

# Taiwan-V4: New Approach to Sustainable Economy and Deepening Taiwan-EU Relations

Adolfo Yinshi Wu

DOI: 10.29180/9786156342393\_2

## 1. Introduction

The Covid-19 pandemic became a global issue that radically changed all types of life and forced people to adopt digitalization in society. The European Union (EU) has also acknowledged the transformation of the economy that has affected all perspectives of working, learning, socializing and shopping. With the Covid-19 pandemic raging around the world, people work and attend classes at home and the demand for various electronic communication products is increasing day by day.

In 2020, the Covid epidemic hit the world hard, but Taiwan's economy grew against the trend because the government strictly managed and regulated public health at the airport. Furthermore, Taiwan had already invested in the semiconductor industry and had constructed the science park for digitalized industry in 1990, which helped the government to avoid suffering many of the impacts of Covid. All the domestic experts described the semiconductor industry as the core element of Taiwan's economy.

The V4 and other nations of the EU have experienced an unexpected demand for chips for Internet Communication Technology and smart automobiles, these have become a scarce and popular commodity and this phenomenon of "car chip shortage" and trends in the ecosystem of digitalization have affected various manufacturing industries and citizens since 2021.

The research proposes two explanations and has investigated significant phenomena in the V4 and analyzed their economic sustainability program, Horizon Europe. In addition, the author will analyze the results of V4 economy in global market that has strengthened V4's status in free market economy and they also participated in the European political and economic system after EU accession (OECD, 2001). The content of the paper investigates the V4's H2020 (Horizon 2020) and sustainable projects that have developed long-term vision, not only for

Taiwan-V4, but also for Taiwan-EU relations. In fact, the research analyzes the connections of Taiwan-V4 in industrial, scientific, and digital innovation that address international competitiveness, stable growth of free trade, sustainability and concludes with the positive impact of Taiwanese industrial policies to deepen Taiwan-EU bilateral relations with the V4 as significant mechanism in the contemporary era.

In the 1990s, Eastern European countries successfully carried out political and economic reforms and markets opened and began to attract many foreign multinational companies to invest. In addition, Western European countries gradually increased labor and production costs to cover costs. After 2000, with relatively low capital and manpower production costs, the countries of Eastern Europe joined the European Union, and Western European countries gradually shifted their commercial investment to Eastern European countries. The trend of the eastward shift of industrial production bases is especially obvious, and most of them are concentrated in Hungary, Poland, the Czech Republic, and Slovakia; countries with good infrastructure and stable markets. This type of opportunity in Europe was transferred from Western Europe to Eastern Europe. The main reason is that after these countries joined the European Union, various domestic policies and regulations had to be in line with the relevant European Union regulations. The policies became more transparent and convenient, coupled with the effects of globalization. Repeatedly providing motivation for Taiwan's small and medium-sized enterprises to deploy in the Visegrád region and other nations of the European Union.

In the report of *Trade for all*, the EU promoted more responsible, more effective and more transparent trade policies that will launch new approaches and a Bilateral Investment Agreement (BIA) with Taiwan (EU, 2015). The negotiation of the EU-Taiwan BIA is a key platform which provided opportunities for international business and market penetration of all Asian countries. Taiwan is a like-minded democracy and economic partner in Asia, and Taiwan and the European Union have similar interests and benefits in politics and business in an EU-Taiwan bilateral relationship.

In the extended study of the Taiwan-V4 approach, Taiwan's export to Central and Eastern Europe is 31.7 percent and the demand in the market currently includes electronic components and telecommunication products (Taiwan Today, 2022). EU-Taiwan relations require maintaining and growing the stable and multilateral exchanges of the two sides and the close political and economic relationships.

The European Union considers Taiwan as a valuable trade partner to launch economic discussions of the Bilateral Investment Agreement, because Taiwan is the EU's fourth largest trading partner in Asia, and the EU is Taiwan's fourth largest foreign market. Furthermore, Taiwan participated in trade blocs and joined cross-regional agreements that strengthened the political influences and trade liberation to merge into the world trade system at the beginning of the 21<sup>st</sup> century. The bilateral collaboration between the 27 members of the EU and Taiwan is not only for business, but also for technical industries with green values, information society research and innovation, education and culture, fisheries, and environmental protection to cultivate the circumstance of the bilateral investment agreement and a Taiwan-EU like-minded partnership.

## 2. EU Regionalism: Past and Future

To date, the European Union is the region that has launched political and economic regional integration. There are significant points that regional agreements are the major forces to deepen the internal and external level of regional integration. In the research of political science, Baylis, Smith and Owens consider regional cooperation that "regional agreements cover different mixtures of economic, social, political, and security concerns. Moreover, there are different forms of interaction between regionalization and the various ways in which states may promote regional cohesion, [...] state-led actions have been responsible for an increase in the development of ties has been more one of 'market-led integration.'" (Baylis – Smith – Owen, 2020, p. 366). The EU considers itself a global player promoting economic interests with foreign markets and Taiwan is a major nation for cooperation with EU industries and sustainable economies.

In the context of Hettne and Söderbaum's research, regionalism is to be viewed as a concept of regional integration and adopted by theories of neoliberal economics, establishing contents and discussion around the political, economic and governance of regionness, known as new regionalism in a multipolar world. Their findings and results with origins and development in the process of economic integration have addressed non-governmental units and issues in globalization. These authors' methodologies are of limited value on regionness and consequently, we propose an alternative approach based on new economic cooperation and market-orientation of cross-region to link social, political and institutional aspects of region-building in a post-hegemonic era (Riggirozzi, 2010; Hettne – Söderbaum, 2005, p. 462).

This is a new perspective of cross-regionalism, dating back to the first decade of the 21<sup>st</sup> century, which has alternatively been called upon by various scholars and investigators with different outcomes and conclusions (Pereira, 2014):

1. Political views: Cross-Regionalism (Crawford – Florentino, 2005), Transoceanic Agreements (Péridy, 2004);
2. Economic views: Preferential Trade Agreements (Bhagwati – Panagariya, 1999), Polilateralism (De Sebastian, 1995);
3. Geopolitical views: Competitive Regionalism (Abugattas Majluf, 2004) and, last, but not least, Additive Regionalism (Harrison et al., 2002);
4. Trans-Geopolitical Views: Cross-Regionalism (Alfred Tovias, 2008), East-Asian Cross-Regionalism (Solís – Katada, 2007).

Considered with the facts of this new trend in cross-regionalism, the active and positive participation of nations in various free trade agreements (FTAs) by bridging economic integration, even if in different regions, these free trade agreements have very different trade standards and regulations, and include different countries in the world. There are many FTAs linking leading EU countries and the US with trade blocs in Asia and Latin America, thus increasing free trade and making cross-integration viable in different geographic regions (Pizarro, 1999).

In fact, the EU has become an important actor and a significant hub for a large variety of interregional arrangements with neighboring regions, and supports political cooperation, cultural interactions, and security cooperation around the world (Barbé, 2008). This research analyzes the EU's role in the world and as a global actor, which is acknowledged with an economic focus on interregionalism and promoted political values and governance with interaction with related nations in different continents by implementing the EU's external relations and foreign policies (Söderbaum – Langenhove, 2006).

In Krugman's study, he identified free trade agreements that promoted incentives for economic integration in the global market (Krugman, 1990). According to this research, the EU is a good trade partner with its members, market-driven cooperation, advanced democratic ethics, free trade, and development-driven focus among regional integrations. (Smith, 2008) The EU has already established free trade agreements with Japan and Korea in Asia and launched different rounds of negotiations with Mercosur in South America (The World Bank, 2010).

During the process of regional integration, nations and governments constantly manage the interdependences between free trade and the demands of the local market in the dynamics of globalization.

Based on neighborhood policy and enlargement policy, the V4 are able to seek a common interest, which is subsequently presented as a common position representing the V4 interest at the EU level. After EU accession in 2004, the V4, sub-regional and institutional unit, presented itself as the representative of regional interests and focused on the field of European foreign policy. The V4, EU sub-actor, has an economic hub to push its own agenda in a changing Europe and has created results in the fields of cooperation such as culture, science, and regional development to link to the EU international collaboration and its status as a global actor (Van Langenhove–Bauerová, 2016; 2018).

European countries, such as Germany and France, mainly rely on Chinese trade and economic cooperation, however, Central European countries, especially the V4, have relatively few free trade cooperations with China and believe that close ties to the United States are essential for national security. Many officials and experts have said that the failure of China's major investments has disappointed many governments and believe that finding another partner or nation would not cause too much loss. According to the article of Wall Street Journal, the governments of many countries in Central and Eastern Europe were disappointed with Chinese investment and the small volume of exports (Kantchev – Woo, 2021). In addition, Ivana Karásková, head of China Observers in Central and Eastern Europe (CHOICE), pointed out that “Central and Eastern European countries have relatively low dependence on China's trade, and they have a stake in the smoothing of Sino-European relations” (Karásková, 2022). Central and Eastern European countries do not need to look at China as much as Western European countries. In Slovakia, Chinese investment in 2019 was 269 million USD, accounting for only 1 percent of the country's total foreign direct investment. In the neighboring Czech Republic, the Ministry of Commerce of China estimated that the investment in the same year was 287 million USD (Kantchev – Woo, 2021).

The V4 has deepened their relations with Taiwan and strived for new cooperation in economic, scientific, and industrial planification in order to transform the market economy with Taiwan's industrial policies. After the EU's financial crisis in 2009, the focus of Taiwanese investment in Europe has gradually shifted to new member states such as Hungary, Poland, the Czech Republic, and Slovakia. The V4's market economy approach has common interests for manufacturing

industries and direct investments are mainly involved in the information communication and technology (ICT) industry, customer service electronics, and consumer electronics products.

### 3. Taiwan: Visegrád Matters?

After the EU expansion, Taiwanese public and private units' investment has gradually shifted to new member states such as Hungary, Poland, the Czech Republic and Slovakia, which are key countries in Central Europe, that have a high performance economic growth, a low rate of employment, and a well-constructed manufacturing sector. The Central European Free Trade Agreement (CEFTA) was founded by the members of the Visegrád countries. In Table 1, there are significant facts that indicate that the V4 is a new economic heart of the EU and the world, and that they had stable economic growth: Hungary 4.5 percent, Poland 4.5 percent, the Czech Republic 2.7 percent and Slovakia 2.4 percent before the pandemic.

Table 1: GDP Growth Rate: Hungary, Poland, Czech Republic and Slovakia

	2019	2018	2017
Hungary	4.58%	5.44%	4.45%
Poland	4.55%	5.36%	4.83%
Czech Republic	2.27%	3.18%	5.35%
Slovakia	2.4%	3.9%	3.04%

Source: CIA, 2020.

After the transition process in the first decade of the 21<sup>st</sup> century, the Visegrád countries planned to start their market economies, with different timing, all of the V4 opened up their economies to attract foreign nations. According to a study on Central Europe, the V4 were in the early stages of rearranging their external trade relations, and it was likely that this process would result in a temporary or even a longer-term decline in intra-regional trade (OECD, 2022). After the EU accession of the Visegrád countries in 2004, one of the most remarkable developments was the sudden upturn of mutual trade. In 2007, the value of aggregate intra-Visegrád trade was two and a half times higher than in 2003 (Richter, 2012). The V4 is a significant platform that has actively extended economic and technological cooperation with the EU and positioned themselves to attract foreign direct investment from other nations.

In the overviews of free trade in the V4, Poland is the world's major fishing boat manufacturer and exporter and its exports are well developed. Take fishing boats with a length of 24 meters or more exported by Poland as an example. The exports accounted for 20 percent of the world, but the price is only one-third of Taiwan's average export unit price. The Czech Republic also has an excellent foundation in transportation and basic industries. Take aircraft weighing less than 2 tons as an example, the global export market accounts for 6 percent, while the Czech Republic accounted for car seat belts 13 percent, generator sets 8 percent, trough-type single-head machine tools 9 percent, and shuttle power looms 7 percent of the global export market. Hungary's current global exports of starter generators, car mirrors, and vulcanized rubber are 10 percent, 9 percent, and 16 percent, respectively, compared to other nations. Hungary is also a major global exporter of agricultural products. Slovakia has developed rapidly in the automobile industry and the heavy metal industry, especially car bodies and car air conditioners. Not only does Slovakia accounts for 41 percent and 9 percent of global exports (Chang – Cheng, 2006; Ministry of Economy, 2022).

In Table 2, Gubik, Sass and Szunomár (2020) analyzed Asian FDIs in the Visegrád region and demonstrated that the main source countries in this content in 2017. Taiwan is the seventh FDI contributor in the V4 and it is a major important investor in Slovakia, whereas the data also demonstrates that Taiwan ranks fourth in the Czech Republic and fifth in Hungary (Gubik – Sass – Szunomár, 2020).

Table 2: FDI stock by Asian countries in the Visegrád countries, 2017 (million USD)

	Czech Republic		Hungary		Poland		Slovakia	
	direct	ultimate	direct	ultimate	direct	ultimate	direct	ultimate
Japan	1907.66	3314.14	1152.56	3185.93	887.43	4996.26	125.16	n.d.
Korea	3254.71	3046.01	1979.25	1986.48	1134.81	1783.54	3535.08	n.d.
China	707.27	1096.04	210.96	1973.42	223.11	826.51	55.12	n.d.
Hong Kong, China	115.69	204.41	319.81	207.51	347.08	465.06	25.03	n.d.
India	-1.12	99.51	-16.04	2657.56	103.38	299.41	-2.72	n.d.
Singapore	344.64	699.07	532.29	-55.72	84.74	109.56	118.49	n.d.
Taiwan	283.53	1007.46	47.28	971.91	30.76	254.14	18.27	n.d.
Sum of countries	6612.36	9466.65	4226.11	10927.09	2811.31	8734.48	3874.42	n.d.
Sum of countries in % of total FDI stock	4.42	6.33	4.64	12.01	1.18	3.66	6.94	n.d.

Source: Gubik – Sass – Szunomár, 2020; Wu, 2022.

All four countries have large shares of FDI as a mainstream of national development, due to their supply chain's close proximity to Western Europe and the

economic conditions offered by the V4 to Asian investors, Japan, South Korea and Taiwan in the long-term. In other words, in Central and Eastern Europe, especially the V4, there are favorable conditions, like industry 4.0 and they have the opportunity for free trade and investment from Asia.

In the reports of the Ministry of Economy and Taipei Representative Office in the EU and Belgium we find the following (Taipei Representative Office EU and Belgium, 2016):

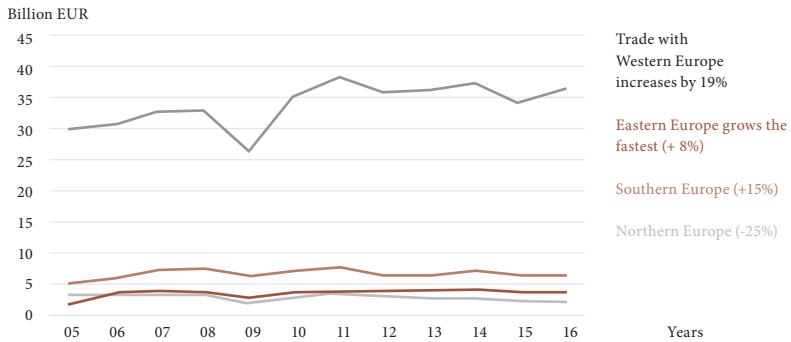
- a) According to the data of the Investment Review Board, Taiwanese businessmen invested in the Czech Republic a total amount of 157.08 million USD in 2016. One of the major Taiwanese investments in the EU was in the Czech Republic, where major investment industries were electronics, computers, optical products, and electrical equipment.
- b) Taiwan is Poland's seventh largest trading partner in Asia and has developed steadily. Products exported from Poland to Taiwan include electrical products, chemical products, and food; products imported from Taiwan include electrical products (LCD screens, semiconductors, and other electronic parts), metal products, and auto parts. Poland has a trade deficit with Taiwan. At present, there are 31 Chinese manufacturers investing in Poland. Poland occupies a strategic position in the center of Europe, its economy continues to grow steadily, and it is the largest manufacturer of home appliances in Europe. It also has a huge automobile and aviation industry, a solid industrial foundation, and complementary and synergistic effects with Taiwan's industry.
- c) Hungary is the Republic of China's 40<sup>th</sup> largest trading partner, 47<sup>th</sup> largest import partner, and 32<sup>nd</sup> largest export partner that has included wholesale and retail of information communication products, footwear, furniture, textiles, and food, as well as catering, and tourism. The value of exports to Hungary was 606,127 million USD, an annual increase of 4.672 percent. For example, ASUS Computer set up a branch in Hungary to sell network communication products; notebook computers and mobile phones in 2007.

Graph 1 and 2 show that trade between Taiwan and Western European countries accounted for 70.7 percent of exports and 7.2 percent of imports compared to East Europe's 11.4 percent of exports and 4 percent of imports. This is reflected in the investment figures, which indicate that Western Europe is an economic hub for Taiwanese investments. Eastern European countries take up a relatively smaller share of trade, however, this European zone has grown by 78 percent from 2005 to 2016 in terms of trade. According to statistical research, Taiwan considers



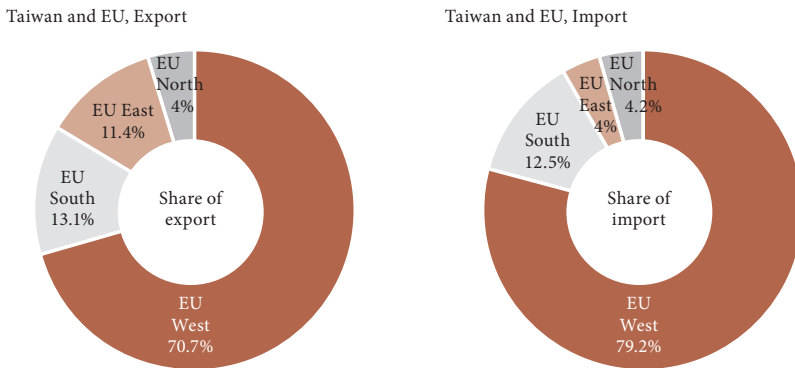
Western European countries important trade partners and the government has built up economic collaboration and investments in different fields of industries after 2016.

Graph 1: Evolution of trade between Taiwan and EU



Source: Taipei Representative Office in the EU and Belgium, 2016.

Graph 2: Distribution trade between Taiwan and EU



Source: Taipei Representative Office in the EU and Belgium, 2016.

From the perspective of political economy, the European Union is considered to be the world’s major market for investors who are concerned about the freedom of the market and the advantages of attracting foreign direct investments. In addition, Taiwan’s current investment in Europe is still dominated by manufacturing with nations of Western Europe. For example, among the European Union economies such as Germany, the Netherlands, and France, which have invested

in higher-developed countries, Taiwan also invests in service industries such as wholesale and retail, finance, and insurance in these countries.

Furthermore, the growth of Taiwanese investments in Europe has gradually shifted to new member states such as Hungary, Poland, the Czech Republic, and Slovakia, which are a new economic hub for EU. The scholar Szabo studied the V4's industry 4.0 policies noting that these nations have invested in new digital technologies like automation and robotization, 3D printing, machine learning or artificial intelligence (Szabo, 2020). In the V4-Taiwanese relationship, the V4 has not only insisted on building sustainability in the market economy, but also the Visegrád region has mainly focus on the automobile, manufacturing of Information and Communication Technology (ICT) and centers of customer service in the EU's industry 4.0 policy.

### 3.1. V4 from H2020 to Industry 4.0: Scientific and Sustainable Economy

In this part of the research, the author elaborates on successful examples of Visegrád 4's participation in the framework program H2020, which is the biggest EU Research and Innovation program ever with nearly 80 billion EUR of funding available over 7 years from 2014 until 2020. The results of the Czech Liaison Office for Research, Development and Innovation (CZELO) in cooperation with the National Research, Development and Innovation Office of Hungary (NRDIO), the Polish Science Contact Agency of the Polish Academy of Sciences (PolSCA), and the Slovak Liaison Office for Research and Development (SLORD) in the H2020 are as follows (CZELO, 2020):

1. The Czech Republic participated in the preparation of 5,689 complete eligible project proposals. Czech research institutions were direct recipients of funding in 817 funded projects with a claimed financial contribution of 286.2 million EUR, in which they cooperated with more than 12,000 foreign partners in the role of direct recipients of funds from the H2020 program budget. The success rate of coordinators from the Czech Republic (7.9 percent) is the third highest among the EU13 countries.
2. Poland has been traditionally strong in basic sciences such as mathematics, astronomy, chemistry, and physics but is also increasingly recognizing research and innovation as the engines for long-term growth. The network has become Europe's third largest research network which aims at promoting business and supporting the development of Polish companies. The main research fields are

automation, chemicals, biomedicine, ICT, materials, and advanced manufacturing.

3. Hungary has a longstanding tradition in scientific research. In the course of the H2020 program from 2014 to May 2019, 434 Hungarian research institutions were the direct recipients of funding in 916 funded projects with a claimed financial contribution of 299.8 million EUR, in which they cooperated with scientists from 96 foreign countries. In comparison to other Central and Eastern European countries, Hungary has a number of strong assets in its science system. For example, with 41 ERC grants, it is highly successful in Horizon 2020's European Research Council, which demonstrates that there are important pockets of scientific excellence in the country.
4. The strengths in Slovakia's Research and Innovation (R&I) system are found in human resources for research and innovation and in attracting business Research and Development (R&D) investments from abroad. In H2020 followed by the HES with 33.9 percent and the Slovak Academy of Sciences (SAS) with 15 percent. The most successful institutions in preparation of project proposals are those based in the Bratislava region (36 percent of the signed grants) and in Zilina (9.6 percent of the signed grants).
5. H2020 projects with V4 participation are: Social and innovative platform on cultural tourism and its potential towards deepening Europeanisation (Coordinator: Mendel University in Brno, Czech Republic); QuantERA ERA-NET Cofund in Quantum Technologies (Coordinator: National Science Centre, Poland); Cultural Opposition: Understanding the Cultural Heritage of Dissent in the Former Socialist Countries (Coordinator: Research Centre for the Humanities, Hungary); Investigation and development of a new generation of machines for the processing of composite and nanocomposites materials (Coordinator: Lublin University of Technology, Poland); Induced pluripotent stem cell seeded active osteochondral nanofibrous scaffolds (Coordinator: Institute of Experimental Medicine, Slovakia). Examples of projects carried out by V4 countries are: Electrochemical lectin and glycan biochips integrated with Nanostructures (Coordinator: Institute of Chemistry, Slovak Academy of Sciences); Bacterial evolution of hypersensitivity and resistance against antimicrobial peptides (Coordinator: Biological Research Centre, Hungary).

Horizon Europe will continue the Horizon 2020 plan and deepen industrial innovation and development. It is also the policy consensus reached by member states on innovation and excellence, and sustainable development in Europe. In the new framework of excellent and advanced science, the EU's implementation period of the 7-Year Plan is 2021-27, which is the second 7-year large-scale scientific and

innovative research project. The EU will focus on international cooperation with scientific innovation and R&D excellence, soliciting strong third-party countries with scientific research capabilities to become co-programmed and co-funded partner institutions or countries. Based on the EU research framework, the V4 could launch the bottom-up project that might develop the R&D excellence of technology and market economy between Taiwan and the V4.

Regarding EU-Taiwanese bilateral relations, Taiwan and Europe have tight relations because Taiwan was an important third country for the EU Horizon 2020. The EU should consider alternatives as scientific and innovative cooperation will reduce risk-dependency on the semiconductor industry and digital technology. Based on the Horizon Europe program, Taiwan will participate in long-term vibrant cooperation with the V4's universities, scientific communities, and industry, including small and medium enterprises and citizens wishing to reinforce the EU's efforts in global leadership.

In the light of the economic recovery following the Covid-19 pandemic, the V4 has developed strategies described below in EU's industry 4.0 (European Union, 2020):

- i. There is a large scope to increase domestic research and innovation. The V4 countries are at most moderate innovators according to the 2019 European Innovation Scoreboard. Apart from the Czech Republic, which ranks in the middle, the other three countries are at the bottom of the rankings. Public funding for research and innovation in ICT is very low.
- ii. Venture capital investment in new technologies is extremely low. It varies from 0.002 percent of the GDP in Slovakia to 0.008 percent in Hungary.
- iii. Until the private sector is mobilized, EU funding can help the V4 countries foster further digital innovation. There are various funding opportunities for extending the digital infrastructure and the digitization of the public sector.
- iv. The V4 Governments are rolling out Industry 4.0 related strategies and action plans. All V4 governments adhered to the European Artificial Intelligence (AI) Strategy launched in 2018 and the High-Level Expert Group on AI and joined the new European AI Alliance. The Polish government also prepared its AI strategy, focusing on issues such as AI R&D, digital public services, and infrastructure. Hungary created a new AI Coalition composed of more than 70 Hungarian and international firms.

In the studies of H2020 and Industry 4.0, different scientific and industrial estimations of public policies have been provided, but a majority suggest that the V4 countries will be particularly affected by the technological digitalization, transformation of manufacturing and openness of the market economy to face the change and reap the benefits. In the EU funding program, the V4 countries will be required to make an effort to adjust their R&D and economic benefits to assess in more detail the magnitude of the changes in the cooperation of the public sector with academia and the private sector.

#### 4. Taiwan Industrial Policies: The V4's Opportunity for Competitiveness and Sustainability

In the World Competitiveness Yearbook (WCY) of the Institute for Management and Development, Taiwan ranks the eighth most competitive economy among 64 economies and highlights business and government efficiency as part of its long-term value creation. Based on the World Economic Outlook 2020, Taiwan emerged as the 18<sup>th</sup> world exporter in 2019 and its trade balance was in surplus, with 1,342 billion USD in 2019 (EU, 2021). Taiwan's good performance in free trade is because it constructed a healthy environment for competitiveness and efficiency in Asia.

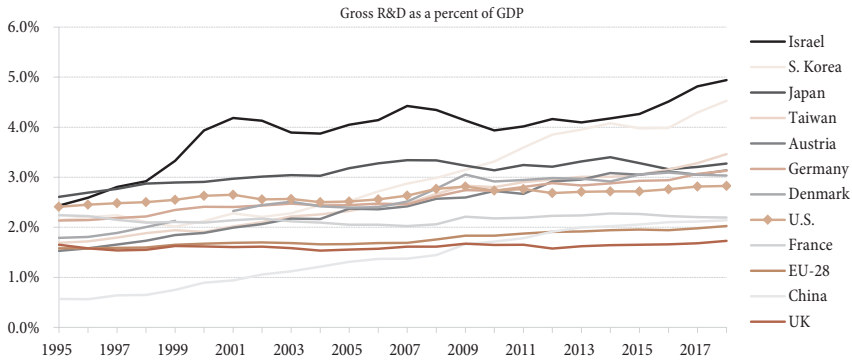
The 27 EU countries continue to invest in Taiwan and become Taiwan's major foreign investors, strengthening free trade and industrial investment. The EU Parliament and Council announced that "whereas the EU and Taiwan are like-minded partners that share common values of freedom, democracy, human rights and the rule of law." (EU Parliament, 2021). The EU continues to have multilateral dialogues and perspectives of exchanges with Taiwan such as human rights justice, gender equality, climate change, and renewable energy. The EU and Taiwan will conduct long-term policy exchanges and dialogues on multilateral issues in the industry, government, and academia in the era of globalization.

In the 21<sup>st</sup> century, Taiwan also launched a "five plus two"<sup>3</sup> national policy that targeted advanced manufacturing of semiconductors, green energy, and smart production of Information Communication Technology (ICT). According to the

<sup>3</sup> Taiwan Executive Yuan's national policy addresses a plan that covers seven industries and projects: intelligent machinery, Asia Silicon Valley, green energy, biomedicine, national defense and aerospace, new agriculture, and the circular economy in Taiwan.

competitiveness Index 4.0 of World Economic Forum (WEF) 2019, Taiwan ranked twelfth out of 141 economies and was identified as having good economic performance and benefits with its comprehensive growth (World Economic Forum, 2019).

Graph 3: Gross R&D as a Percentage of GDP



Source: American Association for the Advance Science, 2020.

In Graph 3, Taiwan shows an innovation capability of about 3.0 percent R&D investment, which is emerging as the fourth most competitive in the world, following Germany, the US, and Switzerland. The indicator gauges the quantity and quality of formal research and development as well as the capacity to turn ideas into innovative and sustainable ecosystems (Huang, 2019).

Seeking to advance the transformation of Taiwan's industry and add new momentum to economic growth, the Executive Yuan, in line with President Tsai Ing-wen's core principles of innovation, employment, and equitable distribution that has included the "five plus two" innovative and sustainable industries plan, which will serve as the central driver of Taiwan's industrial growth in the next era (Taiwan Today, 2022). The government will forge a new model for sustainable development. The plan covers seven industries and projects: intelligent machinery, Asia Silicon Valley, green energy, biomedicine, national defense and aerospace, new agriculture, and the circular economy (Taiwan Executive Yuan, 2020). The innovative planification of national policy in these areas and policies, which will balance development in all counties in Taiwan are the following (Taiwan Executive Yuan, 2020 and 2021 & National Development Council, 2021):

- i. Industry: Increase competitive advantages in wafer production. Efforts include—toward the 2030 goal of 1-nanometer process capability—continuing to strengthen links and interconnections among Taiwan’s Silicon Valley science parks located in Hsinchu, and central and southern Taiwan, and ensuring that this semiconductor industry cluster remains a technology leader.
- ii. National: Bring industry and academia together to establish semiconductor research and development centers and set up research institutes within universities for national priority fields. Increase graduate and undergraduate enrollment in national priority fields (e.g., semiconductors, artificial intelligence, machinery, and materials). Recruit overseas talent through international exchanges facilitated by semiconductor industry and academic associations. These efforts are anticipated to yield 10,000 additional semiconductor professionals per year and will ensure a sufficient supply of quality talent for the semiconductor industry.
- iii. International: Ensure access to strategic resources and key technologies to eliminate supply chain concerns. For equipment, this includes stockpiling in advance niche equipment for 12-inch wafer production and moving toward the development of third-generation compound semiconductors. For materials, the primary focus is self-sufficiency in key chemicals and building a strategic local supply chain.
- iv. Taiwan Asian Silicon Valley: to promote innovation and R&D for devices and applications of the internet of things (IoT); to upgrade Taiwan’s startup and entrepreneurship ecosystem; to establish three global system integrators in Taiwan; to attract investments from two world-class international corporations; and to create an online learning platform for IoT related sectors.
- v. Green Energy Innovation: have a two-year solar energy program, which aims to strengthen the local solar energy industry and its supply chain; a four-year program to promote wind power, which builds up the offshore wind turbine industry and its supply chain; an advanced metering infrastructure (AMI) demonstration project, the installation of 3 million advanced meters by 2024 will drive growth in AMI-related industries and construction of the Shalun Smart Green Energy Science City that Tainan City will host a new industrial innovation cluster bringing together industry, academia and researchers as part of what will become a national hub for the research, development and demonstration of green energy technologies.

With knowledge of the economy and industry 4.0 as important factors in the economic prosperity of nations, Taiwan proposes national policies for an innovative economy, a national green energy policy and six core strategic industries that

create a new model economy and upgrade its manufacturing. Taiwan is proposing that its semiconductor and green energy policies collaborate with the EU's sustainable programs, mapping similar interests and deepening bilateral relations.

#### 4.1. Taiwan-V4-EU Relations: The Taiwan Semiconductor Manufacturing Company (TSMC) Matters

Taiwan is a country where the economy traditionally depends on manufacturing production, Information Communication Technology (ICT) and the trade of Small and Medium sized Enterprises in the world economy. Taiwan's historical development allowed the government to obtain economic benefits and free trade, it had a technology sector of 100 million USD in 1980 and reached 21 billion USD in 1999 (Dempsey, 2020). The Taiwan Semiconductor Manufacturing Company (TSMC) is the leader in global chip foundry manufacturing and services and was founded in 1987 in Taiwan's Hsinchu Science Park where TSMC has manufactured chips for global customers in a wide range of equipment and devices, including computers, communication products, consumer and industrial applications (TSMC, 2021).

According to Rayane Haddou's studies, Taiwan has increased rapidly in the growth of semiconductors, equipment production and in the penetration of multinational companies around the world (Haddou, 2021):

1. TSMC: the world leader for semiconductor foundry, represents 52 percent of the world production
2. ASE: the world leader for semiconductor back-end activities
3. MediaTek: it is in the world's Top 5 companies for semiconductor design, especially in 5G networks
4. Foxconn: the first Apple subcontractor. Its 2019 turnover reached about 200 billion USD.

For example, TSMC estimated that it would adhere to its revenue growth forecast of 14-19 percent sales growth and MediaTek said its outlook was positive to foresee a 2-10 percent increase in sales in 2021 (Dempsey, 2020). These multinational companies are all in leading positions that supported Taiwan's global trade and global supply chains.

Taiwan was the largest producer of personal computers with traditional and original equipment manufacturing (OEM) production structure, but the government



also spent great volume of investment on semiconductor production with a non-traditional model of manufacturing. Based on the global supply chain, TSMC with its model has become the biggest semiconductor manufacturer producing 10,761 different products using 272 distinct technologies for 499 different customers worldwide (TSMC, 2021).

TSMC, with advanced process technology, has already moved into the advanced semiconductor manufacturing market. TSMC has also entered into the research and development of advanced packaging technology. Taiwanese chip companies represented by TSMC have become the strategic focus of the global industry. According to data from the beginning of 2021, TSMC has a market value of 550.9 billion USD, making it one of the top ten companies in the world, surpassing Intel and Samsung in South Korea to become the world's most valuable semiconductor company (Archyw, 2021).

In addition to TSMC, there are four advanced packaging and testing plants in Taiwan, which mainly provide services such as wafer bumping, advanced testing, and back-end 3D packaging. Based on the advanced technology of the semiconductor industry, it is the current trend in the industry to build a one-stop ecosystem for foundries. Based on the model of the one-stop semiconductor foundry, design for manufacturing (DFM), and customer service, it is equivalent to building a huge ecosystem for manufacturing and testing production capacity in line with the industry and is a win-win strategy (Liberty Time, 2021).

#### 4.1.1. TSMC Sustainability and the UN's SDGs

With the vision of sustainable development in business, TSMC has executed the policies: Understanding SDGs and Priorities, Setting Projects and Integrating and Disclosure and Communication that has a connection with the UN's Sustainable Development Goals (SDGs) (TSMC, 2018). TSMC has also addressed social responsibilities with an environmental and educational link to SDGs with its 2025 long-term business strategy. TSMC 2025 Corporate Social Responsibilities and the UN SDGs are the following (TSMC, 2018; 2021):

1. TSMC Integrity management – UN SDG, Peace, Justice and Strong Institution
2. TSMC Innovative service – UN SDG, Quality Education
3. TSMC Responsible supply chain – UN SDG, Affordable Clean Energy
4. TSMC Green manufacturing – UN SDG, Responsible Consumption and Production

5. TSMC Inclusive workplace – UN SDG, Decent Work and Economic Growth
6. TSMC Good society – UN SDG, No Poverty and Climate Action

TSMC has tried to use key advantages to bring changes and innovations to the industry and society. The company practices corporate social responsibility, including the Cultural Education Foundation and the Charity Foundation, its committee convenes on technology development, business development and supply chain management. In fact, TSMC is also aiming for a green strategy that protects the environment and is adopting the goal of being carbon neutral with its customers in Taiwan.

#### 4.2. The Hsinchu Science Park and Sustainability

The Hsinchu Science Park (HSP) was established by The Ministry of Science and Technology in 1980, it was mainly a science park that focused on the development of integrated circuits, computers and peripheral equipment, communications, optoelectronics, precision machinery, and biotechnology. In the 1990s, the purpose of the Hsinchu Science Park was to establish a high-quality humanized environment for Taiwan's R&D, production, work, life, and leisure, to attract high-tech talents, introduce high-tech technology, establish a high-tech industry development base, and promote Taiwan's industrial policy. For example, the output value of the wafer foundry as the world's largest; the output value of the IC design industry, thin film transistor liquid crystal display (TFT LCD), silicon solar cells and other products; and continue to develop core technologies such as the Internet of Things (IoT), artificial intelligence (AI), high-performance computing (HPC), digital convergence, cloud, massive data and B4G wireless broadband (Hsinchu Science Park, 2021). It is the first science park that the government has invested large amounts of funds in. In the short run, the park and Taiwan have also enjoyed an economic miracle with HSP's contribution to computer manufacturing industries and high-tech technology, including semiconductors. Based on the construction of the science park, Taiwan's semiconductor and optoelectronic industries, models of successful operation, occupy an important position in the world and has had firm impacts on development of Taiwan's technology industry.

In the first decades of the 20<sup>th</sup> century, the Ministry of Science and Technology finished two major science parks, the central science park, and the southern science park, where it successfully established Taiwan's high-tech industry's outstanding global reputation. In the development of high-tech industry and trends

of global supply chains, that incorporated innovation and sustainable economy, Taiwan has the clustering effects of science parks in Taiwan (Hinchu Science Park, 2020):

1. The Jhunan Science Park, located in Dingpu Village, opened in 2014;
2. The Tongluo Science Park, located in Gio-Hu Village, opened in 2022;
3. The Hsinchu Biomedical Science Park (HBSP), “HSR Hsinchu Station Special District Project”, in Jhubei City, established in 2019;
4. Yilan Science Park, opened on May 16, 2005;
5. The Longtan Science Park, located at the juncture of three townships in Taoyuan County, opened in 2004.

The science park is an important indicator of the development of science and technology, and a demonstration of the effects of industrial structure and the maintenance of economic prosperity. In this innovative and sustainable model, it has given Taiwan a place in the international high-tech industry; its north, middle and south high-tech industry innovation corridor formed by the parks is conducive to accelerating Taiwan’s development as a global innovation and R&D center.

## 5. Conclusion

As all the above points have demonstrated, the author highlights the V4’s FDI strategy with Taiwan where the government would implement scientific and industrial strategies to adopt demand of EU economic framework and market. Overall, V4’s economic status has impacted on Covid-19 that their industries of ICT and automotive relied on cooperation of semiconductor and digital production in Asian countries. Furthermore, V4 has stable economic growth with good condition labor employment and presents significant candidates of EU scientific program sustainable semiconductor production in different economic and academic projects. Notably, Taiwan-V4 platform has reflected impacts and benefits from the Horizon Europe program in order to create a sustainable model of economy at EU level. In fact, V4 could implement EU funding of H2020 and Horizon Europe that launch the projects of digitalization and advance industries, 5G, semiconductor and supply chains of smart auto, with Taiwan’s government and multinational companies. The V4 would focus on ecosystem of semiconductor industry or digitalization of ICT in order to construct a new economic model with Taiwan’s customers, manufacturers, and suppliers.

To sum up, in the analysis of this research, the Visegrád countries' digitalization industries have transformed themselves into relevance of foreign direct investments as a source of economic growth that has considered high-technology cooperation between V4 countries and Taiwan under the EU's implementation. With regard to the Taiwan-V4 economic model, we believe that it is also impetus of the Taiwan-EU BIA, however, the EU already has concluded the EU-Korea FTA in 2015, and EU-Japan FTA in 2019. The Taiwanese government would launch the new round of negotiation of the Taiwan-V4 free trade agreement or economic framework with advanced technology that has developed stable growth with regard to the Taiwan and EU relations. The EU-Taiwan BIA is a new economic orientation that provides institutional opportunities of business and benefits between the EU and East Asia. The Taiwan-V4 economic alliance will steer the EU's future competitiveness of its emerging industries of digitalization and sustainable economy for the EU 2030 long-term strategies.

## References

Abugattas Majluf, L. (2004): *Swimming in the Spaghetti Bowl: Challenges for Developing Countries under the “New regionalism”*. UNCTAD Policy Issues in International Trade and Commodities Study Series, 27, New York and Geneva: United Nations.

Archworldys (2021): TSMC. Taiwan’s “Scared Mountain of Protecting the Country”. Growth-BBC News. June 15, 2021. [online] available: from <https://www.archworldys.com/tsmc-taiwans-sacred-mountain-of-protecting-the-country-growth-bbc-news/>

Axline, W. A. (1994): *The Political Economy of Regional Cooperation: Comparative Case*. London: Pinter Publishers.

Bhagwati, J. – Panagariya, A. (1999): *Preferential Trading Areas and Multilateralism-Strangers, Friends, or Foes?* In: Bhagwati, J. – Krishna, P. – Panagariya, A. *Alternative Approaches to Analyzing Preferential Trade Agreements*. Cambridge, MA: The MIT Press, pp. 33-100.

Baylis, J. – Smith, S. – Owen, P. (2020): *The Globalization of World Politics: An Introduction to International Relations*. UK: Oxford University Press.

Barbé, E. (2008): *International Relations*. Madrid: Tecnos.

CIA (2021): *The World Factbook*. October 15, 2021. [online] available: from <https://www.cia.gov/the-world-factbook/>

Chang, T.L. – Cheng, J.C. (2022): *Slovakia’s Political and Economic Transitions and Its Impact on Taiwan Trade to Eastern*. August 3, 2022. [online] available: <https://ah.nccu.edu.tw/bitstream/140.119/43669/1/35.pdf>

Crawford, J.A. – Florentino, R.V. (2005): *The Changing Landscape of Regional Trade Agreements*, WTO Discussion Paper No 8.

CZELO (2022): *Good Practice Examples of H2020 Projects in Visegrad countries*. March 17, 2022. [online] available: <https://www.tc.cz/en/publications/publications/publications-list/good-practice-examples-of-h2020-projects-in-visegrad-countries>

Davis, L.S. – Patman, R.G. (Eds.) (2015): *Science Diplomacy: New Day or False Dawn?* Singapore: World Scientific Publishing Co.

Dempsey, P. (2020): Taiwan's bumpy road to globalization. E&T. May 20, 2020. [online] available: <https://eandt.theiet.org/content/articles/2020/05/taiwan-s-bumpy-road-to-globalisation/>

De Sebastian, L. (1995): Trading Blocs and the Stranded Countries. In: Ahiram, E. – Tovias, A. (Eds.) *Whither Israel and the European Union?* Frankfurt: Peter Lang, pp. 147-164.

European Commission (2020): Trade for All: Towards a More Responsible Trade and Investment Policy. [online] available: [https://trade.ec.europa.eu/doclib/docs/2015/october/tradoc\\_153846.pdf](https://trade.ec.europa.eu/doclib/docs/2015/october/tradoc_153846.pdf)

Executive Yuan (2018): Green energy innovation. August 13, 2018. [online] available: <https://english.ey.gov.tw/News3/9E5540D592A5FECD/16bd3a41-9c6a-485c-9498-b6b2b8240f6e>

Executive Yuan (2018): Asia Silicon Valley Development Plan. April 20, 2018. [online] available: <https://english.ey.gov.tw/News3/9E5540D592A5FECD/db883555-fbbd-4e8e-907f-5bb02c462344>

Executive Yuan (2021): Advancing forward-looking Semiconductor talent and R&D. May 21, 2021. [online] available: <https://english.ey.gov.tw/News3/9E5540D592A5FECD/bf3b400e-e014-4e10-af21-48d987ed8b07>

Gubik S. A. – Sass, M. – Szunomár, Á. (2020): Asian Foreign Direct Investments in the Visegrád Countries: What Are Their Motivations for Coming Indirectly? *Danube* 11(3), pp. 239-252. [online] available: <https://sciendo.com/article/10.2478/danb-2020-0014>

Haddou, R. A. (2021): China and Taiwan: between confrontation and cooperation. [online] available: [https://www.eu-logos.org/2021/01/25/taiwan-and-china-between-conflict-and-cooperation/#\\_ftn27E&T](https://www.eu-logos.org/2021/01/25/taiwan-and-china-between-conflict-and-cooperation/#_ftn27E&T), <https://eandt.theiet.org/content/articles/2020/05/taiwan-s-bumpy-road-to-globalisation/>

Harrison, G. – Rutherford, T. – Tarr, D. (2002): Trade Policy Options for Chile: The Importance of Market Access. *The World Bank Economic Review*, 16(1), pp. 49-79.

Helena Bauerová (2018): V4 and European Integration. *Politics in Central Europe*, 14(2). [online] available: <https://sciendo.com/pdf/10.2478/pce-2018-0012>

Hettne, B. – Söderbaum, F. (2000): Theorising the Rise of Regionness. *New Political Economy*, 5(3), pp. 457-472.

Hsinchu Science Park (2021): About HSP. [online] available: <https://www.sipa.gov.tw/index.jsp>

Huang, T.T. (2019): Taiwan 4th most innovative country: Global Competitiveness Report 2019. October 9, 2019. [online] available: <https://www.taiwannews.com.tw/en/news/3792814>

Kantchev G. – Woo, S. (2022): Taiwan Gains Favor in Europe's East Angering China, the Wall Street Journal, October 26, 2021. [online] available: <https://www.wsj.com/articles/taiwan-gains-favor-in-europes-east-angering-china-11635248811>

Karásková, I. (2020): How China Lost Central and Eastern Europe. *China Observers in Central and Eastern Europe (CHOICE)*. April 20, 2020. [online] available: <https://chinaobservers.eu/how-china-lost-central-and-eastern-europe/>

Krugman, P. (1990): Is Bilateralism Bad? In: Helpman, E. – Razin, A. (Eds.) *International Trade and Policy*. Cambridge, MA: MIT Press. pp. 9-23.

Liberty Times Net (2022): Semiconductor, One-stop Service. [online] available: <https://ec.ltn.com.tw/article/paper/1400045>.

Ministry of Economic Affairs (2022): Taiwan and EU upgrade the level of Trade and Investment Dialogue. June 3, 2022. [online] available: <https://www.trade.gov.tw/english/Pages/detail.aspx?nodeID=86&pid=745166>

OECD (2022): International Trade During the COVID-19 Pandemic: Big Shifts and Uncertainty. March 10, 2022. [online] available: [https://read.oecd-ilibrary.org/view/?ref=1129\\_1129345-casormobh7&title=International-trade-during-the-COVID-19-pandemic](https://read.oecd-ilibrary.org/view/?ref=1129_1129345-casormobh7&title=International-trade-during-the-COVID-19-pandemic)

Pen, K. Z. (2014): Analysis of Taiwan-Central European countries. January 7, 2014. [online] available: <https://readers.ctee.com.tw/cm/20140107/a06aa6/488031/share>

Pereira, J. F. G. (2014): Hierarchical regional orders: an analytical framework. *Journal of Policy Modeling*, 36(S1), pp. 26-46. [online] available: <https://ideas.repec.org/a/eee/jpolmo/v36y2014is1ps26-s46.html>

Péridy, N. (2004): The New Trans-Ocean Free Trade Initiatives: Estimating Export and FDI Potentials from Dynamic Panel Data Models. *Economics Bulletin*, 6(9), pp. 1-12.

Pizarro, R. (1999): *Comparative Analysis of Regionalism in Latin America and Asia-Pacific*, Comercio Internacional Serie 6. Chile: United Nations Publication.

Riggiozzi, P. – Tussie, D. (2012): *The Rise of Post-Hegemonic Regionalism: The Case of Latin America*. London: Springer Press.

Smith, K. E. (2008): *European Union Foreign Policy in a Changing World*. Cambridge: Polity Press.

Solis M. –Katada (2007): Introduction: Understanding East Asian Cross-Regionalism: An Analytical Framework, *East Asian Cross-Regionalism*, 80(2), pp. 229-257.

The World Bank (2010): *Global Economic Prospect 2010*. Washington DC: World Bank.

Richter, S. (2012): *Changes in the Structure of Intra-Visegrad Trade after the Visegrad Countries' Accession to the European Union*. The Vienna Institute for International Economic Studies. Statistical Report 5. September 2012. [online] available: <https://wiiw.ac.at/changes-in-the-structure-of-intra-visegrad-trade-after-the-visegrad-countries-accession-to-the-european-union-dlp-2644.pdf>

Szabo, S. (2020): *Transition to Industry 4.0 in Visegrád Countries*. European Commission, Economic Brief 052, June 2020. [online] available: [https://ec.europa.eu/info/sites/default/files/economy-finance/eb052\\_en.pdf](https://ec.europa.eu/info/sites/default/files/economy-finance/eb052_en.pdf)

Taipei Representative Office in the EU and Belgium (2016): *Trade and Investment between Taiwan and the EU*. [online] available: <https://www.roc-taiwan.org/uploads/sites/125/2015/09/201705-Relations-between-Taiwan-and-the-EU.pdf>

Taiwan Today (2021): *Tsai Reaffirms Commitment to Environmental Sustainability*. April 23, 2021. [online] available: <https://taiwantoday.tw/news.php?unit=2,6,10,15,18&post=198703>

Taiwan Executive Yuan (n.d.): *5+2 Innovative Industries Plan*. [online] available: <https://english.ey.gov.tw/iip/B0C195AE54832FAD>



Tovias, A. (2008): The Brave New World of Cross-Regionalism, CEPII. April 2008. [online] available: [http://www.cepii.fr/pdf\\_pub/wp/2008/wp2008-03.pdf](http://www.cepii.fr/pdf_pub/wp/2008/wp2008-03.pdf)

TSMC (2018): Sustainable Governance. [online] available: [https://esg.tsmc.com/download/csr/2018\\_tsmc\\_csr\\_report\\_published\\_May\\_2019/chinese/pdf/c\\_2\\_sustainableGovernance.pdf](https://esg.tsmc.com/download/csr/2018_tsmc_csr_report_published_May_2019/chinese/pdf/c_2_sustainableGovernance.pdf)

TSMC (n.d.): Sustainable Impact. [online] available: <https://esg.tsmc.com/en/ESG/valueCreation.html>

TSMC (n.d.): Dedicated IC Foundry. [online] available: <https://www.tsmc.com/english/dedicatedFoundry>

TSMC (n.d.): About TSMC. [online] available: <https://www.tsmc.com/english/aboutTSMC>

Van Langenhove, L. (2016): Global Science Diplomacy as a New Tool for Global Governance. Barcelona: FOCIR.

Van Langenhove, L. – Söderbaum F. (2006): The EU as a Global Player: The Politics of Interregionalism. London: Routledge.