benefited the USA although studies differ about the precise effects (U.S. International Trade Commission, 2009).

The USA´s approach to trade policy is based on the belief that nations have revealed comparative advantage and that a market-based trading system enables nations to achieve that advantage to the benefit of its consumers. This has led the USA to focus mostly on signing new trade agreements. "However, in recent years, there has been a growing focus on trade enforcement (including the establishment of an Interagency Trade Enforcement Center) based on the belief that the benefits from trade will be less if other nations are not playing by the rules developed by the World Trade Organization" (Atkinson, 2014). Free trade agreements like NAFTA and other free-trade pacts that the USA has signed has flattened the market for raw materials in the USA, and has led to closures (such as for rare earth minerals) because of Chinese production, but some specific tax incentives are periodically provided to spur on specific materials development.

USA´s import policy had few major legislative or regulatory initiatives in the recent years. On the export side, the country has launched the National Export Initiative, aimed at improving trade advocacy and pursuing policies to promote growth; and the Export Control Reform Initiative, to reconcile policies for export controls. International trade and investment policies play an important role in the economy. In 2010, the President set a goal of doubling exports in five years. Exports, as a share of GDP, have grown by 13% since the end of the recession and reached a historic high of 13.8% of GDP in 2011.

7.1.8 Bilateral, Multilateral & International agreements

In terms of international organizations, the USA belongs to the majority of the existing associations, including as the most important the United Nations, the G20, G7, G5, G8, G10, International Finance Corporation, ASEAN (as dialogue partner), Interpol, EITI (implementing country), NATO, OECD, Paris Club, UNCTAD, UNESCO, WTO, WHO, among many others (CIA, 2015c). Since 1994, the North American Free Trade Agreement (NAFTA) is the USA most important commercial agreement signed between the USA, Canada and Mexico. Since the agreement took place, trade between the country and its partners has more than tripled. It

has increased more rapidly than trade with the rest of the world. In 2011, trade among the partners reached US$1 trillion. The two countries accounted for 34% of total exports in 2014 and Canada and Mexico also ranked 2nd and 3rd as suppliers of United States' imports in 2014 (27% of imports) (Villareal and Fergusson, 2015). As the USA two largest export markets, Canada and Mexico buy more Made-in-America goods and services than any other countries.

7.1.9 Sustainable development policies

The USA has been the largest financial supporter of the United Nations (U.N.) since the organization's founding in 1945. The USA currently covers around 22% of the U.N. regular budget in assessed contributions (Browne and Blanchfield, 2013) and more than 27% of the U.N. peacekeeping budget.

As the biggest funder, the USA is involved in all the U.N.-related sustainability discussions. USA is party to most of the global environmental and sustainability initiatives and champions some of them like the World Business Council on Sustainable Development or the U.N. Commission on Sustainable Development. Yet, it takes a contrarian approach to many, for instance by abstaining from some (e.g. U.N. Convention on the Law of the Sea, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization) or by not ratifying them (Convention on Biological Diversity, Kyoto Protocol).

7.2 Legal Factors

7.2.1 Legal Framework

The government of the USA is the federal government of the republic of fifty states that constitute the USA, as well as one capital district, and several other territories. The Constitution of the USA is the nation´s fundamental law providing the framework for its governance and the principles for operation. Federal States have a high degree of autonomy.

The federal government is composed of three distinct branches: legislative, executive and judicial. The USA Congress is the legislative branch of the federal government. It is bicameral, comprising the House of Representatives and the Senate. The Constitution grants numerous powers to Congress including powers ranging from collecting taxes to the coining of money and its value regulation, also to declare war and raise and support armies and other duties.

The executive power in the federal government is vested in the President of the USA, although power is often delegated to the Cabinet members and other officials. The President and Vice President are elected as running mates by the Electoral College, for which each state, as well as the District of Columbia, is allocated a number of seats based on its representation (or ostensible representation, in the case of D.C.) in both houses of Congress. The Judiciary is independent of the other two branches, with justices appointed for life by the President and confirmed by the Senate. Adjudicative judges are assigned by their authorizing body, usually congress, and do not enjoy lifetime appointment. The Supreme Court of Justice, established in 1789, is the highest federal court of the USA, and has appellate jurisdiction over all federal courts and over state courts.

The USA has had stable mineral laws for over 100 years and a well-defined protection of property rights, which has provided incentives for resource development. For example, the general mining law of 1872 promotes development by allowing mining interests to take valuable hard rock minerals including gold, silver, and uranium from public lands without royalty payment to the taxpayer (unlike other mining industries that extract coal, oil or natural gas); at the same time it allows citizens to buy mineral bearing public lands for $5 per acre (1872 prices). In the third place, this law ensures that if a company or an individual holds a mining claim, that claim is treated as a right-to-mine by the federal government. A given location of a new mining project will be subject to multiple layers of laws, but in general, most have been stable. Recently, environmental legislation has provided increasing details on mitigation and prevention requirements, and often local

and state laws are more onerous that federal laws. Grandfathering of operations is not always guaranteed and that can change the economic viability of a site during active operation.

7.2.2 Resources Ownership & Property Rights Law

Mining law refers to the body of law governing access to mineral deposits, the right to mine those deposits and the taxes (or royalties) assessed on the products of mining. In the USA landownership (rights to mine or any other economic activity) can be divided into separate parts, which are referred to as rights. Common divisions include surface rights, water rights, timber rights, and mineral rights. Laws governing mineral ownership take two approaches: 1) the British mining law, holding that minerals are owned by the owner of the surface, an approach that became the basis for mineral law in the USA and Canada and 2) the early German and regalian legal system which holds that minerals are owned by the state, regardless of surface landownership (Kesler, 1994).

In the USA land for developing mining projects can be obtained from certain public lands designated for development or from private sources. The federal government owns roughly 28% of the land in the USA with most of these holdings are concentrated in the West (e.g. in Nevada federal land totals a 84% of the total state land area) and Alaska (Gorte et al., 2012). For instance, the U.S. Bureau of Land Management administer over 258 million acres of public lands and 700 million acres of subsurface minerals nationwide based upon the principle of multiple use and sustained yield (a combination of uses that takes into account long-term needs of future generations for renewable and non-renewable resources) (Rohling, 2011); in contrast most land in the eastern half of the USA is held privately by individuals or corporations.

On federal lands, the acquiring of mining rights is governed by the Mining Law of 1872 (and amendments). State owned lands are managed individually by each state and handled in a wide variety of ways, and offshore minerals (up to 3 miles offshore are state, 3 miles to 200 miles are federal) are handled in a totally different way and usually is tied closely to energy development or sand mining, both of which face more environmental regulations than anything else. On private land, either the land itself or the mineral rights (privately owned) can be obtained through ordinary real estate transactions.

Mineral rights and surface ownership are separable which makes possible (and often desirable) for a mining company to purchase the mineral rights without the surface. In some cases split estate situations happen the surface rights and the subsurface rights (such as the right to develop minerals) for a piece of land are owned by different parties. In these situations, mineral rights are considered the dominant estate, i.e. they take precedence over other rights associated with the property (U.S. Bureau of Land Management, 2015).

These options allow mining to happen under four possible ways:

- Ownership through claims or patents on public land: the federal lands on which mineral claims may be made are administered chiefly by the U.S. Bureau of Land Management and are termed locatable lands (this excludes national parks, wilderness areas, Indian reservations, military installations and others); (Hartman and Mutmansky, 2002);
- Leasing of public land: mining rights may be obtained by bidding on leases for coal, petroleum and natural gas, uranium and most non-metallic minerals occurring on federal and other state lands; (Hartman and Mutmansky, 2002);
- Ownership of private land (fee simple): this is a rare options nowadays (mainly due to escalating costs of real estate and the huge capital investment for a mining operation); yet, ownership of the land is still customary in metal mining (Hartman and Mutmansky, 2002);
- Leasing of private land: this is currently most common way in the USA, especially for energy production. In this way, property owners sell or lease their mineral rights to companies, but retain ownership

of the footprint of the land, leasing the space to the operator as needed and collecting royalties and bonuses on the minerals. A mining company will apply for a lease when it does not want to purchase a property because it is uncertain of the type, amount or quality of minerals that exist there.

Most states have laws that regulate mining and drilling activity. There are also laws that regulate the sale of surface and mineral property. These laws are meant to protect the environment and all parties involved in property transactions. These laws are the only protection available to buyers or sellers on issues that are not specifically addressed in the mineral transaction agreement. Although mineral rights laws are similar from state to state, small variations can make an enormous difference when applied to individual transactions. In addition, mining and oil and gas regulations can vary significantly from one state to another.

7.2.3 Business legislation

USA law is extensive and complex when it comes to government controls regulating business activities. The regulatory interaction between business and government has been shaped through history and defined by broad changes in technology, macroeconomic conditions, and political values. Since the Great Depression of the 1930s until the 1960s, the regulatory environment was marked by New Deal-inspired regulatory regimes shaping most of the industries comprising the USA infrastructure and fostering development in a relatively non-competitive environment; from the ends 1960s until mid-1980s an era of deregulation took place with the removal or re-directing of controls on competition (Vietor, 2000). The current period is now marked by government-managed competition and market-oriented controls.

More recently, it has been claimed that regulations are too complicated and long (The Economist, 2012b). Yet, the USA ranks 7th in the world under the "Ease of doing business" ranking which measures if the regulatory environment is more conducive to the starting and operation of a local firm (World Bank, 2014). In the USA it is not only relatively easy to start a new business, but it is also easy to close one or lay off workers, at least in the non-unionized, non-governmental share of the economy. USA government policies and regulations are considered favourable for foreign investors (KPMG, 2011) The USA ranks 14th in the world in the indicator "Competition Legislation" of the Global Competitiveness Index, a metric which describes whether country´s legislation is efficient or not in preventing unfair competition.

7.2.4 Employment, Labour laws & Unions

The USA labour law is the body of law that mediates the rights and duties of workers, employers and labour unions. The U.S. Department of Labor administers and enforces more than 180 federal laws among which the most important ones are the Fair Labor Standards Act, the Immigration and Nationality Act (labour standard provisions to aliens authorized to work in the USA), the National Labor Relations Act, the Civil Rights Act of 1964, the Mine Safety and Health act, Black Lung Benefits Act, and the Occupational Safety and Health, among others.

In the USA each state has its own set of employment laws in place that vary from rather restrictive with high minimum wages to very loose with "right-to-work" states (25 states), a statute that protects employees from the mandate of joining or paying dues or fees to a union. Federal and state laws protect workers from employment discrimination, on grounds of race, gender, religion, national origin and age. Federal law pre-empts most state statutes that would bar employers from discriminating against employees to prevent them from obtaining pensions or other benefits or retaliating against them for asserting those rights.

Currently only about 10% of USA workers are in unions. Most high-paid positions are non-union. In general, unions only cover low-skill workers outside of specific areas like teachers, pilots, and airplane mechanics. Currently, most unions are aligned with the American Federation of Labor

(AFL)-Congress of Industrial Organizations (CIO) created in 1955, or the Change to Win Federation which split from the AFL-CIO in 2005. Private sector unions are regulated by the National Labor Relations Act, passed in 1935 and the formation of this body represented a major turning point in labour history. The power of unions has been growing smaller and less powerful in the last four decades but unions are still very important in the auto industry, public education, print journalism and in politics. Unions paved the way to the middle class for millions of American workers and pioneered benefits such as paid health care and pensions along the way. Even today, union workers earn significantly more on average than their non-union counterparts, and union employers are more likely to provide benefits (Madland and Walter, 2009).

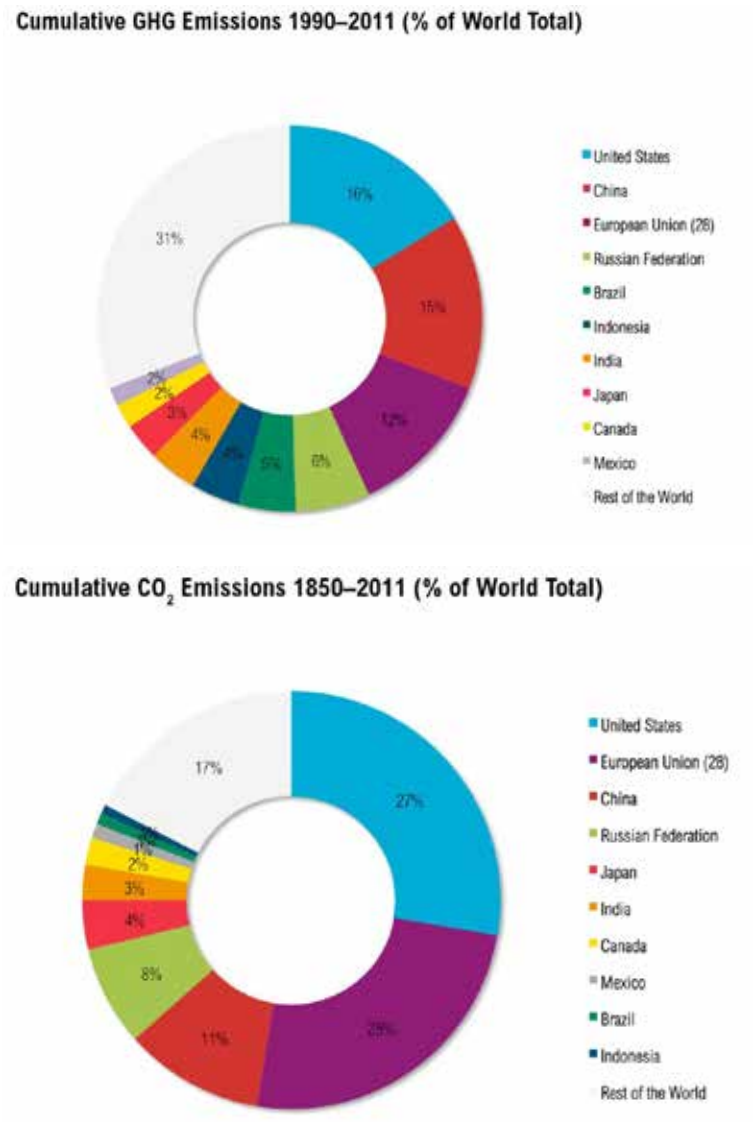
7.2.5 Environmental regulations & their enforcement

Environmental advancements in regulation have been made over the past 150 years regarding industry standards and practices. In the past, companies had been able to regard the air, land, and water as free goods, i.e. companies would regard pollution as an externality. The passing of the National Environmental Policy Act (1969) and the creation of the U.S. Environmental Protection Agency in 1970 were a milestone in the USA environmental regulation history. Both institutions were born amidst a climate of growing environmental awareness and the American environmental movement triggered by Rachel Carson´s Silent Spring book (1962). Major environmental laws followed and include the Clean Air Act (1970), Clean Water Act (1977), Oil Pollution Act (1990, for oceans), Pollution Prevention Act (1970) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, 1980) commonly referred to as Superfund, which gave EPA the authority to clean up uncontrolled hazardous waste sites and spills. For the past 30 years, the Superfund program has been cleaning up the USA most serious hazardous waste sites and by responding to thousands of oil and chemical spills. Many of the sites within the National Priority List of the Superfund include abandoned mine lands.

In the USA several agencies oversee pollution controls. At the top of the pyramid is the EPA, which coordinates and oversees all environmental protection laws nationwide. So far the U.S. EPA has relied on an aggressive enforcement program as the backbone to guarantee compliance with national environmental laws (U.S. EPA, 1999). Climate change and human-induced increases in the amount of atmospheric greenhouse gases (carbon dioxide, methane, nitrous oxide and fluorinated gases) are increasingly gaining attention. The U.S. Clean Air Act has had major impacts on USA emissions and pollution, as well as factors such as acid rain, mercury dispersal, etc., and it has had a major operational impact on raw material development and processing. Regarding greenhouse gas (GHG) emissions, the EPA develops annually a report called the Inventory of USA Greenhouse Gas Emissions and Sinks which tracks GHG emissions and is submitted to the UN in accordance with the Framework Convention on Climate Change. Results from the 1990-2013 Inventory claims that USA´s GHG emissions increased by 2% from 2012 to 2013 but GHG emissions in 2013 were 9% below 2005 levels, i.e. emissions have been declining after a peak in 2007. This is because the USA is being very efficient in terms of reducing CO_2 emissions, especially when oil prices rise, but the scale of the economy overwhelms the relative contribution globally. However, more recently and due to a rebound in coal consumption, CO_2 emissions increased again (Canadell and Raupach, 2014)

The USA remains the second largest CO_2 emitter in the world (emits a 14% of the global energy-related CO_2 emissions) after China and was responsible for the largest amount of cumulative GHG emissions in the period 1990-2011. Likewise, the economic development process of the USA since the mid-1850s was enabled due to the USA being the global largest cumulative emitter of CO_2 gases (***Figure 21***) and the top contributor to global temperature change (on a per capita basis ranks 2nd after the UK) (Matthews et al., 2014).

Figure 21: Global cumulative GHG and CO_2 emissions.



Source: Ge et al., (2014) based on data by the World Resources Institute.

8. Technological factors

8.1 Research and Development (scientific infrastructure)

8.1.1 Knowledge and resource base

Ever since the steel-based industrial revolution of the late 1890s, the USA has joined the ranks of world leaders in innovation. During the early years the catching up of the USA with UK and Germany was enabled by the large USA market enabling firms to successfully enter new mass production industries such as chemicals, steel, autos, aviation and industry. Its greenfield nature, the commercial nature of American culture and government support for infrastructure helped create larger markets. However, notwithstanding these factors, industrial innovation in the USA, prior to (and after) WWII, has been principally fuelled by private inventors and firms (Atkinson, 2014). In this, during and after WWII, the USA military sector must be acknowledged as a key one as it became one of the most important drivers of technology development in the world, both as a sponsor of military R&D and customer of high-tech products (Braddon, 1999).

After WWII a more science-based system of innovation emerged dominated by large corporations with R&D laboratories and by the federal government via mission-based agencies seeking to accomplish a particular mission (e.g. defence and space technology driven by the Cold War and the Space Race) and through a system of peer-reviewed basic research funding at university. In fact, during the Cold War around two-thirds of USA´s R&D was funded by the federal government, primarily for defence. Nowadays around two-thirds of USA´s R&D is funded by private industry (Flamm, 2005). Currently the majority of basic research is conducted the USA government-funded system for supporting scientific research which is based on two fundamental aspects: support for mission-oriented research largely to federal labs, and support for basic research through university funding. The federal government financed approximately USD 140 billion of R&D in 2013 (a 30% of the total expenditure).

From 1976 the federal government began to focus more seriously on the promotion of technology, innovation and competitiveness as nations like France, Germany and Japan were posing challenges to US industry. Besides the creation of new collaborative federal research centres like the SEMATECH, the National Science Foundation, Science and Technology Centres and Engineering Research Centres, the National Institute of Standards and Technology, most of the 50 states transformed their economic development practices to include technology-led initiatives (Atkinson, 2014). During the 1990s, due to the success of Silicon-Valley companies federal pressures to promote industrial innovation receded. During the 2000s the IT sector thrived but industrial competitiveness did not. After the losses of such decades, the Great Recession and the emergence of new technology competitors, the Obama administration has proposed new initiatives like the National Network of Manufacturing Innovation, an expansion in the research and experimentation tax credit, and increased funding for science agencies, among other measures introduced by the USA´s Congress (Atkinson, 2014).

The USA also leads the world rank in business expenditure on R&D. The USA features as a highly attractive destination for researchers and scientists, ranking 2nd in the world after Switzerland (Institute for Management Development, 2014). With regards to availability of scientists and engineers, the USA ranks 5th in the world (World Economic Forum, 2014). The annual numbers of Ph.D. recipients in the USA increased at a rapid rate from 1950 to 1966 with a downswing during the 1970s, followed by a gradual increase from 1980 to 2005. Since the 1980s around 50 % of the growth of Ph.D. production in the United States is attributed to temporary residents (foreign students) earning Ph.Ds. primarily

in the fields of mathematics, science, and engineering (Stephan, 2002).

With regards to minerals, the USA has traditionally continuously invested in geoscientific data as this is considered a critical factor enabling the development of the mining industry. The U.S. Geological Survey was established in 1879 to determine the natural wealth of the country, and has continued to serve that role. There is extensive existing data and published reports on mineral deposits and geology of the USA. The state geological surveys (some also with over 150 years of history such as the California Geological Survey established in 1860) often have even more detailed information. Likewise, the U.S. Geological Survey and the U.S. Census Bureau closely monitor production and consumption of an extensive range of commodities, which provides critical economic intelligence regarding the viability of operations. With an annual budget of around USD 1.1 billion, the information produced by the USGS is considered reliable and it´s one of the most widely used around the world for mineral statistics. For instance, the USGS´s Mineral Resources Data System catalogues information about mineral resources around the United States and the world. Using the map tool, users can zoom in to obtain reports on past and present mines, mine prospects, and processing plants. It is believed that the availability of geoscientific data favours mostly the small and medium mining enterprises, not so much the big ones as they bring their own knowledge base and they do not rely that much on local expertise.

8.1.2 R&D culture

The USA has a strong and traditional R&D culture. USA companies have long had in-house innovation teams (e.g. AT&T, General Electric Corporation, DuPont) and are highly sophisticated, supported by an excellent university system that collaborates closely with the business sector in R&D. Combined with flexible labour markets and the scale opportunities afforded by the size of its economy, these qualities make the USA very competitive.

At present, the USA does not have a national, coordinated innovation policy system, which somehow reflects the belief that innovation is best left to the market. Yet, the knowledge and resource base of the USA figures among the largest and strongest in the world. In terms of scientific infrastructure and total expenditure on R&D, the USA ranks 1st in the world with over USD 450,000 million (federal spending represents around a 30%, private a 70%) in 2012 (though it ranks 11th as a percentage of GDP). Yet, relative to private sector R&D funding trends, federal support for R&D has fallen substantially as a share of GDP from its high levels in the 1960s (over 10% during the Cold War) to less than 4% currently.

In the USA there exists a consensus that investment in R&D has a positive impact on productivity growth (Congressional Budget Office, 2005). A well-known and efficient tech-transfer model is the USA´s National Science Foundation which makes 94% of its research grants to people in university labs and companies, i.e. people with incentives to commercialize their research and work. Currently the USA is working hard on promoting a number of new "bridging institutions" including but not limited to national technology initiatives, science parks, technology incubators, cooperative research centres, proof-of-concept centres, innovation networks which have also become more important on university campuses intending to become critical pivot points in the innovation ecosystem (Boardman, 2014). Current government-funds in R&D are destined to improve science, technology, engineering and math (STEM learning in the USA, to advance precision medicine, combat antibiotic resistance, in home-grown clean energy and national security (Koizumi, 2015).

Compared to many nations, the USA has a highly developed and successful industry-research institute collaboration system. It ranks 2nd in the world in the indicator "University-Industry collaboration on R&D" only behind Finland (World Economic Forum, 2014). Private universities like MIT, Cal Tech, and Stanford (closely related to Silicon Valley) are models that the rest of the world, and indeed, other universities in America, look to for inspiration. Such success is based on a number

of factors, including cultural pragmatic objectives of advancing knowledge, less hierarchical schemes enabling faculty to collaborate with the industry from early on and the encouragement by state and local government to work closely with the industry (Atkinson, 2014). This university-industry partnership has been regarded as one of the contributors to successful USA innovation and growth in the last decades (Hall, 2002). Most recognized high-profile innovation clusters include Silicon Valley, Boston Route 128 and North Carolina´s Research Triangle Park. Although the federal government has played a role in funding such centres, cluster policies have been more related to state and sub-state regions.

Technology development in the USA has historically been closely related to defence industrial policies, and its transfer from military to civil and commercial applications has been acknowledged under the "dual-use R&D policy" approach. The role of government-funded programs is key to the success of high-tech companies such as Apple. Its smartphone benefited from the pioneer role of the armed forces in advancing the internet, GPS position and voice-activated "virtual assistants", the touchscreen was developed in publicly-funded universities and labs, besides the early funding for Silicon Valley (Mazzucato, 2014). Likewise, the research that produced Google's search algorithm, the fount of its wealth, was financed by a grant from the National Science Foundation (The Economist, 2013). Unlike the general trend of a very strong R&D sector in the electronic industry, the mining industry is lagging behind innovation in other countries such as Australia or Canada.

8.2 Patents, products, technologies generated

Since the founding of the Republic, the USA´s federal government has had a robust patent system embedded in the Constitution (Atkinson, 2014). The USA has traditionally been a leader in the patents market and in the number of technologies generated. Nowadays in terms of patent applications (2012) the USA ranks 3rd in the world after China Mainland and Japan; with regards to patent grants, it ranks 2nd in the world after Japan (Institute for Management Development, 2014). Among the nation's most patent-intensive regions, just two, San Diego and the San Jose-San Francisco combined area, rank in the global top 20 and just two more (Boston and Rochester) score in the top 50 (Muro et al., 2015). In the USA history the Bayh-Dole Act (1980) was important for universities as it created a policy towards ownership of patents on the results of federally-funded research, allowing universities to own the patents. Such act seems to have increased patenting and licensing activity (Hall, 2002).

8.3 Telecommunications & E-commerce

The USA is an advanced country in terms of telecommunications production and consumption. American firms are among the world leaders in adoption of information and communications technologies (e.g. hardware and software). USA´s firms invest more as a share of sales and of overall capital investment in hardware, software, and telecommunications than almost any other nation. For example, these investments are almost twice as high as Korean investments (Atkinson, 2014). 83.2% of the population has access to the internet (ranked 16th in the world).

The USA ranks 1st in the world in terms of numbers of computers in use and ranks 14th in the world in the indicator "Communications technology" which measures of the country meets business requirements. The USA´s e-commerce market is among the largest in the world. In 2012 the USA retail e-commerce sales amounted to USD 222.5 billion, particularly led by computer and consumer electronics and the apparel and accessories category, and they are projected to grow to over USD 400 billion by 2017 (Enright, 2013).

9. Conclusions

9.1 Overview of economic development – history and drivers

The economic development history of the USA in the last 150 years has been marked by a transition from a domestic natural resources-based economy to a knowledge- and services-oriented economy. Today's economy is characterised by reliance on intellectual capabilities and endowments like human capital (well-educated population and workforce), knowledge, innovation capacity, good public infrastructure (including information and communications technologies). These factors, together with good institutions explain as much, if not more, than traditional endowments like land, natural resources (physical capital) or labour. The exploitation of natural resources, including energy and non-energy minerals, was a major driver of economic growth, industrial development and prosperity over a broad territory with substantial endowments. If such resources had not been present in the USA, economic development would undoubtedly have followed another pathway.

However, the extraction and use of resources alone was never a significant stimulant to the economic development of the USA. Such development was linked to a range of factors including:

- overall progressive transformation in business and financial organisation,;
- long-term investments in the quantity and quality of education (human capital investments);
- research and knowledge development (e.g. associated with military R&D);
- population growth driven by immigration;
- infrastructure expansion; and, most importantly,
- well-developed and stable political institutions that respected the rule of law, mining laws, the free-market economy regime and private enterprise.

All such aspects were positive influences on economic development during the 20th and 21st centuries. They explain, to a large degree, how the country became:

- one of the world´s largest economies;
- the largest consumer market;
- the world´s largest investor;
- the world´s major consumer of natural resources (with 5% of the world population, it uses roughly 20% of the global primary energy supply and 15% of all globally extracted materials);
- the world´s historically largest cumulative greenhouse gases emitter; and
- why it remains one of the leading countries in technology and innovation.

Findings of this report indicate that, during the 20th and 21st centuries, there were 7 key inflection points in the economic development of the USA. The first of these was in the period 1930-45, i.e. between the Great Depression of the 1930s, the ensuing New Deal programmes and World War II. The New Deal series of programmes redefined the role of the government in the USA free market economy and resumed economic growth based on public spending, oil-based mass production and consumption, which flourished during the post-WWII decades. The latter decade was also important as it involved the emergence of a more science-based system of innovation dominated on the one hand by large corporations with R&D laboratories and, on the other, by the federal government. Federal government during this period funded both mission-based agencies seeking to accomplish particular objectives (e.g. defence and space technology during the Cold War and Space Race) and a system of peer-reviewed basic research funding at university.

In the 1950s the USA became for the first time a net importer of oil and non-energy mineral commodities which explains

the transition from a domestic natural-resources based economy; in other words, domestic natural resources became of second importance in comparison to the manufacturing industries and the service economy. A third key inflection point took place during the mid-1960s with the introduction of social reforms by Johnson´s Great Society and the establishment of several social programmes (e.g. Medicare, Medicaid, Older Americans Act) many of which continue to the present.

A fourth inflection point occurred during the Great Inflation period (1965-1982) because in those years rules were established that guide the monetary policies of the Federal Reserve and other central banks around the world. The Cold War (including the Vietnam war and the Space Race) was a fifth inflection point as it triggered the development of the strategic reserves, both in oil and in mineral commodities and triggered a temporary boom in USA domestic production, with positive impacts on economic growth and mainly military-oriented and government-funded technological development. This was most pronounced in the late 1950s and early 1960s. Also the Cold War and the considerable USA spending on military R&D had a long-lasting impact in the USA becoming a leading-edge high-tech innovator. A sixth inflection point was the Reagan Administration (1981-1989) with the unprecedented increase in military spending, economic liberalisation reforms and the sky rocketing of the national debt (in this period the USA passed from being the world´s largest international creditor to the world´s largest debtor nation). The last inflection point in the USA took place more recently during the Great Recession of the years 2007-2010, which caused a global financial crisis. USA policy responses encompassed a larger government involvement in the private sector and in the bailing out of distressed banks and mortgage lenders and the pumping of government money into the economy.

Since 1854 the USA´s economy has gone through over 30 cycles of economic expansion and contractions. Even in the worst economic crises, the country and its multiple institutions were flexible enough to adapt and re-direct the balance between government´s intervention in the free-market economy to spur economic growth again and regain competitiveness of its industries. In all these adaptations, a special role must be acknowledged to the U.S. Federal Reserve, which has acted as a key player alongside the U.S. Treasury in regulating employment, economic growth and inflation via implementation of monetary policy. The Fed has also played a key role in bailing out banks and mortgage lenders, particularly during the Great Recession.

Like other developed nations, the USA economy is dominated by the services sector but the industrial sector (19% of GDP in 2012) and the mining sector (US$225.1 billion in 2012) continue to be important in the country. The energy industry is one of the most important drivers of the country's economy. The crude oil and natural gas industry contributed to US$ 1 trillion (8% of GDP in 2011). Although this figure may not be as high as the industrial sector, the energy industry keeps the industries competitive, bolsters consumer confidence and promotes improved living standards. Around 70% of the economic activity in the country is from consumer spending.

The national system of innovation is driven by industry-funded R&D (the USA ranks 1st in the world in business expenditure on R&D), complemented with strategic federal government-funded R&D. This system has also been of key importance in providing capacity to adapt and to steer the innovation process towards commercial products. Leading private universities like MIT, Cal Tech or Stanford have had a key role in advancing information and communications technologies and in the creation of high-profile innovation clusters as a crucial part of the national innovation system. This has been supported by a long-standing tradition of university-industry collaborations on R&D, which place the USA 2nd in the world. Such an innovation system has been supported by well-established and successful education and health systems (although these are expensive in comparison to other countries). Linked to this is the fact that the USA has the world´s largest consumer market, which has steadily absorbed the

leading products of the economy and its technological innovations, providing sufficient incentives for universities and innovation clusters to test and provide commercialisation of new inventions. These were first automobiles and electrical appliances, and now electronic equipment related to the digital era (e.g. the USA ranks 1st in the world in terms of the number of computers in use)

Another significant explanatory factor of the success in the economic development of the country lies in the cultural values and associated the fact that the population of the modern USA originated from immigration. Immigrants took the major risk of moving away from their native countries and then had to work hard to survive. Combined with Calvinist beliefs in individualism, competition, achievement and success, the culture of the USA has been permeated by competitive behaviour which has led to risk-taking attitudes and entrepreneurship being values which are embedded in the society. This has sparked the questions of established ways and the pursuit of innovation through its history, first by personal innovation and then under a structured approach via collective collaborative innovation in innovation clusters and R&D centres. This has also permeated the spirit of innovation in the mining industry, e.g. in pushing further the frontiers of exploration in remote areas.

9.2 Conclusions specific to the non-energy raw materials sector

9.2.1 Industry and trade

The mining industry for non-energy minerals developed because of a relatively rich mineral endowment and long and continued history of exploration and discovery of mineral deposits driven by a growing domestic demand for mineral resources (e.g. for construction, for the technology and military industry, for R&D, etc.). Besides an entrepreneurial and risk-taking spirit, a critical factor enabling such development was the availability of geoscience data facilitated by the U.S. Geological Survey (established in 1879) and the long-standing and publicly-funded state geological surveys. It is of note that, for all factors considered, but particularly for minerals policy and regulation, state governance has been extremely influential, in some cases even more than federal.

Likewise, the long-standing and well-developed mining industry in the USA expanded under a politically and institutionally stable framework with a high respect for the rule of law and the security of tenure which favoured mining investments. Even though it has lost position against other international more attractive locations for mining investments (e.g. Canada, Finland, Australia, South America), the USA remains internationally important as a mining nation. This is due to stable mineral legislation which has been in place for over 100 years, has favoured resource exploration and development and has been supported by well-defined protection of property rights. Other factors of importance have been:

- the mineral ownership rights scheme, which separates surface and mineral rights and encourages exploration;
- availability of capital markets and risk finance;
- a skilled workforce trained in local universities;
- non-confiscatory fiscal policies;
- a well-developed services industry; and
- access to land, water, energy and an extended network of infrastructure.

More recently the industry is facing challenges with respect to securing a social licence to operate because the USA overall does not view itself as a mining country anymore. The typical public view of mine operations is generally negative, primarily because of ongoing impacts from abandoned mines from the 19th and early 20th centuries. Other sector-specific challenges are a workforce of geoscientists that is ageing, low investments in R&D and very long and inefficient permitting procedures which tend to deter prospective new projects and investors.

A more complete and detailed analysis of this issue will be found in the Transactional Analysis Report produced in WP1.4

(D 1.5 *Report on transactional analysis of Industry and Trade*).

9.2.2 Education and outreach

The USA has a solid, well-educated general workforce and a large workforce in the geosciences (around 300,000 geoscientists). However, there are serious concerns about the future availability of the geoscience workforce: the U.S. Bureau of Labor Statistics projects an overall 19% increase in all geoscience-related occupations between 2006 and 2016, which is 9% faster than the growth rate for all U.S. occupations. However, the supply of new geoscience graduates to the workforce does not meet current demands, much less the projected increase in demand over the coming years. An additional and related concern is the ageing of the geoscientific workforce, with approximately 50% of geoscience professionals within 10-15 years of retirement (Gonzales and Keane, 2010). If the mining specific workforce is considered, this is much more limited and has been declining for generations as the size of the necessary mining labour pool has shrunk. The USA now only has 13 mining-focused university programmes and faces imminent loss of critical skills (e.g. underground ventilation). Whilst the lack of a 'home grown' mining skills base is a concern in terms of sustainability, the importation of skilled labour is not overly difficult, especially on a contracting basis.

A more complete and detailed analysis of this issue will be found in the Transactional Analysis Report produced in WP1.3 (D 1.4 *Report on transactional analysis of Education and Outreach*).

9.2.3 Research and innovation

The USA has traditionally continuously invested in geoscientific data as this is considered a critical factor enabling the development of the mining industry. The U.S. Geological Survey was established in 1879 to determine the natural wealth of the country, and has continued to serve that role. There is extensive existing data and published reports on mineral deposits and geology of the USA. The state geological surveys (some also with over 150 years of history such as the California Geological Survey established in 1860) often have even more detailed information. Likewise, the U.S. Geological Survey and the U.S. Census Bureau closely monitor production and consumption of an extensive range of commodities, which provides critical economic intelligence regarding the viability of operations. With an annual budget of around USD 1.1 billion, the information produced by the USGS is internationally considered reliable and their data and publications are amongst the most widely used around the world for mineral statistics. The availability of excellent geoscientific data favours small and medium sized mining enterprises disproportionately; larger enterprises tend to create and maintain their own knowledge bases and they do not rely so much on publicly available data.

A more complete and detailed analysis of this issue will be found in the Transactional Analysis Report produced in WP1.2 (D 1.3 *Report on transactional analysis of Research and Innovation*).

Appendix US1: Multi-factor matrix and radar charts

The multi-factor matrix

The information in the preceding sections of this report is summarised in a multi-factor matrix which is presented in Appendix US1. In each Country Report, the findings of the research (presented in Chapters 4 to 8 inclusive) have been used to develop a "multi-factor matrix". The matrix for each Reference Country aims to both summarise the findings of the research and to represent the relative importance of each factor to the economic development of each country. The weightings ascribed to factors in the matrices (and the 'radar charts' to which they give rise) are included for completeness in this report; this organisation of information and preliminary analysis of findings provides the basis for ongoing discussion within the WP1 team and between the WP1 team and the expert panels.

Each matrix has 6 columns as indicated below.

Category I Code I Subcategory I Weight I Justification of judgement I Source

Five main categories of factors have been considered (column 1), reflecting the main chapter headings in each of the country reports (see above).

These are further divided into subcategories, consistent with the sub-sections of each chapter (one for each of the 49 explanatory factors), and the codes ascribed to the sub-categories are the sub-section numbers (columns 2 and 3). The importance of each subcategory has been ascribed a numerical weight in column 4, using the following scale:

Table 1: Numerical weights for fulfilling the multi-factor matrix

Weight	Level of importance
5	Very high importance
4	High importance
3	Medium importance
2	Low importance
1	Very low importance

The assignment of weights for the multi-factor matrices has been a collaborative effort between WP 1 partners with input from the country experts. A short justification for the ascribed weighting is given in column 5 and the source(s) of information are given in column 6.

Sub-totals are given for the weighting scores at the end of the matrix section for each main category and, at the end of the matrix, an average score is created for each main category by dividing the sum of the weighting scores by the number of factors (subcategories) considered.

Radar charts

The information and weighting scores assigned in the matrix have been summarised via 5- and 12- axis "radar charts" (***Figure 26*** and ***Figure 27***). The five axis charts depict the relative importance of the five main categories of factors considered, by plotting the average weighting score on the relevant axis. To further emphasise the relative importance of the primary factors, the sizes of the points on the radar chart are proportional to the average scores.

To provide more detailed insight into the relative importance of factors in the multi-factor matrices, a more 'granular' radar chart has been produced for each country, with 12 axes, each representing one (or a group) of the subcategories in the matrix. The 12 factors selected are as follows (numbers in brackets are the codes (and subsection numbers) relating to the 12 factors chosen):

Geo-environmental Factors (Chapter 4)
1. Natural and mineral resources (4.2)

Socio-cultural Factors (Chapter 5)
2. Demographics and immigration (5.2.1)
3. Cultural norms and values (5.2.5)
4. Education system & infrastructure (average of 5.3.1 and 5.3.2)

Economic factors (Chapter 6)
5. Economic output (6.2.2)
6. Foreign investment (6.2.7)
7. Energy system and consumption (6.3.1)
8. Transport infrastructure (6.3.2)

Political and legal factors (Chapter 7)
9. Resources ownership & property rights law (7.2.2)
10. Trade and trade policies (average of 6.1.3 and 7.1.7)

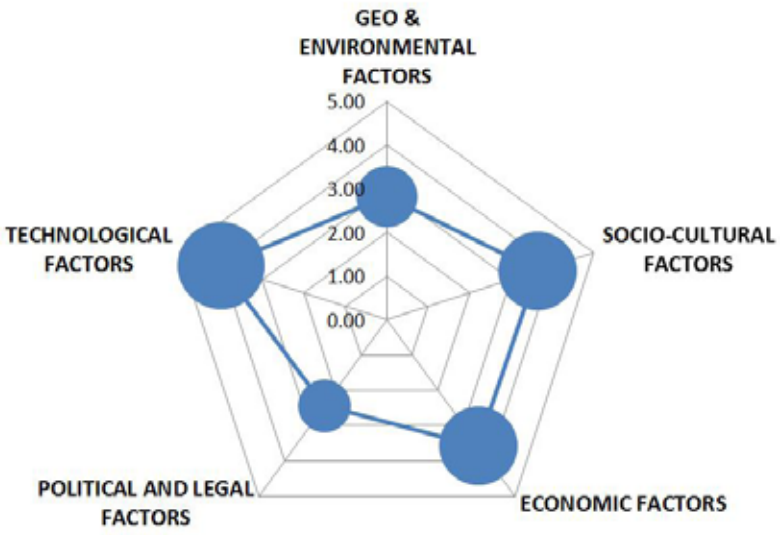
Technological factors (Chapter 8)
11. Knowledge and resource base and R&D culture (average of 8.1.1 and 8.1.2)
12. Patents, products and technology (8.2)

The choice of 12 factors and groups of factors from the 49 subcategories in the multi-factor matrix was subjective and the final selection was based on discussion within the WP1 team and with the country experts. These are intended to allow for more detailed characterisation of and comparison between the reference countries and, ultimately, with EU countries. They have been selected to be broadly consistent with key factors provided by the World Economic Forum in its Global Competitiveness Report, and to be equally relevant to explaining economic development in general and the raw materials sector in particular in all countries included in this project. Unlike the 5 axis chart, the plotted points on the 12 axis chart are all the same size.

5 axis radar chart for the USA

The high importance of the technology sector is explained due to the strong R&D culture in the USA, particular after WWII when a more science-based and government

Figure 22: Five axes radar chart for the USA.



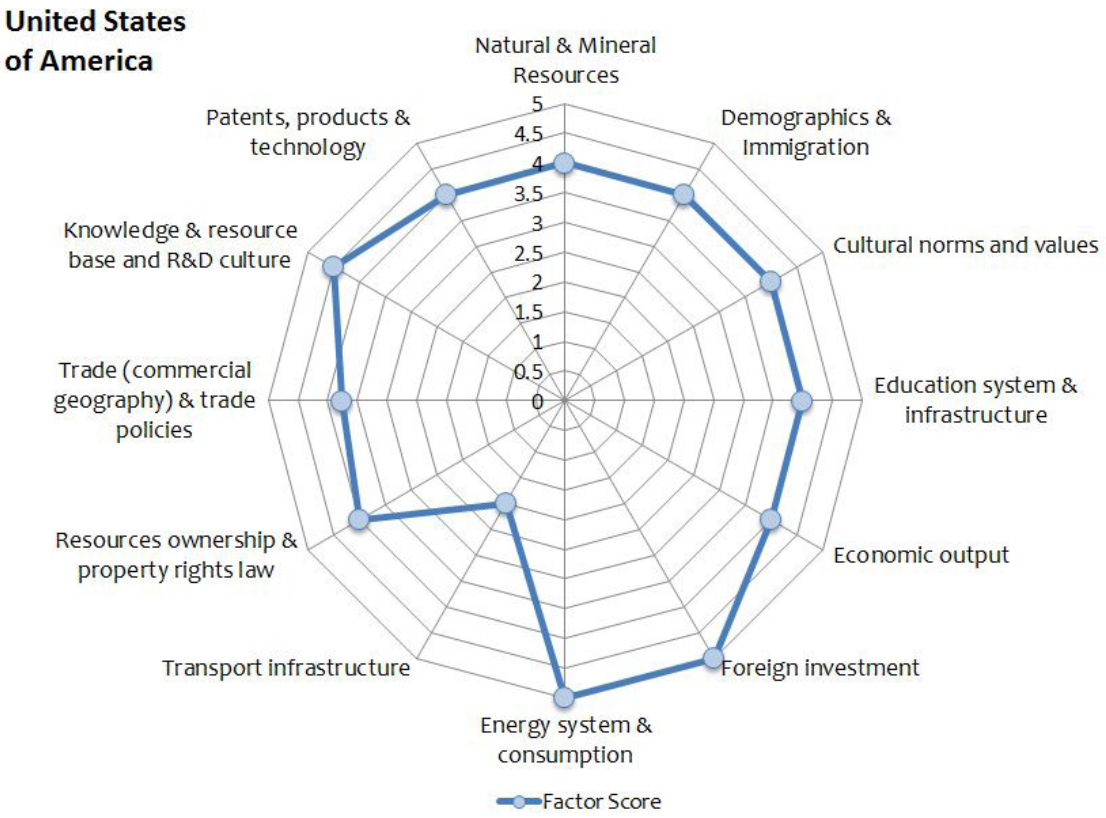
co-financed research and innovation system was established. Innovation played a significant role in helping the industry remain competitive during many decades of the 20th century and also allowed the transition to the knowledge economy of the present era. Economic factors have also been very important as the USA´s economy has evolved finding the correct balance between government-led interventions and regulations to the finance, industrial and services sectors and the role of the free-market. This was particularly important for the economy to exit the Great Depression of the 1930s and more recently the Great Recession. Socio-cultural factors such as a high value of quality education, a large affluent population eager to consume innovative products and a risk-taking and entrepreneur culture have also been essential in explaining the inherent innovative character of many USA firms.

12 axis radar chart for the USA

The country has historically benefited from its wealth in raw materials (forest products and minerals).

This has influenced the economic development more heavily in the past; during the second half of the 20th century and still during the 21st century the country became less reliant on its domestic endowment of natural resources by favouring and securing a stable supply of raw materials, particularly energy minerals, from imports. As shown in ***Figure 23***, the energy system (oil, natural gas and coal-based) has remained very important in the competitiveness of the USA economy and so has its spending power as the world´s largest consumer market.

Figure 23: Twelve axes radar chart for USA.



Appendix US2: USA multi-factor matrix

Category	Code	Subcategory	Weight	Justification of judgement	Source
GEO & ENVIRONMENTAL FACTORS	4.1	Geographical Situation	4	The USA is the 3rd largest country in the world as measured by area and has been endowed with a wide distribution of natural resources throughout its territory. This endowment, the insulation provided by the vast oceans (making transportation costs high during the early 20th century) and the lack of industrialized nations during its early economic development have played a key role in allowing the country to expand. Likewise, its geopolitical situation during World War II was favourable to avoid inland battles.	Stratfor 2011; Power 2002
	4.2	Natural & Mineral resources	4	Historically and with preponderance during the early industrialization in the early 20th century, the USA was dependent on its mineral resources for the rapid development of the economy and technology which eventually led it to become the world leader in manufacturing in the early parts of the 20th century. Despite its transition to a knowledge-intensive economy, natural and mineral resources (domestic and imported, energy and non-energy minerals) remain one of the backbones of the USA economy	Barbier 2005; Power 2002; Wright and Czelusta 2003; Kelly 2002
	4.3	Water resources	3	Water availability varies dramatically between regions in the USA. Plenty of water is available in the East and Alaska, a moderate availability exists for the central plains and the southwestern part is affected by very scarce water availability. Despite such difference, all parts have mineral production, and even the water-stressed southwestern part of the country has seen the development of the mining industry and of agriculture. Therefore, the availability of water for economic development is assessed as of medium importance given that it appears that it has not been a structural deterrent or enabler of mining operations.	Ackerman and Stanton 2011
	4.4	Climate	2	Since 1988 there has been at least one climate extreme event causing at least USD 1 billion in damages. Yet, despite a long history of extreme events of different kinds, the country has steadily advanced its economic development and has actually benefited during the reconstruction of affected cities or regions. Therefore, climate risks and extreme climate events are not considered to have been important in the economic development of the country.	Kunkel et al. 2013
	4.5	Geological Factors	1	In the USA despite numerous regular earthquakes and the high risk of disasters posed by big earthquakes, e.g. in the West coast, the economic development and urbanization of the country has continued during the 20th century. Earthquakes are a regular threat but they have not stopped or expanded the economy in a significant way which explains the weight.	-

Category	Code	Subcategory	Weight	Justification of judgement	Source
	4.6	Ecologically Sensitive Areas	3	The biosphere and the ecosystems (providing renewable goods and environmental services) have only more recently been recognized as such, although they have provided services during the entire 20th century (clean water, clean air, wood, etc.). Yet, they are considered of medium importance as they do not include the non-renewable (mineral) resources which have been key for the economic development of the USA. Moreover, at times there have been conflicts between natural areas and mineral developments, reinforcement the medium importance weight.	Wild Salmon Center, 2015
Subtotal		All geo & environmental factors (6)	17		
SOCIO-CULTURAL FACTORS	5.1	Historical Background	5	During the 20th century there have been at least four inflection points which have re-structured the relationship between the federal government and the private sector in the free-market economy leading to economic cycles of expansion and contraction but almost always keeping the USA economy as the world leader. The Great Depression and the New Deal programs are the first event, second comes the World War II and the post-war economic boom, third comes the launch of the Great Society in the mid-1960s, fourth the Reagan era liberalization which boosted economic growth and finally the recent Great Recession which encompassed a further involvement of the federal government in the economy to revitalize it. These economic cycles and the measures taken by the government and the private sector are the key to explaining the economic development process and transition towards a knowledge-intensive of the USA economy during the 20th century.	-
	5.2.1	Demographics	4	Immigration (internal and external) and population growth have had a major role during the economic development of the USA as it has created the world´s largest consumer market, regularly shaping an affluent demand for goods and services. As an example during the 1950s and 1960s an economic growth process was led by people needing houses to shelter young Boomers, and public infrastructure (roads and schools) to support them. Likewise, during the 1980s the economic growth was achieved due to Boomers pouring into the labour force, settling down and starting families. Boomers entering their peak earning-, investing-, and home-buying years drove the stock market explosion in the 1990s and the housing boom in the 2000s. The USA has the third largest population in the world currently and the world´s largest consumer market which reflects how important this domestic market has been for the economic development of the country.	-

Category	Code	Subcategory	Weight	Justification of judgement	Source
	5.2.2	Ethnic composition	4	The United States has a racially and ethnically diverse population. Internal (regional) and external immigration have been essential for the population development of the country, first when European, Africans and Asian immigrants colonized the Nation (voluntarily or as slaves), and more recently with Hispanic migration revitalizing an aging population. Immigrants have always been very important for the economy, for instance, one way to quantify immigrants' contribution to the USA economy is to look at the wages and salaries they earn, as well as the income of immigrant-owned businesses, as a share of all wages, salaries, and business income in the United States. For the United States as a whole, immigrants' share of total output was about 14.7% over 2009–2011.	Costa et al. 2014; Aguilar 2013; Anderson and Platzer 2006; Bellows 2011; Peri, 2010
	5.2.3	Language	3	The United States does not have a national official language; nevertheless, English (specifically American English) is the primary language used for legislation, regulations, executive orders, treaties, federal court rulings, and all other official pronouncements. The language is shared among other industrialized countries and has had a medium importance in the economic development of the country; nowadays Spanish is the second most spoken language in the country which has to a certain degree been the result of economic integration with Mexico.	
	5.2.4	Religion	3	Religion in the USA is reported to play a very important role in the lives of USA´s citizens, a proportion unique in developed countries. Research between religion and economic growth has only identified some linkages, e.g. religiosity affects economic outcomes partly because religious involvement has generally beneficial effects on health and well-being. Yet, no research in the USA has determined a strong linkage, thus, the weight assigned is of medium importance.	Lehrer 2004; The Pew Research Center 2002
	5.2.5	Cultural Norms, Values & Conflicts	4	Central tenets of the USA´s culture are individual freedom and self-reliance. So are a risk-taking culture, entrepreneurship, competitiveness, a culture of achievement and success. All these cultural values have been evaluated as having been key in the American attitudes and behaviours to question the established way of doing things and searching for innovations.	Atkinson 2014; The Hofstede Centre 2015
	5.2.6	Civil society & environmental awareness	3	Civil right movements and the environmental movement in the USA Have played a moderately important role in the economic development of the country granting rights to minorities and driving the industry towards a cleaner and more efficient production.	

Category	Code	Subcategory	Weight	Justification of judgement	Source
	5.3.1	Education system	4	The levels of educational attainment in the USA have been steadily rising, also shortening the differences with the minorities. Tertiary education in the USA Is a major issue requiring considerable investments by students to attend college or university but students take education as a serious investment. This is based on the belief and the existing relationship between level of education and level of earnings. The USA´s government and private industries are aware that a well-educated population and workforce increases economic productivity, standard of living, creativity and promote entrepreneurship. Thus, education target towards market requirements has had a crucial role in the economic development of the country.	Aghion et al., 2009; Berger and Fisher 2013; The Brookings Institution 2010; OECD 2014b
	5.3.2	Education infrastructure	4	The role of universal free public education and a massive higher education resulting in a bulk of global graduate degree production and a high level of tertiary-educated people have been very important in the flexibility and adaptation possibilities of the workforce towards the changing market conditions. Thus, a proper infrastructure (public and private schools, colleges and universities) has been very important.	-
	5.4.1	Health system	3	Health care access is important to keep a healthy workforce and population for any country. Yet, the USA does not have a universal health insurance coverage system. During the 20th century the level of population with access to health has been increasing, especially for instance with the creation of the Medicare and Medicaid programs during the mid-1960s or more recently with the passing of the Affordable Care Act in 2010. Yet, even nowadays, the rate of uninsured reaches around a 13% of the population. Much of the health care spending has been private, which has at some points even boosted the economy. Public spending on health is currently 17% of GDP and including private spending, health expenditures per capita are by far the highest among OECD countries. Yet, despite the high spending in health care, the USA underperforms other industrialized nations on issues such as health outcomes, equity, quality, efficiency and healthy lives. All in all, access to health has not been a major driver for the economic development of the country.	Kasperkevic, 2014; OECD, 2011; Obamacare, 2015; Davis et al., 2014
	5.4.2	Health infrastructure	3	The USA ranks 31st in the indicator "health infrastructure" which evaluates if the infrastructure meets or not the needs of society placed far below Japan, Canada or Australia. The private-led health care system has negatively impacted labour costs of the workforce and reduced the competitiveness of the country. Thus it is considered to have played a moderate importance in the economic development process.	Institute for Management Development, 2014
Subtotal		All socio-cultural factors (11)	40		

Category	Code	Subcategory	Weight	Justification of judgement	Source
ECONOMIC FACTORS	6.1.1	Economic structure	4	Despite the challenge from emerging economies, the USA remains the most heavily invested-into country in the world, with the stock of direct foreign investments at home worth USD 2.8 trillion as of 2012. This indicates good and favourable economic structure to attract investors from around the world. The USA has a service, knowledge-based economy which has been the key drive of economic development and the leading position of the country during the last decades. Currently the USA has the largest consumer market in the world which has also been a major driver of technology innovation and mass consumption of goods and services.	OECD, 2009
	6.1.2	Industrial Geography	4	Despite the relative decline of the manufacturing sector during the 1990s, the sector is currently recovering and the USA is considered one of the world´s preeminent industrial powers alongside China. Currently, manufacturing is not the preeminent industry of the country, but shares its importance with other technology and knowledge-based industries. The USA´s 50 advanced industries comprise manufacturing (iron and steel, industrial machinery, motor vehicles and parts, aerospace electronics, food processing, consumer goods, petroleum and coal products, semiconductors and other electronic components, medical equipment and supply, etc.), energy (oil and gas extraction, metal ore mining, electric power generation) and services (telecommunications, computer systems design, medical and diagnostic laboratories, etc.). The development of such industries and the struggle for competitiveness has been a backbone of the USA economic development process during the 20th century.	-
	6.1.3	Commercial Geography	4	Foreign trade has also kept a crucial role in making the industry work, especially from the mid-1950s when the country became (and has remained ever since with fluctuations in the rates) a net importer of energy and non-energy minerals with an increasing negative balance of trade. Currently the USA has 14 free trade agreements with 20 countries. Total trade (exports and imports) accounted for 30% of USA´s GDP in 2013.	USTR, 2015; Trading Economics 2015b;Lindert, 2000
	6.1.4	Agricultural Geography	3	The country is the third largest agricultural producer in the world behind China and India. Agriculture is a vital part of the economy and society. Agriculture sector made up 1.2% of US's GDP in 2012. Farmers are also one of the major political lobbyists in the country as they are primarily responsible for the country's food demands, as well as a major export industry with more than US$150 billion of agricultural products exported in 2014. Yet, agriculture has not been a major driver of economic development as has been the industry, hence, the weight of medium importance.	-

Category	Code	Subcategory	Weight	Justification of judgement	Source
	6.2.1	Economic diversity	4	Being a developed nation, the USA services sector is the fastest growing component of its economy. But the manufacturing industry is also important to the GDP development contributing to $2.1 trillion in 2013. Thus, the USA has both a competent manufacturing industry as well as a big service sector. Economic diversity (and regional diversity) has been important in the capacity to adapt to the changing global market conditions (economic resilience). Also important has been the changing and adjusting relationship between a free-market economy and government regulation, e.g. changing role of the Fed through economic cycles.	Haksever and Render, 2013
	6.2.2	Economic output	4	Total output for the USA economy in 2014 was $17.46 trillion, approximately a 22% of the world´s GDP. The cycles of expansion and contraction of the GDP have been very important throughout USA Economic history.	-
	6.2.3	Labour costs, mobility & employment	2	The role of labour costs (affecting the industry competitiveness, and themselves affected by a mostly private health care system) has had a moderate importance in the economic development of the country, more important has been the maintenance of productivity high. Mobility has been of a higher importance with the population moving according to job opportunities and employment levels have accompanied the economic cycles. All in all, these factors have not been key in the economic development process.	-
	6.2.4	Interest rates	4	The Federal Reserve conducts monetary policy to achieve maximum employment, stable prices, and moderate long-term interest rates. The FED has had an essential role stimulating the economy and controlling inflation via monetary policy during economic downturns during WWI and WWII, during Nixon´s stagflation period and more recently during the Great Recession.	Pope, 2000; Federal Reserve, 2015b
	6.2.5	Inflation rates	4	Inflation rates have been a key concern throughout the modern USA´s economic development history. During the 1960s inflation and unemployment were the key topic among economic discussions (Great Inflation period, 1965-1982) and so was inflation during the late 1970s when the rate reached historical highs. Inflation has been controlled by the Fed as one of its main objectives.	Bryan, 2013
	6.2.6	Customer liquidation and spending power	2	The level of liquidity among the USA population has had a low importance in the economic development history. Currently, USA households are considered "liquid asset poor" (they have less than three months´ worth of savings) but the economy is recovering. The USA has the world´s largest consumer market (measured by household final consumption expenditure) and constitutes the 3rd largest in the world as measured by GDP (ppp). This large domestic market has been very important during the economic development of the 20th century.	Mcwhinnie, 2014

Category	Code	Subcategory	Weight	Justification of judgement	Source
	6.2.7	Foreign investment	5	Investment in the United States by both domestic and foreign businesses is a major engine of economic growth and job creation, and the United States attracts more foreign direct investment (FDI) than any other nation worldwide.	CIA, 2015c; OECD, 2009; Economy Watch, 2013
	6.2.8	Public finance situation	3	Historically the USA federal government annual budget has been characterized by a higher degree of spending (outlays) than the income or revenue received (receipts), i.e. by a deficit. The national debt and the debt-GDP ratio have also been increasing lately. The USA national debt is currently the world´s largest (in absolute terms) but the debt-to GDP ratio is not very high in comparison to other countries like Japan or Italy doing much worse. The public finance issue has been kept managed under the debt-to-GDP indicators, and thus the absolute national debt has not halted the economic development process of the USA	Office of Management and Budget 2015
	6.3.1	Energy system, consumption & access	5	Reliable and affordable energy underpins virtually every element of the United States' economy, providing mobility, power generation, heating and cooling. In other words, the (oil and gas) energy economy is (and has been after WWII) the foundation of the USA economy	-
	6.3.2	Transport infrastructure	2	Infrastructure is critical to economic growth, but the aging USA´s transportation system suffers from insufficient investment. USA´s transportation fell from fifth in the World Economic Forum's rankings in 2002 to twenty-fourth in 2011.	Markovich, 2014
Subtotal		All economic factors (14)	50		
POLITICAL AND LEGAL FACTORS	7.1.1	Administrative structure	2	The USA features a complex system with 50 autonomous states, each with unique constitutions, statutes, and governments, with a three-branch system of government with executive, legislative, and judicial branches. To some degree, and for instance for mining activities, this has slowed down economic activities. All in all it is not considered a factor of high importance for the economic development.	-
	7.1.2	Governmental stability & transparency	3	The country has a corruption perception index of 74 in 2014 which is ranked 17th in the world. The seamless tradition of transition from one presidential administration to the next has allowed the country a vision of stability and has supported business and consumer confidence (KPMG, 2011). Yet, stability & transparency have only had a moderate importance.	KPMG, 2011; Transparency International, 2015
	7.1.3	Fiscal policies	2	Taxing policies have not been recognized as a driver of economic growth and development in USA´s history. Currently the USA is considered to have an uncompetitive tax code.	Pomerleau and Lundeen, 2014
	7.1.4	Government spending priorities & allocation	3	Government spending has had a key role in some parts of the USA history (e.g. During WWI and WWII) but it has not been a key driver of the economic history. It reaches nowadays around a 21% of the GDP with the private sector being the major player in a free market economy.	USGovernmentSpending, 2015

Category	Code	Subcategory	Weight	Justification of judgement	Source
	7.1.5	National Security	3	Expenses in national security (military expenditure) were of importance during WWI and WWII but after such episodes spending (as a share of GDP) has fluctuated between 3% and 5%, without having been a major driver of the economic development.	USGovernmentSpending, 2015
	7.1.6	Safety & crime	1	Crime rates in the USA were high during the 1970s and early 1990s and since then there has been a decline. Crime was important in some stages of the USA´s economy history (e.g. Rising during the 1960s) but it has not been a key driver of economic growth.	Truman and Planty, 2012
	7.1.7	Trade policies	3.5	USA trade policies have been very important in the marketing of USA manufactured goods and in the provision of services. They have also been instrumental in securing the provision of resources for the USA economy. USA´s trade policies have been based on the belief that an open and market-based trading systems is the best option and thus trade liberalization (promoted for instance through the WTO) has broadly benefited the USA. Yet, free-market trade policies have been contrasted with policy initiatives, like for instance, the recently launched National Export Initiative, aimed at improving trade advocacy and pursuing policies to promote growth. However, overall, trade policies have had an important participation in the economic history of the USA.	Atkinson, 2014; U.S. International Trade Commission, 2009
	7.1.8	Bilateral, Multilateral & International agreements	3.5	Trade agreements at all levels have been of moderate-high importance in the economic development of the country, exemplified by the NAFTA, the participation in the WTO or in security council meetings.	-
	7.1.9	Sustainable development policies	1	The role of sustainability as a driver of economic development has only been recognized in the last decades and the USA has championed some initiatives but abstained from other important ones (e.g. Kyoto Protocol). Thus, sustainability has not been a major driver of economic growth.	-
	7.2.1	Legal Framework	1	The legal framework and federal organization of the country under the National Constitution has had a low importance in the economic development of the country.	-
	7.2.2	Resources Ownership & Property Rights Law	4	In the USA landownership can be divided into separate parts, often referred to as rights. Thus, surface rights, subsurface rights, water rights, timber rights and mineral rights can be separated. Thus this difference allows that mineral rights (located in the subsurface) and surface rights can be managed separately, allowing energy and mining companies to buy or lease the subsurface rights without the need to buy the surface of the property. This distinction has played a significant role in the development of the USA resource extraction industry.	Kesler, 1994; Hartman and Mutmansky, 2002

Category	Code	Subcategory	Weight	Justification of judgement	Source
	7.2.3	Business legislation	3	USA´s law is extensive and complex when it comes to government controls regulating business activities. Business legislation has not substantially encouraged mining activities. The USA ranks 14th in the world in the indicator "Competition Legislation" of the Global Competitiveness Index, a metric which describes whether country´s legislation is efficient or not in preventing unfair competition. And the USA ranks 7th in the world under the "Ease of doing business" indicator which indicates the business legislation regulatory environment has had a moderate role in the economic development of the country.	World Bank, 2014
	7.2.4	Employment, Labour laws & Unions	2	Labour laws and unions have had relatively low importance in the economic development of the country. Although labour laws have created the framework for many advances in social aspects (e.g. for workers protection in the mining industry), employment laws vary considerably among States and can´t be held accountable for the development of the entire Nation. Currently only about 10% of USA workers are in unions. Most high-paid positions are non-union.	-
	7.2.5	Environmental regulations & their enforcement	2	Like other developed nations, the USA has strong environment regulations regarding industry. Environmental regulations in the USA history have not been a key driver of economic growth.	-
Subtotal		All political and legal factors (14)	34		
TECHNOLO-GICAL FACTORS	7.1.1	Knowledge and resource base	4	Ever since the steel-based industrial revolution of the late 1890s, the USA has joined the ranks of world leaders in innovation. Government and industry-funded institutions have been developing throughout the 20th century which has given the country a solid R&D infrastructure, including government-funded labs, high-tech profile innovation clusters like Silicon Valley, and many others. The USA also leads the world rank in business expenditure on R&D. The USA features as a highly attractive destination for researchers and scientists, ranking 2nd in the world after Switzerland. All of this shows that the knowledge and resource base (infrastructure) in the country has been of high importance in the USA transition towards a knowledge-based economy.	Institute for Management Development, 2014; Atkinson, 2014; World Economic Forum, 2014
	7.1.2	R&D culture	5	The USA has a strong R&D culture. Compared to many nations, the USA has a highly developed and successful industry-research institute collaboration system; It ranks 2nd in the world in the indicator "University-Industry collaboration on R&D" only behind Finland. USA companies are highly sophisticated and innovative, supported by an excellent university system that collaborates admirably with the business sector in R&D. Econometric studies strongly suggest that R&D spending has a positive influence on productivity, with a rate of return that is likely to exceed that on conventional investments. R&D expenditure is currently at 2.8% of the GDP for the past few years which shows that it will rise with economic growth.	Institute for Management Development, 2014; Atkinson, 2014; World Economic Forum, 2014

Category	Code	Subcategory	Weight	Justification of judgement	Source
	7.2	Patents, products, technologies generated	4	Since the founding of the Republic, the USA´s federal government has had a robust patent system embedded in the Constitution. The USA has traditionally been a leader in the patents market and in the number of technologies generated. Nowadays in terms of patent applications (2012) the USA ranks 3rd in the world after China Mainland and Japan; with regards to patent grants, it ranks 2nd in the world after Japan. The generation of new patents and new technologies has had a key role in the economic development of the country, particularly in the second half of the 20th century.	Institute for Management Development, 2014; Atkinson, 2014
	7.3	Telecommunications & E-commerce	3	The USA is an advanced country in terms of telecommunications production and consumption. USA´s firms are among the world leaders in adoption of information and communications technologies (e.g. hardware and software). USA firms invest more as a share of sales and of overall capital investment in hardware, software, and telecommunications than almost any other nation. The USA e-commerce market is among the largest in the world. Yet, this factor has only more recently gained in importance and does not figure among the key drivers during the 20th century.	Atkinson, 2014; Enright, 2013
Subtotal		All tech factors (4)	16		

RADAR CHART	Sum of weights	Number of factors	Average	Multiplied by ten (to create the size of the point in the radar chart)
GEO & ENVIRONMENTAL FACTORS	17	6	2.83	28.3
SOCIO-CULTURAL FACTORS	40	11	3.64	36.4
ECONOMIC FACTORS	50	14	3.57	35.7
POLITICAL AND LEGAL FACTORS	34	14	2.43	24.3
TECHNOLOGICAL FACTORS	16	4	4.00	40.0

APPENDIX US3: REFERENCES FOR THE USA COUNTRY REPORT

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