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As one of the most prosperous economies in the world, characterised by its high export-orientation and ability to attract foreign investment, Switzerland is expected to gradually accelerate its economic growth to 2022. The positive outlook will be supported by a recovery in trade volumes, a weakening of the Swiss Franc, and backed by global economic headwinds.

Robust international demand and a continued rise in domestic consumption will enable the Swiss manufacturing sector to continue its growth trajectory over the next 4 years. Riding on international recognition of the ‘made in Switzerland’ brand name, the Swiss manufacturing sector possesses a strong competitive edge with advanced manufacturing capabilities, specialising in high quality and high value-added goods. This differentiated approach has allowed it to establish a niche globally and maintain a strong contribution to Swiss Gross Value Added (GVA) and employment.

Going forward, technological changes and globalisation will play an increasingly important role in shaping the course of the manufacturing sector. To succeed and retain its strength in global manufacturing, Switzerland must recognise its unique capabilities and position itself well. In one aspect, Switzerland is well placed for providing a conducive environment that fosters experimentation and innovation by manufacturing companies. The Swiss government has put in place some relevant tools and necessary schemes to support innovation, digitisation and internationalisation efforts in its manufacturing sector.

Moving forward, the impact of these efforts could be strengthened by focusing on building capabilities in key aspects such as, positioning Switzerland as an Industry 4.0 pilot location and centre of excellence, as well as driving the internationalisation of its Small and Medium-sized Enterprises (SMEs) by encouraging strategic partnerships and leveraging of global platforms. In this report, we outline two themes that have the potential to further strengthen the Swiss manufacturing sectors:

A. Prepare Switzerland to be a global leader in Industry 4.0: Switzerland must adopt a unified framework for Industry 4.0 that capitalises on the unique value proposition of the country as a manufacturing destination

B. Support internationalisation efforts for Swiss SMEs: Swiss SMEs must be prepared to internationalise by engaging in strategic partnerships, leveraging global platforms, and targeting new growth markets

For the Swiss manufacturing sector to successfully navigate these changes, companies will need to be more agile in their approach to doing business and seek opportunities for collaboration, such as with technology companies, which will allow them to utilise forefront technologies in adopting new business models and improving their operations. The Swiss government will need to continue to enhance its support to the manufacturing sector to capitalise on its strengths such as in the availability and quality of human capital, physical and digital infrastructure through to ensuring a favourable regulatory environment.

“Switzerland continues to be a global leader in manufacturing and innovation, and one of the few countries that has maintained the role of manufacturing in the economy as well as in exports. With the Swiss emphasis on providing its citizens with strong foundations in education, technology, health, and global exposure, this is not a surprise. Switzerland has managed to combine manufacturing, sustainability, and innovation to create competitive advantage for both its SMEs and larger industrial and pharmaceutical companies. These, coupled with the Swiss emphasis on internationalization, are key drivers for Switzerland’s innovative and export-oriented manufacturing sector.”

Dr. Anil Khurana
PwC Partner, US & ME, and Advisor, GMIS Organizing Committee

“As the fourth industrial revolution evolves, a number of countries are emerging as pioneers, setting the course for a future of global prosperity. Switzerland is built on the foundations of a solid economy, forward-thinking government schemes and world-leading talent. It is therefore uniquely placed to become a leading example of manufacturing innovation and sustainable development for others to follow.”

Badr Al-Olama
Head of GMIS Organising Committee
A macroeconomic snapshot

Switzerland is one of the most affluent countries in Europe with a Gross Domestic Product (GDP) per capita of US$80,189 in 2017\(^1\) and a population of just over 8 million people. It is an export-oriented economy which has experienced real growth through its recovery from the global financial crisis, to a GDP of CHF 676 billion (US$680 billion) in 2017, with a real growth rate of 1.1% in 2017\(^2\). Real GDP growth is expected to further strengthen over the next 5 years to 1.7% in 2022\(^3\).

Switzerland’s growth has been underpinned by its strong technology and product innovation in high value-added sectors, supported by the country’s strong positioning as a financial centre, and robust consumer spending. Switzerland consistently tops rankings for global competitiveness due to strong fundamentals in its education and public health systems. However, despite these robust growth drivers, some significant medium and long-term risks to the economy remain in the form of escalation of trade conflicts globally and an ageing population.

Real GDP growth, 2010-22 (%)

<table>
<thead>
<tr>
<th>Country</th>
<th>2010</th>
<th>2017</th>
<th>2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switzerland</td>
<td>2.9</td>
<td>1.1</td>
<td>1.7</td>
</tr>
<tr>
<td>Sweden</td>
<td>6.0</td>
<td>2.4</td>
<td>1.9</td>
</tr>
<tr>
<td>France</td>
<td>2.0</td>
<td>1.8</td>
<td>1.6</td>
</tr>
<tr>
<td>Germany</td>
<td>3.9</td>
<td>2.5</td>
<td>1.3</td>
</tr>
</tbody>
</table>

Source: IMF, World Economic Outlook Database, April 2018

Economic growth supported by global headwinds

- Switzerland’s export orientation - with total trade accounting for nearly 119% of GDP in 2017\(^4\) - has allowed it to benefit from the strong global economy where growth has neared 2% in 2018
- Unemployment rate\(^*\) was 4.9% in 2016 and is forecasted to reach 4.8% in 2018\(^5\) due to changes in federal regulations that gave priority to Swiss workers and measures to deepen the integration of the EU workers into the national job market\(^6\)
- As a result of strong economic growth and low unemployment, Swiss household spending grew to US$ 366 billion in 2017, at a Compound Annual Growth Rate (CAGR) of 2.6% between 2010 to 2017

\(^*\)Note: The definition of unemployed according to the International Labour Organisation refers to the number of people not employed but who were looking for work and available to work in the reference period
Key exports from Switzerland, 2010-16 (%)

<table>
<thead>
<tr>
<th>Year</th>
<th>US$ (Billion)</th>
<th>Export Breakdown</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>223</td>
<td>15% Machines, 14% Precious Metals, 17% Chemical Products, 21% Metals, 29% Others</td>
</tr>
<tr>
<td>2016</td>
<td>280</td>
<td>30% Machines, 12% Precious Metals, 13% Chemical Products, 13% Metals, 29% Others</td>
</tr>
</tbody>
</table>

Note: Others include plastics & rubbers, foodstuffs, transportation, paper goods etc.
Source: OEC (the Observatory of Economic Complexity)

Top 5 Export Partners (2016)

1. Germany (14%)
2. USA (12%)
3. UK (11%)
4. China (9%)
5. Hong Kong (6%)
Source: UN Comtrade

Export growth driven by technological strengths and strong international reputation

- Exports of goods has been a substantial contributor to the Swiss economy representing 46.2% of GDP in 2017.
- "Made in Switzerland" has developed a brand name synonymous with premium quality, cutting-edge technology and high quality craftsmanship - Swiss exports are resultantly highly desirable in the luxury goods segment and in the R&D intensive high-technology segment.
- Strong global exports are enabled by a significant network of 36 trade agreements, although the high cost of doing business in Switzerland has been a challenge for exporting companies.
- Switzerland has faced significant challenges in managing its exchange rates. Global economic uncertainty has triggered financial inflows to Switzerland, causing currency appreciation and eroding competitiveness of domestic companies.
Foreign Direct Investment (FDI) inflow into Switzerland, 2010-17 (US$ billion)

Source: OECD

Top 5 FDI Investors (2016)
1. Netherlands (33.4%)
2. Luxembourg (20%)
3. USA (12.9%)
4. Offshore Centres (7.2%)
5. UK (5.3%)

Source: Santander Trade

Top Sectors by FDI Stock (2016)
1. Finance & Holding (56.9%)
2. Trade (16.6%)
3. Chemicals & Plastics (6.9%)
4. Services (5.9%)
5. Electronics, Watches, Energy & Optics (4.3%)

Attractive investment destination with strong financial and manufacturing sectors
- Switzerland ranked 8th globally on FDI inflows in 2016, and in 2017, its FDI inflow exceeded Germany’s to reach US$ 41 billion and US$ 35 billion respectively.
- The financial sector is the primary recipient of FDI inflows recording a share of 56.9% of total FDI inflows, followed by the trade sector at 16.6%. The other financial hubs in Europe such as the Netherlands and Luxembourg lead as sources of FDI flows to Switzerland.
- For the high-technology sector, world class R&D infrastructure, high skilled labor force and strategic location in Europe create the supporting conditions required to attract investment.
- As a result, many Fortune 500 companies such as Nestlé, Novartis and ABB are headquartered in Switzerland.
The evolution of Swiss manufacturing

Switzerland has been successful at retaining and transitioning its manufacturing sector despite increasing global competition. The manufacturing sector represented a substantial 18.6% of the country’s GVA in 2017\textsuperscript{10}, and is expected to remain a key contributor to Swiss GVA going forward. Overall, Manufacturing Value Added (MVA) for Switzerland in 2017 stood at US$ 121.9 billion and grew at a CAGR of 1.51\%\textsuperscript{11} from 2010 to 2017. The country also ranked 6\textsuperscript{th} globally\textsuperscript{12} in the 2017 Competitive Industrial Performance Index as a result of its high MVA per capita, high levels of industrialization and a high share of medium and high-tech activities.

Switzerland has been able to maintain its industrialisation levels as a result of the resilience and innovativeness of its SMEs. However, there is also a considerable presence of global industrial giants such as ABB, specialising in robotics, automation and power, and Burckhardt Compression, a specialist in the manufacture of reciprocating compressors.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure1.png}
\caption{Swiss manufacturing is expected to continue its growth trajectory MVA, 2010-22 (US$ billion)}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure2.png}
\caption{Manufacturing remains a central contributor to Swiss GVA in 2017 Contribution of Manufacturing to GVA (\%)}
\end{figure}

\textit{Note: Others refer to Industry, Construction, Finance etc.}
\textit{Source: OECD Data}
Switzerland’s manufacturing sector employed 575,500 people and constituted 11% of jobs in Switzerland in 2017\textsuperscript{13} with one of the highest average manufacturing wage levels in the world, at US$82,510 in year 2014\textsuperscript{14}, driven by the large share of highly-skilled technical jobs in manufacturing.

**Figure 3: Switzerland’s employment in the manufacturing sector dropped slightly in 2017**

Contribution of Manufacturing to Labour Force (%)

<table>
<thead>
<tr>
<th>Year</th>
<th>Manufacturing</th>
<th>Services</th>
<th>Agriculture</th>
<th>Industry (including construction)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>12.2</td>
<td>66.1</td>
<td>2.9</td>
<td>18.7</td>
</tr>
<tr>
<td>2017</td>
<td>11.0</td>
<td>68.4</td>
<td>2.7</td>
<td>17.8</td>
</tr>
</tbody>
</table>

Source: OECD Data
Pharmaceuticals

Figure 4: Switzerland’s Pharmaceuticals Products Exports, 2010-17
(US$ billion)

Switzerland’s pharmaceutical industry is one of its flagship export-driven industries. The sector accounted for 23.5% of total exports in 2017 with a total export value of $70.3 billion\(^{15}\) that has grown at 6.5% CAGR from 2010 to 2017. Leading export markets were primarily developed countries – the United States (US$ 17.4 bn), Germany (US$ 7.9 bn) and United Kingdom (US$ 4.6 bn) were top three export markets in 2017\(^{16}\). On top of export revenue, domestic pharmaceutical sales accounted for an additional US$7.9 billion of revenue in 2017 with an annual growth rate of 2.6%\(^{17}\). Switzerland’s pharmaceutical industry has deep roots with international public health organisations such as the World Health Organisation (WHO) and major pharmaceutical and bio-tech companies conducting R&D and innovation-driven activities in the country.

Source: UN Comtrade

Clocks and Watches

Figure 5: Switzerland’s Clocks, Watches & Parts Exports, 2010-17
(US$ billion)

The Swiss clock and watch industry has a rich heritage and established international reputation, and is one of the industries that has best demonstrated and most benefited from significant value created with the ‘Made in Switzerland’ label. In 2017, Switzerland exported US$ 20.2 billion\(^{18}\) worth of clocks, watches and their parts, and the sector has grown by the increasing demand for luxury goods globally and particularly in Asia. Hong Kong (US$ 2.6 bn), the United States (US$ 2.1 bn) and China (US$ 1.6 bn)\(^{19}\) were the top three export markets for Swiss watches & clocks in 2017\(^{16}\). Swiss handcrafted mechanical watches have an international reputation for high precision, engineering and pedigree, led by brands such as Patek Philippe, Audemars Piguet, Rolex and TISSOT. Almost all (95%) of Swiss watch manufacturing are based within clusters in Biel, Geneva and La Chaux-de-Fond.

Source: UN Comtrade
The MEM sector, valued at US$ 66.9 billion, is the largest manufacturing sub-sector in Switzerland, representing 30% of all exported goods in 2017. This is driven by exports of mechanical engineering and vehicle construction products (39.7%), precision instruments (23.4%), metallurgical products (20.3%) and electrical & electronics equipment (16.2%). Specifically, machinery exports made up a third of total MEM exports, valued at US$23.7 billion in 2017. Large industrial producers such as Germany (US$ 5.6 bn), the United States (US$ 2.7 bn) and China (US$ 1.8 bn) were key export markets, accounting for 42% of the sector’s exports. Switzerland is also home to numerous multinationals such as ABB, Liebherr, Endress+Hauser and Logitech, which are global leaders in their segments and have established the country’s expertise in precision measuring instruments, industrial automation and robotics. The MEM industry is highly concentrated in the Canton of Bern.
**Case Study:**
Switzerland’s focus on Sustainable Development in Manufacturing

**Efforts in driving Sustainable Industrialisation**

Switzerland’s Sustainable Development Strategy 2016-2019 is the cornerstone of its efforts to realise the UN Sustainable Development Goals (SDGs). The action plan has 9 actions areas each of which are tied to one or more goals in the UN Agenda for Sustainable Development. The targets in the Sustainable Development Strategy are also tied to the UN SDG goals.

For example, Switzerland aims to achieve UN SDG 12- ‘Ensure sustainable consumption and production patterns’ under Action Area 1 ‘Consumption and Production’ through goals such as Goal 1.2 “Companies achieve maximum resource-efficiency by optimizing the design of their production processes and products”. As part of Goal 1.2, Switzerland aims to work with companies across sectors to identify effective criteria to reduce the environmental impact of production including through materials use, energy and cost savings and improving resource efficiency. For example, one area of focus is to encourage companies to apply eco-design, which is about improving product design to reduce environmental impact at all stages of the product lifecycle. Furthermore, Switzerland is also supporting international efforts that aim to move the economy towards sustainable consumption and production patterns including the 10-Year Framework for Programmes on Sustainable Consumption and Production (10YFP), the Green Growth Knowledge Platform (GGKP) and the International Resource Panel (IRP).

Switzerland also plans to achieve UN SDG 9 -“Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation”. It seeks to do this by looking outside its borders to promote initiatives for inclusive and sustainable industrialisation in developing countries and to ensure that they are “increasingly included in the profitable stages of international value chains and that the resulting gains benefit a broad section of the population”. As part of achieving SDG 9, one of the goals outlined is Goal 2.4 “Both underground and overground structures are planned, built, operated and continuously developed in accordance with recognised standards of sustainability. They represent a solution that is optimised throughout the structures’ life cycle.” The Swiss government plans to drive networking and coordination across key stakeholders in the sustainable-construction value chain. Particularly, it looks to support coordination between the private and public sector in order to enhance alignment in the definition of sustainability in the construction sector as well as to support industry-set standards and corresponding quality labels.

**Evolution to a Circular Economy**

Switzerland’s Federal Council created the Swiss Clean-tech Masterplan (SCMP) in 2010 to encourage innovation among clean technology companies, creating significant opportunities for the manufacturing sector in Switzerland. The Cleantech industry in Switzerland is relatively advanced, where it already represents 5% of Swiss GDP in 2017 and employs 5.5% of the workforce. Furthermore, Switzerland’s 2013 Green Economy Action Plan has a mandate to reduce overall resource consumption in the country and drive Switzerland’s evolution to a circular economy. Measures imposed include putting in place requirements of transparency and standards on raw material use and waste ordinances, as well as to drive coordination with other sectors such as the financial sector and to put in place appropriate incentive structures.

*Source: Global Manufacturing and Industrialization Summit (GMIS), United Nations Industrial Development Organisation (UNIDO), International Telecommunication Union (ITU)*
Case Study: Harnessing technological innovations to drive connectivity in developing sustainable, smart cities

Digital technology exponentially expands capabilities to enable the monitoring and capture of unprecedented levels of data and visibility across a wide array of aspects of city living. This enhances the generation of insights and improves understanding in the management of urban spaces, allowing for the shaping of best solutions to drive efficiency and effectiveness – the makings of a smart city. City management is otherwise subject to the lack of monitoring, which creates uncertainty and misinformation in governance.

With feedback-driven intelligence from implementing digital technologies such as data analytics, Artificial Intelligence, and the Internet of Things (IoT), decision-making is better informed, resulting in the ability to optimize quality, performance, cost-effectiveness and resource consumption of public services than ever before. For example, artificial intelligence and autonomous vehicles can be utilized in the planning and dissemination of public transportation services for more efficient management of resources to minimize wastage, and enables on-demand public services. Also, the use of sensors and IoT devices have the ability to increase security and deter crime to create a more liveable and secure city.

The country is making significant progress in ICT sector. According to the latest International Telecommunication Union’s (ITU) yearly ICT Development Index report, Switzerland gained in ranking and ranked 3 compared to 4 place in 2016, right behind Iceland and South Korea. The good example of its great ICT infrastructure is the fact that Switzerland exhibits usually one of the highest network performances in Europe along with the Scandinavian countries. The Swiss ambition to improve the ICT infrastructure even more is one of the main pillars of the “Industry 2025” Initiative aiming to strengthen the country’s competitiveness.

In the age of connectivity and digitalisation, it is important to adopt enabling legal and regulatory frameworks that address key concerns of data protection, cyber-security and data breaches. Establishing alignment, participation and close collaboration of all stakeholders - from policy makers, regulators, service providers and operators through to manufacturers is essential to foster better policy-making in the new era of connectivity.

Source: Global Manufacturing and Industrialization Summit (GMIS), United Nations Industrial Development Organisation (UNIDO), International Telecommunication Union (ITU)
The Leap Forward

Creating a robust platform for innovation has allowed the manufacturing sector to become one of the engines of the Swiss economy. As Swiss-manufactured products generate demand on the basis of their quality, moving forward, the sector must not only retain its reputation for innovation and quality but also create its own unique model for the evolution of Industry 4.0. Swiss SMEs in particular, must prepare to fully capitalise on the myriad of opportunities in international markets by adopting new business models.

Figure 7: Swiss manufacturing has grown steadily, supported by government and industry initiatives

Key milestones in the development of Swiss manufacturing

1927
- Switzerland Global Enterprise (S-GE), works on behalf of SECO (Swiss Secretariat for Economic Affairs) and Swiss cantons to promote Switzerland and bring in foreign investors to the country
- S-GE provides free of charge information to prospective investors regarding the administrative, legal, labour, tax, documentation aspects of setting up companies in Switzerland

2006
- ManuFuture-CH was created as a knowledge & technology transfer (KTT) platform to connect Swiss manufacturing SMEs and academic institutions
- The initiative focuses on organising events, supporting firms to plan and prepare for innovation projects, from project ideation up to the final execution phase

2015
- Swiss National Banks’ decision to end the limit of Swiss franc against Euro led to currency skyrocketing, impacting export-oriented industries particularly MEM (Mechanical, Electricity and Metal) as sales and profit margins weakened
- Weakened sales and profit margins impacted companies’ ability to invest in digitalisation and technologies for smart manufacturing

2025
- Industrie 2025 is a platform initiated by three Swiss associations: asut, Swissmem and SwissT.net
- Its main objective is to safeguard and grow the competitiveness of Swiss companies and workplace by creating a comprehensive action plan, solve queries related to Industry 4.0 in Switzerland, build an Industry 4.0 knowledge repository and co-ordinate related events and activities in the country

The future of Swiss manufacturing will be shaped by two trends:
A. Prepare Switzerland to be a global leader in Industry 4.0: Switzerland must adopt a unified framework for Industry 4.0 that capitalises on the unique value proposition of Switzerland as a manufacturing destination
B. Support internationalisation efforts for Swiss SMEs: Swiss SMEs must be prepared to internationalise by engaging in strategic partnerships, leverage global platforms, and targeting new growth markets
Switzerland is one of only two European countries (apart from Germany) that avoided major deindustrialisation in recent years – its MVA share of GDP declined only slightly from 20.5% in 1990 to 18.2% in 2017\textsuperscript{22}, as compared to a steeper overall decline for the EU, falling from 19.2% to 13.6% in the same period. This is despite high operational costs in Switzerland and a strong currency. With the presence of advanced physical and digital infrastructure and a highly skilled labour force, Switzerland possesses the necessary advantages for it to succeed as a leading Industry 4.0 country. However, some industry experts consider the country’s potential in the Industry 4.0 context to be hampered by the smaller scale of its manufacturing sector, as compared to that of other developed economies in Germany, US, or Japan. Nevertheless, the country has seen the emergence of manufacturing giants, such as ABB and Schindler that have led the Swiss manufacturing sector into Industry 4.0 with highly sophisticated operations, responsive to changes in technology and market needs. Some of the SMEs in manufacturing have also kept up with advanced Industry 4.0 applications.

**A. Prepare Switzerland to be a global leader in Industry 4.0**

![Figure 8: Swiss companies are advanced in their implementation of Industry 4.0 technologies](image)

<table>
<thead>
<tr>
<th>Technology</th>
<th>Switzerland</th>
<th>Global</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing Execution Systems (MES)</td>
<td>34%</td>
<td>45%</td>
</tr>
<tr>
<td>Predictive maintenance of assets and products</td>
<td>45%</td>
<td>48%</td>
</tr>
<tr>
<td>Collaborative robots, smart robots, Robotic Process Automation (RPA)</td>
<td>41%</td>
<td></td>
</tr>
<tr>
<td>Integrated end-to-end supply chain planning</td>
<td>33%</td>
<td>44%</td>
</tr>
<tr>
<td>Connectivity, Industrial Internet of Things (IIoT)</td>
<td>29%</td>
<td>42%</td>
</tr>
<tr>
<td>Digital twin of products and manufacturing line</td>
<td>21%</td>
<td>33%</td>
</tr>
<tr>
<td>Blockchain technology</td>
<td>11%</td>
<td>24%</td>
</tr>
<tr>
<td>Virtual Reality, Augmented reality solutions</td>
<td>4%</td>
<td>8%</td>
</tr>
<tr>
<td>Artificial Intelligence (AI)</td>
<td>1%</td>
<td>9%</td>
</tr>
</tbody>
</table>

*Note: Survey of 55 Swiss companies and 1,155 global companies*

*Source: PwC Survey*
**Focus Area**

**Position Switzerland as a pilot playground for cutting-edge Industry 4.0**

Switzerland has a highly skilled workforce making the country amongst the best-positioned globally to leverage Industry 4.0 to drive growth. Its manufacturing workforce is well-trained, innovative, productive, and are ranked third globally on workforce flexibility according to the World Economic Forum’s Global Competitiveness Index 2017 - 2018, which distinguishes Switzerland from other highly developed countries in its readiness to adapt to expected changes to roles and capabilities required for Industry 4.0. The country is also ranked high on labour-employer relations in the Global Competitiveness Index 2017-2018, capacity to attract and retain talent, hiring and firing practices and flexibility of wage determination. Switzerland has also topped the Global Innovation Index for the last 7 years in succession. In the 2017 Index, Switzerland scored the highest out of 130 countries in terms of innovation outputs, such as creative products and services, knowledge and technology.

In addition, there is a strong presence of manufacturing clusters, which aids the diffusion of technology across companies and industries in the Industry 4.0 adoption. Clusters are mostly concentrated in Greater Zurich Area in the north, stretching westwards, and are present in a number of sectors such as in Aerospace & Defence, Pharmaceuticals & Biotechnology, Medical equipment and Precision instruments and many more. These are supported by close collaborations between the private sector and globally recognised Swiss technical universities and institutes, which are enabled and financially supported by the government’s innovation promotion agency, Commission for Technology and Innovation (CTI).

This also includes research centres such as the Paul Scherrer Institut that brings together industry, the Swiss Federal Institutes of Technology Domain, universities and other research institutes. Since 2002, the CTI has funded 5,000 projects at an average of CHF 330,000 (US$330,000) per project over a period of 2 years. Nanosurf is a successful case example of CTI’s funding as they achieved a global ranking of third place in the nano microscope segment.

The new iteration of this program, Innosuisse, which became operational in 2018, seeks to drive increased integration of companies and universities within the Swiss research and innovation environment, on top of providing funding support. Despite possessing advantages that will facilitate Industry 4.0 adoption, Switzerland lacks a more holistic and coordinated strategy. A unified plan could align the vision and way forward across stakeholders in the government and private sector, including manufacturers, digital infrastructure providers and technology companies. The plan can also build on existing efforts by key agencies such as Manufuture-CH, Innovation Switzerland and Global Enterprise Switzerland that have provided significant guidance for Industry 4.0 adoption and have set a good foundation to be further built on. The plan can establish Switzerland as a conducive platform to test and successfully pilot new Industry 4.0 models to attract global manufacturing companies to be based in the country. It could focus on leveraging Switzerland’s unique advantages such as having the necessary supporting infrastructure - in terms of a quality and high adaptive labour force, physical and digital infrastructure, and fully-enabled “digital factory” and “digital supply chain” models, as well as Switzerland’s strategic location surrounded by large consumer markets.
The plan could also focus on driving partnerships with developing countries and frontier economies looking to provide their local companies with a testbed for Industry 4.0 tools but currently lack the capabilities to do so. Companies in these emerging economies may be unwilling to test Industry 4.0 solutions in their home markets due to the high upfront investment costs and operational uncertainties. Another way to facilitate partnerships is also to encourage the dissemination of Industry 4.0 know-how from companies’ digital factories in Switzerland to other international factory locations. Already, the Swiss Global Enterprise, a government agency that supports the internationalisation of Swiss companies, has proposed to work with countries such as Poland that are still in the infancy of their Industry 4.0 journey.

Apart from providing a platform for testing and piloting new models, Switzerland could also position itself as an Industry 4.0 centre of excellence and focus on developing new applications for existing tools as well as next-generation tools.

For example, it could be a suitable knowledge hub for companies mature in Industry 4.0 adoption looking to incorporate new tools and applications without disrupting current models, to gain access to leading-edge Industry 4.0 resources. An important enabler of the Swiss Industry 4.0 plan would be to drive close collaboration between Swiss research universities, researchers at Swiss and foreign companies and global technology companies. Attracting leading edge global technology companies to develop new Industry 4.0 solutions in Switzerland and to set up demonstration centres for new technologies could serve as a powerful draw for global manufacturing companies. Switzerland could be positioned as a conducive platform and starting point for facilitating such collaborations, which could then translate into longer-term partnerships.
Case Example:
Leverage expertise in blockchain technology hub in Zug to propel Industry 4.0 adoption in Swiss manufacturing sector to the next level

Switzerland’s manufacturing industry could leverage the country’s growing expertise in blockchain technology. The canton of Zug, located about 35 kms from Zurich, is fast gaining an international reputation as “Crypto Valley” where it has become an epicentre and global hub for blockchain technology development, currently hosting close to 200 blockchain companies. It also hosts the foundation for Ethereum, the second largest cryptocurrency in the world.

The city of Zug is a pioneer in the application of blockchain technology, such as in e-government services. In July 2016, it gained prominence for accepting bitcoin as payment for municipal services. Since then, it has piloted a ‘Zug City ID’ hosted on blockchain that allows citizens to seamlessly access services without logging in and to selectively share private data with the city government. The city also hosted the first blockchain-based municipal vote in July 2018. Switzerland’s reputation for strong data protection frameworks creates opportunities in areas such as cognitive computing. Several industry leaders and universities has established operations in Switzerland to capitalise on these opportunities including Google’s AI Lab, IBM’s Research Centre and NVIDIA’s Deep Learning Institute.

The Canton of Zug is also traditionally a hub for manufacturing. It houses the headquarters of many commodities, machinery, pharmaceutical, medical technology and food processing companies, responsible for corporate functions from procurement, supply chain to intellectual property governance. Zug is also part of the Zurich-Zug-Lucerne pharmaceuticals cluster with a GVA of US$1.2 billion in 2016, and is also where pharmaceutical giants such as Roche, Novartis and Amneal are headquartered.

Zug Valley presents myriad opportunities for collaboration between the blockchain cluster and the manufacturing sector. Blockchain technologies provide new ways to share and use data created through the implementation of Industry 4.0 technologies to power decision-making and enable operational improvements, whilst also supporting the drive towards Industry 4.0. Blockchain’s distributed and encoded digital ledger system enables a community of users to record transactions securely. It shares the same premise of decentralisation as Industry 4.0, focused on the interoperability and automation of people, machine, and devices across the supply chain to drive autonomous and timely decision making.

Specifically, an area that blockchain technology which could be executed is in “Smart Contracting” that addresses the problem of significant lags between updating of inventory levels and the payment for contracts. Blockchains can enable smart contracts that allow stock levels, sales, inventory and payments to be automatically coordinated based on a set of pre-established rules, reducing manual effort, friction and time in the contracting process and drives efficiency in the system. Furthermore, blockchain technology can be utilised for traceability such as in the monitoring of the movement of goods across borders. Potential applications for blockchain in procurement and the manufacturing sector as a whole are yet to be fully explored or realised.

The potential of these collaborations could be a strong attraction for global manufacturers who look to leverage the presence of Switzerland’s renowned blockchain expertise. The country is well positioned to provide a conducive environment to be a pilot playground for the development of applications and implementations of blockchain technologies that could propel Industry 4.0 adoption to the next level.

Source: The Financial Times, Procurement IQ, Validity Labs, CoinDesk, Cointelegraph
**B. Support internationalisation efforts for Swiss SMEs**

SMEs provide two-thirds of all jobs in Switzerland\(^2\) and represent the vast majority of companies in the manufacturing sector. In the Swiss Mechanical, Electrical and Metals (MEM) sector, Switzerland’s largest industrial employer, 99% of companies in the sector are SMEs with less than 250 employees. Even though Switzerland’s manufacturing sector is primarily exports-driven with exports making up more than 80% of revenue, about 4 in 10 of SME manufacturers are not already exporting their products, and only about 15% export minimally to derive less than 20% of their sales from exports\(^2\). Compared to larger organisations, there is also a relatively smaller focus on driving value-add and innovation, given the SMEs’ lower ability to invest. For example, in the MEM sector, less than half (45%) of SMEs are investing in research and development (R&D) as compared to the 7 out of 10 large MEM companies that invest in R&D.

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**Figure 9: Key weaknesses of Swiss SMEs with regard to internationalization**

% reporting factor as a key weakness

<table>
<thead>
<tr>
<th>Weakness</th>
<th>% Reporting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost structures too high, product and service costs too high</td>
<td>42%</td>
</tr>
<tr>
<td>Insufficient market research</td>
<td>15%</td>
</tr>
<tr>
<td>Insufficient familiarity with international laws and regulations</td>
<td>14%</td>
</tr>
<tr>
<td>Insufficient linguistic expertise of employees</td>
<td>11%</td>
</tr>
<tr>
<td>Lack of international experience among employees</td>
<td>9%</td>
</tr>
<tr>
<td>Lack of international experience among executive management</td>
<td>9%</td>
</tr>
<tr>
<td>Products not adequately developed for the international market</td>
<td>5%</td>
</tr>
<tr>
<td>Insufficient specialist expertise of employees</td>
<td>4%</td>
</tr>
<tr>
<td>Lack of innovation</td>
<td>3%</td>
</tr>
<tr>
<td>Other</td>
<td>16%</td>
</tr>
</tbody>
</table>

*Source: Entrepreneurship Survey 2016*
Focus Area 1

Encourage strategic partnerships and leverage global platforms to support internationalisation

The SMEs in Switzerland’s manufacturing sector possess advanced technical capabilities and produce globally competitive, quality products. There is a strong presence of international demand for Swiss SMEs’ products and services – about 7 in 10 of Swiss SMEs cited demand from foreign customers as the main reason for internationalisation in a 2016 Swiss International Entrepreneurship Survey. In fact, internationalised Swiss SMEs are more inclined to occupy highly specialised, niche markets, where they are able to showcase outstanding capabilities and establish a competitive edge. Also, compared to other European SMEs, the Swiss SMEs’ ability to internationalise is positioned on their use of advanced technologies and innovation. However, most Swiss SMEs lack the capabilities and upfront capital investments that are required for sourcing and production to ultimately export internationally. According to the 2016 Swiss International Entrepreneurship Survey, 42.4% of Swiss SMEs think that the most common challenge to internationalisation is ‘overly high-cost structures such as product and service costs’. Additionally, capabilities that are lacking are specifically attributed to ‘insufficient market research’, ‘insufficient familiarity with international laws and regulations’, ‘insufficient linguistic expertise of employees’ and ‘lack of international experience among employees’ among others.

One way to address these challenges is to encourage Swiss SMEs to enter into partnerships with larger companies with an international presence, to leverage their existing global networks to enable access to new markets. In particular, SMEs that are already present in the supply chains of larger internationalised Swiss companies have the advantage of potentially accessing the established customer base and distribution networks overseas of larger companies that can help speed up new market entry and quickly acquire new customers. For example, multinational corporation ABB Group, has invested in close to 30 startup companies through its venture capital unit, ABB Technology Ventures. The startup companies benefit from access to R&D capabilities, domain expertise, global customer network, among others. In addition, the credential of supplying to larger and globalised Swiss brand names establishes credibility and reliability for lesser known SMEs. On the other hand, larger internationalised Swiss companies would also benefit from such a partnership – from having a better-integrated relationship with its suppliers in foreign markets, a greater ability to tap into new innovations and ideas generated by SMEs, where the ability to experiment is enhanced by virtue of their greater agility.

Swiss SMEs could also consider leveraging existing global platforms to generate awareness and to utilise existing tools to enhance capabilities to drive internationalisation. In this aspect, the Switzerland Global Enterprise, an investment and trade promotion agency that supports Swiss companies in expanding internationally has established a global presence with 22 Swiss business hubs, along with a network of experienced consultants and experts to support Swiss SMEs to enter into new markets. The agency provides SMEs access to knowledge tools such as the Export Digital platform, created in association with Google Switzerland to conduct market research, realise online sales potential and access new export opportunities.

Finally, manufacturing SMEs could also look to partner with technology companies to build and develop product offerings in Industry 4.0 technologies like automation and robotics in order to establish a globally competitive proposition. Partnering with technology companies will also enable Swiss SMEs to quickly adapt to latest trends in the manufacturing industry, such as in implementing service-oriented business models. Service-oriented business models are built to cater more closely to customer needs and preferences, are focused on driving satisfaction, repeat purchase and referrals. This is expected to drive long-term revenue especially in export markets, although it requires more effort in operationalisation.
Case Study: Global platform of the GMIS supports Swiss start-up UrbanAlps in internationalisation journey

Swiss start-up UrbanAlps, a high-tech security firm that uses Additive Manufacturing and renowned for their patented 3D metal printed keys “StealthKey”, leveraged the global platform of the Global Manufacturing & Industrialisation Summit (GMIS) to generate awareness internationally and successfully expand its client base across a number of markets.

GMIS is a joint initiative by the United Nations Industrial Development Organisation (UNIDO) and the Ministry of Energy and Industry of the United Arab Emirates. It is the world’s first cross-industry forum, tasked with a mission to drive industrial development globally by bringing together stakeholders in the public and private sector to shape the transformation of global manufacturing.

As a start-up pushing the seams of Industry 4.0 and delivering solutions empowered by Industry 4.0 technologies, UrbanAlps leveraged the GMIS’ 2017 global forum in Abu Dhabi to communicate its vision on the future of high-security locks. At the forum, they showcased the prototype of the StealthKey, the world’s first metal 3D printed key with unparalleled levels of key duplication security. Pioneered by Swiss engineers, the company employs Stealth technology for mechanical keys, cylinder and padlock applications applied in securing government assets, military facilities and oil and gas facilities.

UrbanAlps’s presence at the GMIS 2017 resulted in market validation and widespread media coverage from specialized publications like The Economist and MIT Review. The company also attracted and secured investors to provide financing for further product development and to build a strong team of highly profiled industry experts – all of whom were attracted to the potential of large scale industrialisation of 3D metals and its impact on the security and locks industry.

Within a year of GMIS 2017, UrbanAlps had expanded rapidly internationally, supplying to high-security companies across the Middle East, UK, Germany and the US. Based in Zurich, the company has an advanced engineering laboratory and has since set up satellite offices in Dubai and Prague. The company is now working towards mass-market production to deliver affordable, anti-copying security solutions.

Source: UNIDO, GMIS International, UrbanAlps, 3D Printing Media Network
**Focus Area 2**

**Explore the potential of growth markets for Swiss SMEs**

The ‘Made in Switzerland’ brand is extremely strong globally and carries a world-class reputation of quality, reliability, and precision technology. On top of that, the country is strategically and centrally located with access to large surrounding markets in Western Europe. This provides a strong basis for Swiss SMEs to capitalise on in the quest for internationalisation. Backing this up, the 2016 Swiss International Entrepreneurship Survey reported presence of strong demand from foreign customers (54%) and ‘exploiting the benefits of Swissness’ (22%) as reasons for internationalization.

High-growth economies of emerging markets could be a source of strong demand for Swiss-made products and Swiss manufacturing, in the presence of high levels of industrialisation and urbanisation. Globally, growth markets are expected to average GDP growth rates of 5% in the next 4 years, making them high demand markets; as compared to the Euro area, a key export region for Swiss manufacturing, whose average GDP growth rates are expected to average under 1.8% in the same period.

In addition, the ‘Made in Switzerland’ brand already enjoys a strong reputation in growth markets, being ranked as the most valued brand among consumers in BRIC countries, which together accounts for a substantial 40% of the world’s population, according to a survey conducted by the University of St. Gallens. Specifically, in Thailand where there is a strong Industry 4.0 push via the country’s ‘Thailand 4.0’ industrialisation plan, Swiss-manufactured products have been in high demand and this is likely to grow.

However, challenges are abound for SMEs in expanding exports internationally. Fluctuating exchange rates and strengthening of the Swiss Franc work against their favour. In 2015, the Swiss SME Export Outlook fell nearly 20 points from 65 to 46 when the Euro minimum exchange rate against the Swiss Franc was abolished. Also, the small-sized Swiss market limits the scaling of operations, adding to the challenge of expanding internationally. Nevertheless, Swiss SMEs should continue to push ahead on their growth markets agenda and focus on acquiring required knowledge and capabilities. One way to do this is to expand and build on existing efforts of the Switzerland Global Enterprise (SGE). While the SGE supports Swiss SMEs in trade promotion, location analysis and has set up numerous overseas business hubs, its presence and expertise is concentrated in developed markets, particularly in Western Europe.

The SGE could look into expanding its coverage to growth markets and develop expertise areas so as to match SMEs with relevant tools to help overcome common barriers to entering growth markets. Some common challenges cited by Swiss SMEs with regards to internationalisation are, ‘insufficient market research’ (14.6%), ‘insufficient familiarity with international laws and regulations’ (14.4%) and ‘insufficient linguistic expertise of employees’ (11%).

The SGE could provide support to SMEs in overcoming language barriers, navigating regulatory complexity. These issues are also likely to be more exaggerated when targeting growth markets and therefore the role of SGE will become even more crucial.

In addition, the SGE should also look into supporting SMEs in formulating a growth market entry strategy in order to position well for market entry. This includes aspects such as evaluating most attractive growth markets for exports, identifying new customer base and tailoring the value proposition model to customer needs, planning a go-to-market approach including marketing outreach, among others. To help overcome the limitation of financing and address higher risks associated with entering into growth markets, the SGE could also look into augmenting current financing options for SME internationalisation. Existing financing options available to manufacturing SMEs (not necessarily related to internationalisation) include commercial guarantees through regional guarantee cooperatives, loan guarantees of up to CHF 500,000, as well as the Swiss Export Risk Insurance (SERV). Additionally, SGE can also look into providing more risk sharing schemes that accommodates riskier ventures, such as to include solutions to mitigate political risks.
The Trade Promotion Coordinating Committee (TPCC) in the United States is an inter-agency government task force that drives coordination and development of a strategic plan for export promotion and export financing. The TPCC is made up of 20 government agencies that provide a range of services to support US companies in exporting internationally.

Out of the 20 agencies that make up the TPCC, 7 are core agencies, including the Department of Commerce (DOC), Export-Import Bank, Overseas Private Investment Corporation (OPIC), US Trade and Development Agency (USTDA), Small Business Administration (SBA), Department of State and Department of Agriculture (USDA). Specifically, the Small Business Administration (SBA) provides focused support to SMEs, which form the backbone of the US economy.

**Case Study:**
**Government inter-agency efforts in the United States supports American SMEs to export internationally**

The SBA specialises in providing support to small American businesses in the aspects of business financing, training, counselling, and other types of assistance. The SBA has organised specific initiatives as well, including the Rural Lending Initiative, which provides financing to SMEs from rural regions in the US, and the Emerging Leaders initiative, which provides free training in entrepreneurship to small business owners.

SBA supports SMEs in various areas including:

- **Business financing**
- **Identify opportunities in government contracting**
- **Individual counselling**
- **Low cost training for new entrepreneurs**
- **Advocate for American SMEs & review congress legislation**

Professionals from 3 key agencies of the TPCC also make up a network of United States Export Assistance Centers which are new to exporting, want to expand to other markets or want to increase their market share in existing markets. There are over 100 centres in the US and they mainly help match US businesses with prospective trade partners, connect to trade specialists who deliver market and industry briefings, introduces pre-screened buyers and distributors at domestic trade shows, and to access international trade leads.

The USEAC was pivotal in helping a medium-sized, US automated packaging equipment manufacturer, Fargo Automation, in exporting internationally. With more than 20 years of experience and having achieved success in the local market, the company looked to expand internationally. The USEAC helped Fargo Automation access customized, in-depth assistance services that helped prioritise most attractive markets for entry, and provided support in identifying and executing overseas deals. As a result, Fargo Automation started exporting successfully to Ireland.

*Source: Export.gov, U.S. Small Business Administration, Export-Import Bank of the United States, USA.gov*
Conclusion

As an export-oriented economy, Switzerland has benefitted from its strategic location in the heart of Western Europe and have developed an international reputation for quality despite their high price point. The country’s exports are heavily constituted of R&D intensive, high-technology industrial goods and machinery as well as consumer goods such as clocks and watches. Switzerland’s prowess in trade and favourable tax structures have also attracted significant levels of foreign investment, particularly within its financial sector.

Switzerland’s manufacturing sector is a potent economic force in the country, serving as a major contributor to the country’s GVA and as a source of employment. Swiss manufacturers produce high-value added products that consistently command a premium price in the market due to their technological innovation (for products such as pharmaceuticals and electrical components), as well as craftsmanship and precision technology (for products such as clocks and watches). The Swiss government provides significant support to the manufacturing sector in terms of fostering innovation and supporting the internationalisation of companies, and Swiss companies are advanced in their applications of Industry 4.0 technologies.

However, there is a lack of a coordinated effort across the public and private sectors to address challenges in Switzerland’s Industry 4.0 journey, such as in carving out a unique proposition for the country in establishing Industry 4.0 global leadership and in adapting the Industry 4.0 plan to the Swiss context. For example, there is significant potential in enhancing collaboration between the manufacturing and technology sectors, to capitalise on the world-renowned capabilities of Zug Valley in blockchain technology and its untapped potential when applied in advanced manufacturing.

Swiss SMEs, who make up the majority of companies in the manufacturing sector, will also require additional support as they progress on their internationalisation journeys, particularly from government agencies such as the Swiss Global Enterprise, to drive their adoption of new approaches and business models in partnership with established Swiss companies across sectors. At the same time, they will also need to tap into international platforms, taking the lead from successful case example of UrbanAlps that leveraged the GMIS 2017 forum to create international awareness.

Looking forward, Switzerland’s manufacturing sector is likely to remain highly innovative and technologically advanced, as the country possesses necessary supporting conditions, including access to technology and skills required to foster greater investments in the sector. As such, there is immense potential for Switzerland to establish global leadership with a unique value proposition in the age of Industry 4.0. The Swiss manufacturing sector, made up a majority of SMEs, could also further internationalise and build on the strong “Made in Switzerland” quality reputation in growth markets. To achieve these goals, it is essential to take on a collaborative approach with both the public and private sectors working hand in hand to support the digitisation and internationalisation journey of the industry.
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Acknowledgements

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- Stella Lau, Growth Markets Centre, PwC
- Aparna Chandrasekar, Growth Markets Centre, PwC
- Indraneel Ray, Growth Markets Centre, PwC
- Abigail Widjaja, Growth Markets Centre, PwC
- Anishta Lakhani, PwC Middle East
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A joint initiative by the United Arab Emirates and the United Nations Industrial Development Organization, GMIS – as a platform for leaders to transform manufacturing, a builder of cross-sectoral partnerships, and a knowledge-base that identifies opportunities for the sector to generate universal benefit – is committed to placing manufacturing at the heart of economic regeneration, policymaking, international collaboration, and contribution to global good. Find out more about the GMIS mission, and how you can be part of it, at www.gmisummit.com

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