



The Swiss Blockchain Technology Cluster

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Executive Summary

During the recent years, blockchain technology has experienced a significant increase in public attention because of its promised potential to disrupt entire industries. Among few other countries, Switzerland was able to attract numerous companies specializing in blockchain technology with the objective to turn the country into a leading hub in this industry. The purpose of the focal report is to describe and analyze the emerging Swiss blockchain tech cluster and to derive recommendations based on identified key competitiveness issues of the ecosystem. An evaluation of Switzerland, based on Porter's Diamond model, reveals that the country offers a favorable environment for digital industries, such as blockchain and FinTech, while some challenges exist. Subsequently, an introduction of blockchain technology and the blockchain ecosystem in Switzerland is provided. An in-depth analysis of the ecosystem enabled the detailed mapping and description of the emerging cluster. Furthermore, the competitiveness of the cluster is assessed based on the Emerald model. The analysis reveals that the cluster is highly attractive for talents, education, R&D and innovation, and ownership. Improvement is needed in terms of the attractiveness from an environmental, overall cluster attractiveness and knowledge-dynamics perspective. The report suggests the establishment of an ultimate cluster organization, the exploration of new capital sources for the ecosystem as well as the international collaboration among blockchain hubs to establish flagship projects that show realization of the technology's value.

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Glossary

bn	billion	OECD	Organization for Economic Co-operation and Development
Comco	Swiss Competition Commission		
CVVC	CV VC AG	PISA	Program for International Student Assessment
EDA	Federal Department of Foreign Affairs	P2P	Peer-to-Peer
EPFL	École polytechnique fédérale de Lausanne	R&D	Research & Development
ETHZ	Federal Institute of Technology in Zurich	SECO	State Secretariat for Economic Affairs
EU	European Union	SERI	State Secretariat for Education, Research and Innovation
FDI	Foreign Direct Investment	SME	Small and medium-sized enterprises
FINMA	Financial Market Supervisory Authority	STCIC	Swiss Tax Conference Information Committee
FSO	Federal Statistical Office	STO	Security Token Offerings
FTA	Free Trade Agreement	THE	Times Higher Education
GCI	Global Competitiveness Index	UK	United Kingdom
GDP	Gross Domestic Product	USD	US-Dollar
IC	Computer & Communication Sciences	VC	Venture Capital
ICO	Initial Coin Offering	WEF	World Economic Forum
ICT	Information & Communication Technology		
IFZ	Institute of Financial Services Zug		
IGE	Swiss Federal Institute of Intellectual Property		
INSEAD	Institut Européen d'Administration des Affaires		
IoT	Internet of Things		
IPO	Initial Public Offering		
NYU	New York University		

1 Country Profile Switzerland

Switzerland is a small, mountainous country located in Western Europe covering a surface area of 41,285 km² (OECD, 2007; EDA 2019a). As figure 1 shows, Switzerland is bordered and landlocked by Lichtenstein and the EU members Germany, Austria, Italy and France. The country itself is not a member of the European Union

Figure 1: Map of Switzerland



Source: <http://traffic-club.info/2018simage-switzerland-capital-map.awp>

but in the Schengen area (EU, 2019; Worldatlas.com, 2019). Switzerland is a federal state and divided in 26 independent and sovereign cantons having its capital and political center in Bern (EDA, 2019b). The state powers are divided by the confederation, the cantons, and the communes with each canton having its own constitution, acts, parliament, government and courts (Federal Chancellery, 2019a). The population amounts to 8.48 million and German, French, Italian, and Romansh are the official languages (United Nations, 2017; EDA, 2019c). With 66%, German is the most-used workplace language followed by French (29%), English (18%) and Italian (8.7%) (EDA, 2019c). With a population of 376,990 inhabitants, north-located Zurich is by far the most populated canton and besides to Berne, Vaude and Geneva an important contributor to the Swiss economy (Switzerland Tourism, 2019; EDA, 2019d).

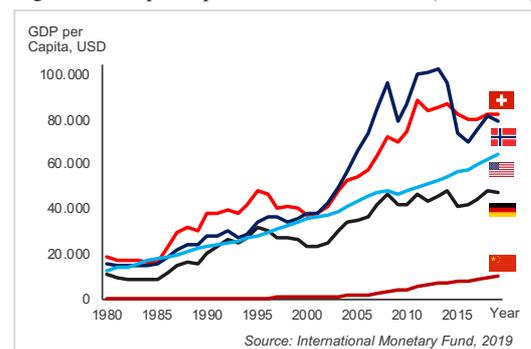
1.1 Industry Structure

The Swiss economy is based on a sophisticated service sector, contributing approximately 74% to the country's GDP (EDA, 2019e). Major industries in this sector involve banking, insurance and tourism. The country, however, also has a strong position in manufacturing, accounting for 25.5% of the GDP. The agriculture sector in Switzerland is small and contributes less than 1% to the country's GDP. Overall, while Switzerland has several well-known major industry players (e.g. Nestlé, Roche, ABB), the majority (99%) of Swiss companies are SMEs with less than 250 employees (EDA, 2019e).

1.2 Economic Performance

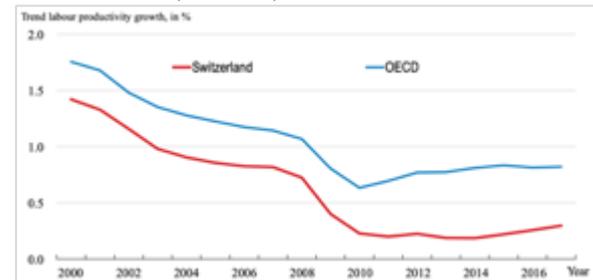
With a GDP per capita of USD 82,412, the Swiss economy is performing very well in an international comparison (see figure 2), having the 3rd highest GDP per capita among all OECD countries (IMF, 2019). Hence, the population has a high standard of living, which is also confirmed by other measures of well-being (e.g. subjective well-being, personal security). In 2018, the economy grew by 2.5%

Figure 2: GDP per Capita for selected countries (1980-2018)



compared to a growth rate of 1.6% in 2017 (Countryeconomy, 2019). Moreover, Switzerland sustains a high level of labor productivity in the country thus annual trend labor productivity growth has been declining for years to one third of the OECD average, as shown in figure 3 (OECD, 2017a, p.16).

Figure 3: Trend labor productivity growth (in %) Switzerland vs. OECD (2000-2017)



Source: OECD, OECD Economic outlook 102 Database (2017)

This seems to be a major problem, as Switzerland's GDP per Capita growth during the 2000's was mainly driven by increasing employment which has reached a record high and does not offer a lot of potential for improvement (Ollivaud, 2018). Therefore, future GDP per Capita growth needs to be achieved by keeping high labor productivity levels (Ollivaud, 2018). According to experts, the decreasing trend is mainly caused by a two-speed economy, meaning that a small number of companies are doing extremely well (also in terms of labor productivity growth), while others are suffering (Ollivaud, 2018). It was furthermore found that this performance gap is related to the innovative and R&D related activity of firms. Generally, Swiss R&D is highly concentrated in the top 1% companies of the country and is correlated with above average performance and high labor productivity growth (Ollivaud, 2018).

1.3 Legal System

Switzerland's civil law legal system is based on the Germanic and French legal system considering written law as the primary source of jurisdiction (NYU Law, 2019). Swiss law consists of public law on the one hand, dealing with state organization and relationships between the state and individuals, and civil law on the other hand, dealing with the rights and duties of natural and legal persons in its sub-divisions such as tax and criminal law for instance (NYU Law, 2019). The civil law is also a three-layered system that divides legal powers between the Confederation, the cantons and the municipalities with higher-layer law enjoying seniority (Lawyers Switzerland, 2019). The Federal Criminal Court, the Federal Administrative Court, and the Federal Patent Court are the highest courts and each canton has its own sub-ordinated courts (Federal Chancellery, 2019b). The Swiss legal system ranks 4th in the World Bank rule of law index and achieves a score of 1.93 on the range -2.5 (weak) to +2.5 (strong) (theGlobalEconomy.com, 2019a).

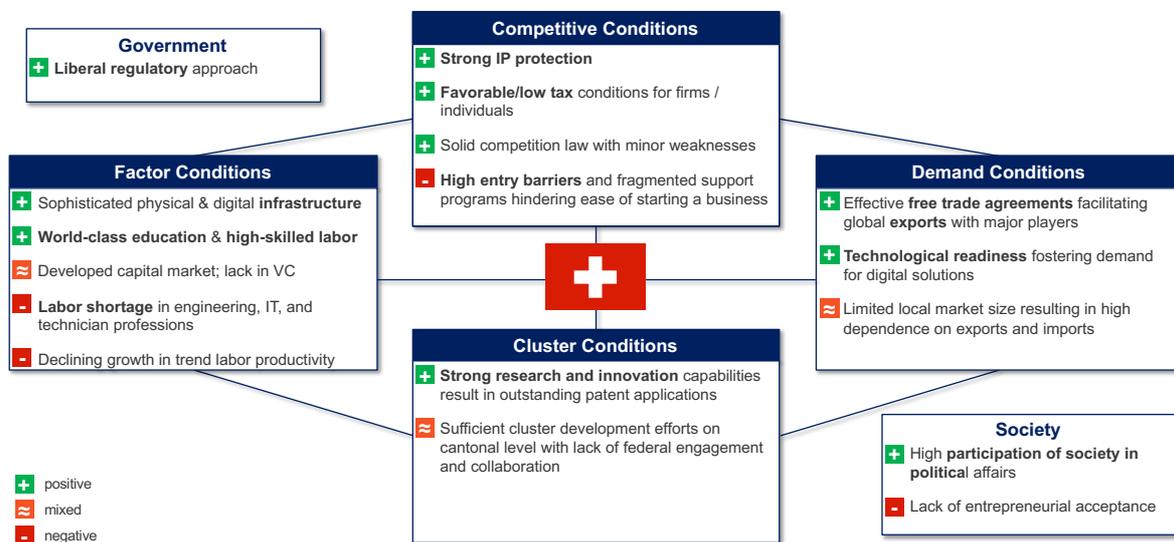
1.4 Tax System

The Swiss tax system reflects the Confederation's federal structure implying that taxes are levied on the federal, cantonal and communal level (Swiss Tax Conference Information Committee (STCIC), 2017, p.5, 9). The Federal Constitution aims fiscal sovereignty of the three bodies and allocates the rights to collect taxes between the confederation, the cantons and the communes in a way to prevent mutual impediments and excessive burdens for taxpayers (STCIC, 2017, p.9). Personal income is

subject to a direct federal tax with a progressive but maximum rate of 11.5% and an additional tax on the cantonal level. Progressiveness and maximum tax rate vary from canton to canton (STCIC, 2017, p.29–31, 50–53). In 2018, maximum income tax rates for individuals ranged between 22.86% in Zug and 44.75% in Geneva (KPMG AG, 2018, p.22). Corporate income is subject to a proportional direct federal tax of 8.5% on net profits while on the cantonal level legal entities have to pay similar income taxes with specifications varying between cantons (STCIC, 2017, p.32, 55). Almost all cantons and communes levy a proportional net profit tax and a tax on paid-up share capital (STCIC, 2017, p.55). The 2018 overall maximum effective tax rate on pre-tax corporate profits ranges between 12.32% in the Canton Lucerne and 24.16% in Geneva (KPMG AG, 2018, p.7).

2 Diamond Model

Figure 4: Diamond Model Switzerland



Source: Group analysis

2.1 Factor Conditions

≈ Capital Access. Switzerland is known for its strong financial sector providing 171.6% of GDP as credits to the private sector and the financial system ranking 4th in the Global Competitiveness Index (GCI) 2018 (WEF, 2018). Despite being a quite small country, Switzerland has attracted enormous foreign direct investment (FDI) through its strong manufacturing and service sectors in the past (OECD, 2018b). Inward FDI stocks amounted to notable USD 1,154.8bn in 2017 compared to USD 2,901.4bn in China for instance (OECD, 2018b). However, recent inward FDI flows were somewhat volatile and decreased significantly in 2017 due to a strong Swiss franc, low unemployment and high wage levels (OECD, 2018b; EY, 2018a). Experts suggest high FDI growth potential driven by Switzerland's leading position in automation and efficiency gains in the industrial sector (EY, 2018a). According to the GCI 2018, the Swiss finance sector shows some weaknesses in the financing of SMEs and the availability of venture capital (VC) which impedes entrepreneurship and startup conditions (WEF, 2018). Although VC availability improved and volume increased

significantly in the last few years, especially higher stage finance rounds, i.e. A and B rounds remain challenging for startups pursuing expansion (startupticker.ch, 2019; Forsting, 2018).

+ Infrastructure. Switzerland has a sophisticated infrastructure consisting of a dense and reliable road and rail network, 3 international and 11 regional airports enabling efficient travelling within and outside the country which is granted a 3rd rank in the GCI infrastructure pillar (EDA, 2019f; WEF, 2018). Switzerland relies on the external supply for oil and gas accounting for 50.6% and 13.5% of energy sources while electricity accounts for 25% (EDA, 2019g). Electricity is mainly generated by hydropower (59.9%) and nuclear power (33.5%) (EDA, 2019g). The country has a highly developed, excellent telecommunications infrastructure and a high internet penetration rate of more than 75% of households being connected to the internet (EDA, 2019h). Switzerland also has one of the densest broadband networks whose capacity is set to increase considerably in the near future by replacing copper with fibre-optic cables across the country (EDA, 2019i). According to the Networked Readiness Index 2016, the country ranks 7th and is well-prepared to reap the benefits of emerging technologies and capitalize on the opportunities presented by the digital transformation and beyond (WEF & INSEAD, 2016).

+ Education and Human Resources. Education enjoys a high priority in Switzerland with education spending per student being above the OECD average (OECD, 2017b, p.177). In 2016, 17.5% of public expenditures which corresponds to 5.6% of GDP were spent on education (FSO, 2018). In the last two PISA studies, Swiss pupils proved the strong educational system by achieving above OECD average results especially in science and mathematics (OECD, 2018a, 2014). Switzerland has 12 state-run universities, 8 Universities of Applied Sciences and Arts, and 20 Universities of teacher education (academics GmbH, 2019) seven of which are ranked in the top 200 of the QS World Ranking 2019 (QS, 2019). High-ranked, outstanding institutions are the ETH Zurich and the EPFL Lausanne both having data science as one of their focus areas (QS, 2019; ETH, 2019a; EPFL, 2019). The high quality of the education system is reflected by a highly-skilled labor force and Switzerland being ranked second regarding skills in the GCI 2018 (WEF, 2018). The result is driven by outstanding quality in the categories staff training, vocational training and the skillset of graduates (WEF, 2018). However, studies suggest an acute labor shortage in engineering, technician and IT professions that is partly driven by demographic change (Adecco Group Switzerland, 2019). The growing demand for high-skilled workers was partly met by agreements with the EU that have eased immigration (OECD, 2017a). Yet, Switzerland's ability to tackle labor shortages is limited by a complex immigration process in general and the 2016 establishment of rules that require employers to prioritize Swiss residents in sectors or regions with above-average unemployment (Henley, 2016). In addition, third-country immigration is strictly regulated by immigration quotas (Richardson, 2018).

2.2 Competitive Conditions

+ Competition Law. The Swiss competition law was introduced in 1995 through the so-called Cartel Act. The task to protect and sustain the competition in the market economy is performed by the Competition Commission (Comco), which acts as an independent federal authority. The main responsibilities of the commissions include the control of mergers, the restriction of the formation of cartels and the prevention of governmental interference in the competition policy. A reform of the Cartel Act in 2003 granted the commission more powers such as taking direct measures against the initiators in case of a development that might bring harm to the market competition (OECD, 2006). The OECD identified weaknesses in the Swiss competition law, such as a potential conflict of interests for board members of Comco (OECD, 2006). Switzerland ranks 13th in terms of the effectiveness of its anti-monopoly policy in the GCI (WEF, 2017a).

+ IP Protection. Switzerland puts a strong emphasis on intellectual property protection of individuals, organizations and corporations. In Switzerland the intellectual property is protected through both international and federal law. The policies include the protection of patents, copyrights, trademarks and designs, where all new entries are to be registered at the Swiss Federal Institute of Intellectual Property (IGE, 2019). The institute functions as an independent agency, with the main task to advise the Federal Council as well as individuals and businesses in intellectual rights matters (IGE, 2019). The institute also makes sure that the Swiss IP law is in accordance with international laws. In comparison to other countries, Switzerland is ranked in 2nd place in the GCI in terms of Intellectual Property protection (WEF, 2018).

+ Tax. In an international comparison, Switzerland provides favorable tax conditions on the individual and corporate level. With an average corporate income tax rate of 17.71% and the lowest rate being 12.32%, Switzerland is an attractive tax location when disregarding famous tax domiciles (KPMG AG, 2018, p.14). With maximum individual income tax rates between 22.86% and 44.75% Switzerland is also an attractive tax location for wealthy individuals (KPMG AG, 2018, p.22). On the International Tax Competitiveness Index, measuring how a country's tax system contributes to the country's neutrality and competitiveness, Switzerland ranks 6th out of 25 (Tax Foundation, 2018).

- Entry Barriers. There are some distinct challenges that entrepreneurs face, when starting a business in Switzerland. These lie particularly in the bureaucratic processes of the country. Though firms in Switzerland show comparably high survival rates, the OECD sees potential for improvement when it comes to the entry rates into the Swiss economy. The Doing Business Report (2019) ranks Switzerland 77th in the category of starting a business. In particular, restrictions for entrepreneurs are the high capital requirements as well as the time to register a business, which takes ten days and lies well above the OECD average (Doing Business, 2019). It is also difficult for entrepreneurs to receive

credit, a category in which Switzerland only ranks 73rd (Doing Business, 2019). There is also little effectiveness in the support for entrepreneurs, due to the high fragmentation of support programs (OECD, 2017a). Overall, around half of the firms exiting the Swiss economy name bureaucracy to be a main reason for their decision (OECD, 2017a).

2.3 Demand Conditions

+ Foreign Trade. In terms of local market size, Switzerland scores rather low in the GCI 2018 (ranks 39th) showing the need for sophisticated foreign trade. Not being a member of the EU, Switzerland has aligned most of its trade regulations in order to get access to the EU single market. Not only has Switzerland a free trade agreement (FTA) with the EU, but also negotiated 30 FTAs with 40 partners worldwide, such as China and Japan (SECO, 2019a). As a member of the European Free Trade Association, the country is benefitting from a strong network that enables a good base for further negotiations, while individual FTAs remain possible. Nowadays, the EU is Switzerland's most important trading partner, accounting for 78% of Swiss imports and 43% of Swiss exports (EDA, 2019e). Especially, exports to Germany have soared significantly, besides the US, China and India who became major oversea destinations for Swiss export products. By 2018, Switzerland has become the 18th largest export economy in the world and achieved an annual trade surplus of USD 12bn (OECD, 2019a). The export of goods and services as percent of GDP was approximately 65% in 2017, showing the high dependence of the country on foreign trade (theGlobalEconomy.com, 2019b). Exports are mainly generated by the chemical and pharmaceutical industry (42% of exports), the machinery and electronics industry (15%), and the watch industry (10%) (SECO, 2019b). Overall, trade barriers are low, fostering high exports and imports. Yet, some existing obstacles and protectionism in the agriculture sector in Switzerland are criticized by international organizations.

+ Technological Readiness. The GCI 2017 acknowledges that Switzerland is a country with a high degree of technological readiness among its citizens (WEF, 2017). This was recently confirmed by Switzerland's first place in the KPMG change readiness index (KPMG, 2017). The index measures the capabilities of the country's enterprises, the government and the society at large to react towards abrupt changes in their environment, such as disruptive technologies or economic shocks. Specifically, Switzerland's society and enterprises were found to be flexible and prepared for changes. With regard to the demand for digitization among Swiss companies, the consulting firm Accenture recently acknowledged a good stand for Switzerland compared to other countries in the adoption of digital solutions (Accenture, 2017).

2.4 Cluster Conditions

≈ Cluster Development Switzerland. Unlike in many countries of the EU, such as Germany, there is currently no coherent cluster policy in Switzerland on a federal level (Hauser, 2016). In 2010, the

Swiss Federal Council voted against such an independent cluster policy (SECO, 2010). Instead, cluster initiatives and policies to enhance and foster cluster development exist on a regional and cantonal level in Switzerland through a collaboration of the cantonal governments, business and universities (Federal Ministry for Economic Affairs and Energy, 2016). The respective canton provides economic promotion, networking assistance and the supply of data and information to the players in the cluster (Canton of Zurich, 2019). Around 22 larger clusters with a total of 62 cluster initiatives have emerged in Switzerland, with one to five cluster initiatives existing in each canton (Federal Ministry for Economic Affairs and Energy, 2016). Important clusters include pharmaceuticals, the financial industry and the watch industry. In terms of the state of cluster development Switzerland ranks third on the Global Competitiveness Index (WEF, 2018), but there remains potential for collaboration on the federal and cantonal level in terms of economic and technology promotion. (Strauf & Scherer, 2006).

+ Research and Innovation. Switzerland is a leading country with respect to research activities spending 3.4% of GDP on research and development activities in 2015 which is clearly above the OECD average and especially high per capita (OECD, 2019b). The main research focus areas in Switzerland are among others technical sciences, engineering, information technology, physics, and life sciences (academics GmbH, 2019). Switzerland's highly ranked education and research institutions have an outstanding scientific impact shown by a relative high number of scientific papers per capita, a high citations rate that highlights its impact and Switzerland being the country with the most patents per inhabitant (SERI, 2017, p.12; Switzerland Global Enterprise, 2018). Switzerland's Innovation capability also ranks third in the GCI 2018 driven by high scores in cluster development, high R&D expenditures, the quality of research institutions, and patent applications (WEF, 2018).

2.5 Government

+ Liberal Regulatory Business Environment. With regard to the restrictiveness of the regulatory business environment, Switzerland appears to be rather liberal. Historically, regulators and authorities have been relying on a partially self-regulating system in the financial sector for more than four decades. Moreover, industries relating to the digital economy (such as Cryptocurrencies, FinTech) have been subject to recent favorable legislations in Switzerland in international comparisons (Atkins, 2018). Overall, the government seems to be supportive for new industries and tries to provide fast regulatory clarity in order to ensure the competitiveness of developing technology.

2.6 Society

- Entrepreneurship Acceptance. The OECD (2017a) stresses that compared to other countries the Swiss society does not perceive entrepreneurship as an adequate career path, in fact meaning that there is a potential for improvement with regard to a supportive entrepreneurial culture. This is mainly

confirmed by the Global Entrepreneurship Monitor (GERA, 2018) who finds some major obstacles for a sophisticated entrepreneurial culture, such as a lack of social acceptance of failure in Switzerland and low entrepreneurial activity and aspiration among the Swiss youth (even compared to the OECD average). However, the report also acknowledges that there are regional differences that appear to be related to the language. While in the German speaking parts of Switzerland the fear of failure is significantly below the Swiss average, the social acceptance of entrepreneurship as a career path is low, compared to Swiss-French or Swiss-Italian.

+ Direct Democracy. Switzerland is one of the few countries in the world regarded as closest to a direct democracy system of government. Currently, two major mechanisms of direct democracy are included in the Swiss constitution and can be distinguished into referendums and initiatives (EDA, 2019j). A referendum – where all Swiss people entitled to vote would be asked - is a mandatory instrument for the politics if a decision on an important political issue or a revision of the constitution has to be made. Additionally, the Swiss population can use initiatives to propose new laws or changes in the constitution. If a significant number of citizens support the initiative, the politics will be forced to hold a national referendum about the issue (EDA, 2019j). According to an OECD assessment, the Swiss system of direct democracy has resulted in an outstandingly high confidence rate of 80% among citizens in the national government compared to 40% on OECD average (OECD, 2017a, p.15).

2.7 Country-Level Recommendations

Challenges	Recommendations
Labor Shortage <ul style="list-style-type: none"> Acute shortage of skilled labor in engineering, technician and IT professions 	<ul style="list-style-type: none"> Abolish rules requiring employers to prioritize Swiss citizens over EU citizens Simplify formal immigration procedures Establish immigration program attracting skilled people Abolish third-country immigration quotas for skilled labor
Below OECD average productivity growth <ul style="list-style-type: none"> Declining trend productivity growth Two-speed economy due to high R&D and innovation concentration in few firms 	Foster Innovation & Entrepreneurship <ul style="list-style-type: none"> Reduce and simplify bureaucratic processes of starting a business Initiate entrepreneurship programs in schools to increase and foster early acceptance of entrepreneurship in society Establish uniform information point of contact that informs about governmental support for entrepreneurs
Entry Barriers and Entrepreneurship <ul style="list-style-type: none"> Administrative obstacles to start a business Low Public Acceptance of Entrepreneurship Fragmented governmental support programs 	
No federal cluster policy <ul style="list-style-type: none"> Lack of collaboration of federal and cantonal authorities that promote technological and economic development 	<ul style="list-style-type: none"> Make cluster development a priority in federal economic policy Establish federal cluster policy to provide financing and training initiatives to foster cluster development Create national cluster platform as an information source for cluster firms in Switzerland to improve collaboration

3 Blockchain Industry Overview

Experts attest blockchain technology the great potential to change the way the world does business by reinventing processes across the business value chain (Deloitte, 2018). According to experts, the global blockchain technology has the potential to reach a market size of up to USD 60 billion by 2024 (Wintergreen Research, 2018). The strength of the technology lies in its ability to handle data-rich and transaction-heavy businesses with high trust based on a decentralized network of collaboration and computer code (Roland Berger, 2017). The ability to verify and store secure transactions decentral might make mediating institutions and “middlemen” redundant in the future (Roland Berger, 2017). While blockchain is not quite ready for prime time and yet has mostly been used for crypto currencies, it is getting closer to its breakout moment and the focus is shifting from learning and exploring the technology potential to identifying and building practical business applications (Deloitte, 2018). According to experts, blockchain technology has a high potential to enrich businesses like finance, insurance, smart-contracting, document authentication, decentralized storage, decentralized internet of things (IoT) and diverse internet applications (Crosby et al, 2016).

Excuse: What is Blockchain?

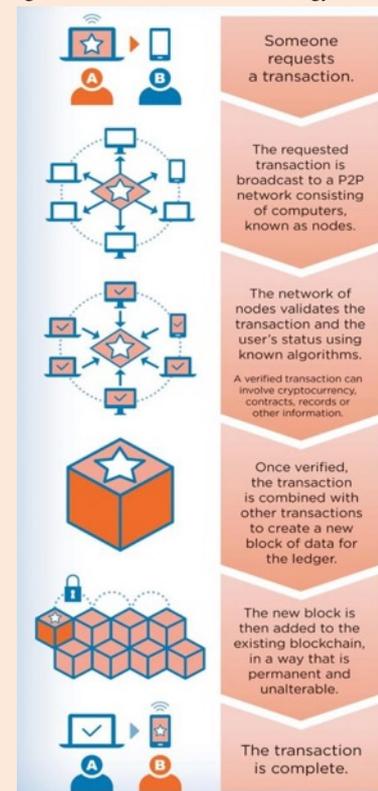
“A blockchain is a new type of database that enables multiple parties to share the database and to be able to modify that in a safe and secure way even if they don’t trust each other.”

Gideon Greenspan, CoinSciences (Multichain) CEO

The blockchain technology pursues the purpose to validate, safeguard and preserve digital transactions (Crosby et al, 2016). Accordingly, a blockchain is a shared, digital public ledger containing a complete list of transactions or digital events that have been executed among participating parties (Crosby et al, 2016). More specifically, the ledger consists of a chain of blocks each of which contains information about transactions that happened at the same time (Zheng et al., 2017). As a result, any time one or more transactions occur, a new block is attached and enhances the blockchain (Crosby et al, 2016).

One specific property of the blockchain ledger is that it is not stored centrally but shared, replicated, and synchronized among all members of a decentralized network such that each member has a duplicate of the whole ledger impeding manipulation (Brakeville & Perepa, 2018). Furthermore, there is no need for a central authority or third-party mediator between transaction parties since the network participants govern and agree by consensus on updates to the ledger records i.e. validate the authentication of transactions (Brakeville & Perepa, 2018). Any transaction in the distributed ledger gets a timestamp and a unique cryptographic signature and thus, making the ledger a decentral-stored, auditable, persistent, and anonymous history of all transactions in the network, making mediating institutions redundant (Brakeville & Perepa, 2018).

Figure 5: How blockchain technology works



Source: <https://www.csbj.com/2018/01/19/behind-news-blockchain-explained/>

4 Major Global Blockchain Clusters

Since the blockchain and cryptocurrency hype in recent years, some countries took the lead in the landscape of global blockchain ecosystems. Especially Switzerland and Singapore have fostered the

development of blockchain clusters by establishing a favorable regulatory business environment for the emerging industry. Besides some regulatory uncertainty, the Global Startup Ecosystem Report (Startup Genome, 2018) moreover identifies the United Kingdom, the USA, as well as Estonia as some leading blockchain tech clusters.

Excuse: What is an ICO?

ICO, also referred to as Initial Coin Offering, is a fundraising method based on the blockchain technology. The basic idea behind an ICO is comparable to a traditional IPO (Initial Public Offering) where the intention is to get access to capital in exchange for shares of the company. However, some important key differences apply (EY, 2018b):

Firstly, an ICO does usually not offer shares of the company. Instead, they offer tokens which is an entity with a value specified by the eminent. According to FINMA (2018), three types of tokens can be distinguished:

- Payment tokens are used as a means of payment (e.g. cryptocurrency)
- Utility tokens provide access to an application or service in a blockchain based infrastructure of the issuer
- Asset tokens represent assets such as debts or equity claims on the issuer (e.g. share of future earnings)

Secondly, an ICO is less (or not at all) regulated because it is unclear whether traditional financial market regulations are applicable. This has led to the ban of ICOs in some countries (e.g. China) while other have applied liberal regulatory approaches (e.g. Switzerland, Singapore).

Thirdly, in most of the cases an ICO does not imply a legal claim against the issuer of the token and therefore the success of an ICO is based on the investor's speculation that the token will increase in value (i.e. the focal blockchain application will get more popular and demand will lead to higher prices for tokens).

Lastly, an ICO can be classified as a crowdfunding method, as mostly private, small scale investors are targeted. Since 2014, blockchain startups have raised a total volume of nearly USD 25bn using ICOs.

Since blockchain clusters mostly comprise of young startups, it appears difficult to use commonly known operating figures (e.g. revenue, employees) for the purpose of cluster comparison as they are not readily available. Instead, this report will use ICO volume and events in order to class Switzerland among other leading blockchain clusters in the world, as shown in Table 1. The comparison reveals that Switzerland, in fact, is among the leading blockchain hubs with regard to ICO volume and events. With 5% of global ICO events, the country has attracted 7% of ICO funds, which indicates above average valuation of the ecosystem. Only the USA has achieved a better ratio.

Table 1: Comparison of global blockchain tech clusters by ICO volume and events

Countries	Cities with highest concentration	Total ICO Volume (funds raised by end of 2018 in US\$ & share of global funds)		Total ICO Events (# of projects by end of 2018 & share of global ICO events)	
		Volume (US\$)	Share (%)	Events	Share (%)
USA	New York City, Silicon Valley	\$ 7 419 250 631	≈ 30%	701	≈ 14%
Singapore	Singapore	\$ 2 259 138 372	≈ 9%	511	≈ 10%
Switzerland	Zug, Zurich, Geneva	\$ 1 837 260 545	≈ 7%	237	≈ 5%
United Kingdom	London	\$ 1 286 536 209	≈ 5%	421	≈ 8%
Estonia	N.A.	\$ 817 577 306	≈ 3%	220	≈ 4%
Globally		\$ 24 763 283 637		4954	

Source: ICOBench.com - ICO Market Quarterly Analysis Q1 2019

5 Swiss Blockchain Cluster

Development. The Swiss blockchain tech cluster originated in the canton and eponymous city of Zug when blockchain technology became popular in 2009. Since then, the city has been able to attract numerous international blockchain and cryptocurrency companies. Formerly known as one of Switzerland's poorest cantons in the early 20th century, Zug initiated an important policy change in its tax system to improve the economic attractiveness of this region (Van Orsouw, 1994). As one of few cantons in Switzerland, Zug established the so called "holding privilege", which implies that holdings do not have to pay corporate taxes on earnings on a cantonal and communal level. Following these changes, prosperity began to flow into the canton and the city. With the introduction of the cryptocurrency Bitcoin in 2008 and the rising interest in its underlying blockchain technology many international blockchain and cryptocurrency companies identified Switzerland and primarily Zug as a favorable location to conduct their operations, due to its crypto-friendly regulation, and the favorable tax conditions (CVVC, 2019a). When the leading blockchain company Ethereum decided to locate its foundation and headquarters in Zug in 2014, the city gained a strong increase in its international recognition. As a consequence, many companies followed the example of Ethereum and settled in Zug, making the city and region a leading hub in blockchain and cryptocurrency technology, often referred to as Crypto Valley (CVVC, 2019a). Since then, the Swiss blockchain ecosystem has spread from Zug to regions all over Switzerland.

Current Situation. Today, the Crypto Valley extends over many cantons such as Zurich, Ticino, Geneva and Lausanne. The cluster comprises approximately 778 companies somehow related to blockchain and cryptocurrency technology. Over 50% of the companies are based in the canton of Zug (CVVC, 2019b). The activities of the companies in the cluster range from blockchain technology in the financial industry and data analytics through legal and consulting services to research and academia. In the last quarter of 2018, the number of companies participating in Crypto Valley increased by 20%, showing the continuous growth of the ecosystem. The top 50 companies in the cluster value a total of USD 20bn, including four unicorn companies worth over one billion dollars. The average rating of all 778 companies in the Crypto Valley is 27 million dollars (CVVC, 2019b). The entire Swiss blockchain industry employs over 3,300 people with 480 employees in the 50 largest companies. The 50 leading companies in the Crypto Valley account for almost 20% of the global blockchain and crypto market (CVVC, 2019b).

Figure 6 (p.12) shows a conceptualized map of the Swiss blockchain ecosystem which is the result of an in-depth analysis based on CVVC (2019c) ecosystem directory. The map illustrates all involved actors as well as their relationships within the ecosystem. A further specification of the most important actors can be found in Table 2 (p.13), including a brief description of their activities and examples of associated companies.

Figure 6: Cluster Map

Source: Own figure based on team analysis of CVVC (2019c) ecosystem directory

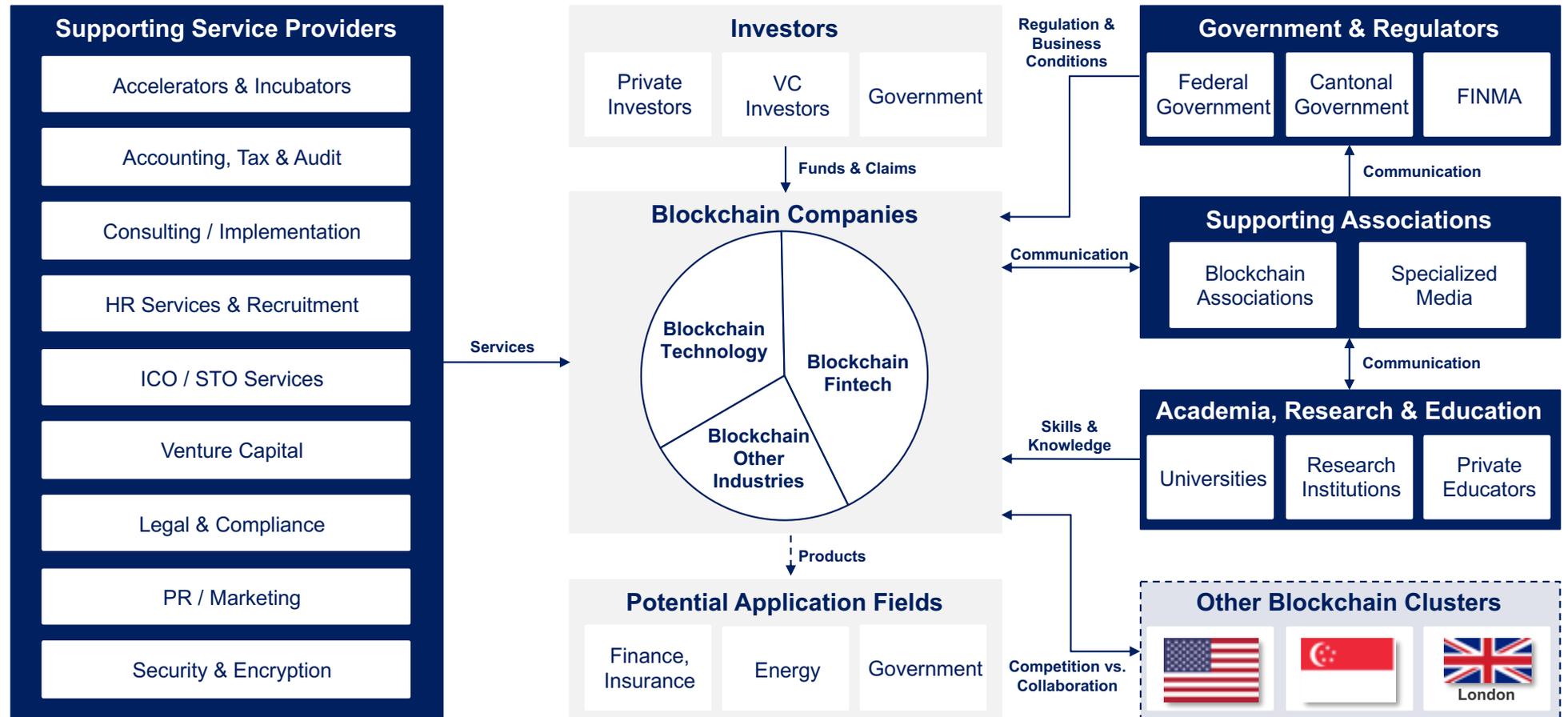


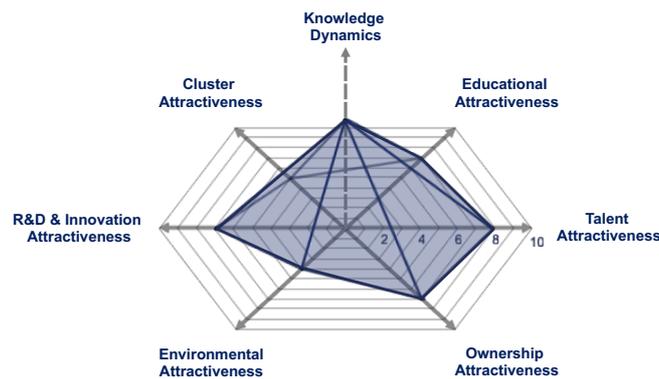
Table 2: Cluster Description

Source: Based on analysis of CVVC (2019c) ecosystem directory

Category	Description	Selected Sub-Categories	Important Members	# of Firms
Blockchain Technology	Development and improvement of the core blockchain technology	Mining, Platform & Protocol, Data & Analytics, AI, IoT, Hardware & Infrastructure		153
Blockchain FinTech	Application and utilization of blockchain technology to develop or disrupt financial industry products	Lending & Funding, Asset Management, Investment, Broker, Trade & Exchange, Crypto Tokens, Wallet & Vault		197
Blockchain Other Industries	Application and utilization of blockchain technology to develop or disrupt other industries	E-Government & Personal Data, InsurTech, RegTech & LegalTech, Transports and Supply Chain		109
Government & Regulators	Providence of liberal regulatory environment for ICOs and blockchain technology in Switzerland	Federal and Cantonal Government, FINMA		3
Supporting Associations	Providence of networking opportunities, knowledge exchange, collaboration among research and blockchain companies; Providence of policy recommendations for regulators	Associations, Specialized Media, Events		48
Supporting Service Providers	Providence of supporting services for the companies (mostly startups) in the ecosystem, e.g. ICO related services, Incubators & CO-working space	Accelerators, Incubators, ICO/STO Services, Legal & Compliance, PR/Marketing, Security & Encryption, VC		233
Research & Education	Research and education in the field of blockchain technology; Providence of training opportunities for blockchain entrepreneurs and companies; Education of new talents for the cluster companies	Universities, Research Institutions, Private Educators,		34

6 Emerald Model

Figure 7: Emerald Model of Swiss Blockchain Tech Cluster



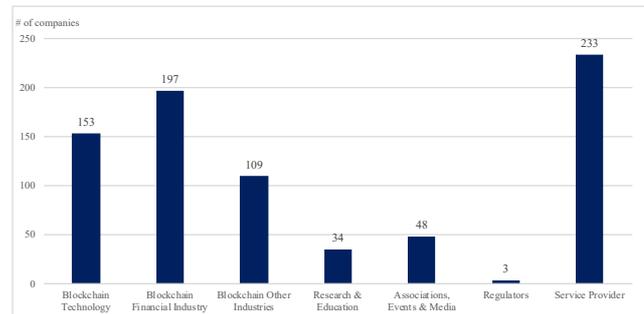
Source: Group analysis

6.1 Cluster Attractiveness

The cluster ranks moderate in the dimension of cluster attractiveness. A sufficient degree of completeness and cluster concentration fosters a favorable environment for blockchain startups with obstacles in the availability of coding and banking services. Furthermore, a high potential is foreseen for the cluster, while the realization of value has been a significant problem for the whole blockchain industry. A central cluster organization for representation of the entire ecosystem is missing.

Cluster Completeness. For the focal cluster it is difficult to evaluate the cluster completeness based on traditional value chain concepts, as those do not seem to apply. The analysis of CVVC (2019c)’s ecosystem directory revealed that a total of 778 organizations are part of the blockchain ecosystem in Switzerland. A large

Figure 8: Composition of the ecosystem by company category



Source: Own analysis based on CVVC (2019c) ecosystem directory

amount of service providers, research & education institutions, as well as cluster associations have developed over time and support the Swiss ecosystem of blockchain firms, as shown in figure 8. Especially the big share of service providers enables the blockchain firms to grow (e.g. incubators, accelerators) or to receive support for ICO initiatives¹. The landscape of blockchain firms covers different areas, from companies dealing with the core technology towards others that try to apply the technology in a variety of industries. The analysis, however, revealed that there are two main issues with regard to cluster completeness². Some services, such as coding firms and banking services for crypto companies, are only limitedly represented in the cluster. Indications were found that Swiss blockchain firms occasionally take on a distributed work model as blockchain coding skills are scarce

¹ Insight from the interview with Christian Flasshoff (Blockchain expert and consultant at Frankfurt School of Finance & Management Blockchain Center) on April 11, 2019

² Insight from the interview with Stefan Klauser (ETH Zurich; Lead Digital Society/ Finance 4.0; Board member of BlockchainX Initiative; Co-founder of Blockchain School of Sustainability) on April 16, 2019.

landscape of blockchain firms and supporting services. Hence, the cluster concentration is moderately high as there is some spread among the country, while simultaneously it is limited to some hubs. However, an issue that was identified during the analysis that is partially related to the spread of the cluster is the pure number of associations. The cluster contains over 20 associations that are located all over Switzerland (see figure 9) and try to support the ecosystem by fostering collaboration, bundling the ecosystem's interest against the government, and enhance knowledge exchange. Some of those associations have focused on regional parts of the ecosystem, while other claim to represent the cluster on national or international level. Though, none of the associations has yet achieved the legitimacy or status of a cluster organization for the whole ecosystem, making it difficult for third parties to approach the cluster. So far, this has worked sufficiently as the interest of blockchain firms has been properly represented towards the government, resulting in favorable regulatory adjustments Switzerland (Atkins, 2018). Yet, from a long-term perspective a cluster organization is needed to ensure coordination of cluster efforts and an appropriate representation in the international blockchain industry.

6.2 Educational Attractiveness

The report analyzes the attractiveness based on how the educational institutions in the cluster are able to attract local as well as foreign students and to what degree blockchain technology is included into academic programs. It is found that the Swiss blockchain cluster scores considerably high, due to the prestigious universities and institutions in the region that attract students from around the world due to their excellent international reputation. The institutions are at an early stage when it comes to the implementation of blockchain into the academic curriculum.

Educational Institutions. The region of the Swiss blockchain cluster is home to numerous prestigious institutions such as the University of St. Gallen, the University of Zurich, ETH Zurich (ETHZ) and the Ecole Polytechnique Fédérale de Lausanne (EPFL). Particularly, ETHZ and EPFL are highly ranked in the subjects of engineering and computer science, which are of high relevance for employees in the blockchain industry (Lee, 2019). In computer science both universities rank among the ten best institutions in the world (THE, 2018). The share of students pursuing their education in those subjects has shown a steady positive development over the last years. The number of students enrolled in Computer & Communication Sciences (IC) at EPFL has increased by almost 57% over the last ten years (EPFL, 2017). On the master's level, the number of graduates in Engineering and Computer Sciences has increased by 20% at EPFL (EPFL, 2018) and by 19% at ETHZ from 2016 to 2018 (ETH Zurich, 2018). Both institutions benefit from their international reputation in attracting international students from across the world. At EPFL the share of foreign students pursuing their master's degree in IC increased by 52% over the last 5 years (EPFL, 2018),

while ETHZ records a total increase of foreign students by 7% on the doctoral and 16% on the master's level (ETH Zurich, 2018).

Implementation of Blockchain. Blockchain technology has become of increasing importance for Swiss universities. Most of the Swiss universities have developed own centers with a research focus on blockchain. In addition, institutions such as ETHZ and EPFL, cooperatively organize events, such as the Swiss Blockchain Summer School, with the intend to bring together students, academics and industry experts to discuss the future and opportunities of the technology (EPFL & ETHZ, 2017). ETHZ currently offers the course “Blockchain for Sustainability” in the curriculum of the spring term 2019 suited for students on the doctoral level (ETH Zurich, 2019b). Nevertheless, the implementation of blockchain into academic curricula is at an early stage, but indications suggest that Swiss universities plan to offer more blockchain related courses for students in the near future (Netherlands Enterprise Agency, 2018).

6.3 Talent Attractiveness

The cluster scores high in the dimension of talent attractiveness. In absence of any employee statistics or related data from the Swiss ecosystem, other indicators were used in the analysis. In fact, the blockchain cluster has an overall good stand in attracting talents due to the global hype about blockchain technology, high and intensive media coverage, as well as individual success stories from the Swiss blockchain cluster.

Global Blockchain Hype. Blockchain technology became popular after its application in the cryptocurrency Bitcoin. When Bitcoin reached a value increase of more than 75,000% within 5 years, a global hype about cryptocurrencies developed (Brenneis, 2017). Success stories made the round of early stage investors of Bitcoin currency who had become millionaires, disregarding the high volatility and risk involved in those currencies (Espiner, 2018) Nevertheless, experts soon realized the potential of the technology behind Bitcoin, namely blockchain, to revolutionize P2P transactions in numerous industries. Backed by a liberal regulatory environment in some countries (e.g. Switzerland, Singapore), startup founding rates of blockchain related firms in those countries skyrocketed. The hype was further fueled by the ICO funding mechanism that gave startups access to tremendous amounts of funding to realize their ideas, with low or no commitment towards the investors. Hence, the global hype of the technology, combined with the capital availability and the potential of the technology to revolutionize whole industries has attracted numerous talents, either as founders, employees of blockchain firms or in the supporting services (Albrecht, 2019). However, the recent decline in ICOs and the devaluation of blockchain firms might make it more difficult for blockchain firms to acquire talents in the future.

Cluster Reputation. For years, Switzerland has remained in its world-leading position in the Global Talent Competitiveness index (INSEAD, 2019) showing its overall good stand for attracting talents. The Swiss blockchain ecosystem is clearly benefiting from Switzerland's overall reputation and excellent educational institutions, that enable a natural density of talents close to the cluster. Zug, Switzerland's blockchain capital, shows some indications for having an excellent reputation. The city was recently appointed as Europe's fastest growing Tech community (Atomico, 2018) based on attendee growth for tech related meetups. Moreover, the cluster has created four unicorn firms and was valued at more than USD 44bn in 2018 (CVVC, 2018). Thus, even compared to other blockchain hubs in the world, Swiss-based blockchain companies seem to be attractive for talents.

6.4 Ownership Attractiveness

The Swiss blockchain industry has been very attractive for entrepreneurs to start their business, as they were able to attract large amounts of private investments. However, due to the strong decrease in ICO investments, startups will face challenges, trying to attract new sources of capital in the future.

Initial Coin Offerings. In the past two years, startups in the Swiss blockchain industry were able to attract large amounts of private investments, by using the crowdfunding tool of Initial Coin Offerings (ICOs). The reasons for the strong increase were mainly in the low regulation and the speculative nature of ICO funding (Allen, 2018). Yet, there has been an increased skepticism towards the concept of ICOs, as the low regulation and investor protection allowed for scam and fraud. In addition, rising death rates of ICO funded startups have been observed. Statistics show that up to 50% of Swiss startups founded in 2017 have already failed (Allen, 2018). As a consequence, ICOs in Switzerland have decreased drastically in volume from USD 728 million to USD 234 million between 2017 to 2018 (startupticker.ch, 2019). The decrease in ICOs goes along with a shift to the more regulated Security Token Offerings (STOs), which provide more financial rights to the investors, such as shares and dividends (PwC, 2019). The shift reduces the ease with which startups in the blockchain cluster can acquire capital, as STOs derive a higher degree of commitment from the issuer due to the possible assertion of legal claims by the investors.³

Traditional Venture Capital. Traditional venture capital investments into blockchain companies have been increasing in the recent years. Despite the increase in VC funding in 2017, especially in the Swiss FinTech industry, most of the funding was dominated through ICO, accounting for almost 70% of the capital raised in this sector (IFZ, 2018). The Swiss blockchain industry has established initiatives to attract more traditional venture capitalists in addition to ICOs, as they can provide competent capital, such as industry-specific know-how and managerial support. Initiatives include

³ Insight from the interview with Christian Flasshoff (Blockchain expert and consultant at Frankfurt School of Finance & Management Blockchain Center) on April 11, 2019

the founding of the investment company Crypto Valley Venture Capital, a consortium of Swiss investors (Allen, 2018), and the Swiss Entrepreneur Foundation, a venture capital fund, which aims to improve entrepreneurship and to foster technological innovation (SwissEF, 2019).

Government Investment. The support of startups in Switzerland is organized on a cantonal level. Startups have the opportunity to receive support through a variety of programs offered by the different cantons. The programs range from advisory services to financial support programs, such as debt financing programs and equity offerings. However, the extent of the support programs varies considerably between the cantons (Willimann & Godel, 2016).

6.5 Environmental Attractiveness

The Swiss blockchain cluster ranks medium regarding environmental attractiveness since it is currently quite ineffective regarding energy consumption but is said to have the potential for efficiency improvements in the future. It is not trivial to evaluate the environmental impact of an emerging cluster that is part of an emerging industry that develops blockchain technology. Therefore, the focal analysis relies on data available so far and focuses on energy consumption as a currently significant factor. Crypto currencies are based on blockchain technology and existing data resulted from enormous trading activities in the recent years. Bitcoin for instance, probably the most famous crypto currency, has an estimated annual electricity consumption of 55.76 TWh corresponding to 0.25% of the world's or 41.6% of Norway's electricity consumption (Digiconomist, 2019; NVE, 2018). The high energy consumption for such crypto currency transactions is clearly a significant critique for the blockchain technology and is caused by many network participants performing the same calculation work. The technology can therefore not yet compete with traditional methods and it is unclear whether the technology in general will have such a high energy consumption. However, there are other fields where the blockchain technology is expected to improve the efficiency of processes. In the energy sector for instance, experts suggest that the technology can improve record keeping and payment methods (Say, 2019). The technology is said to have a great potential for efficiency improvements but has to prove whether these can outweigh the high electricity consumption in the future, which will greatly determine the cluster's environmental attractiveness.

6.6 R&D and Innovation Attractiveness

The cluster scores moderately high regarding R&D and innovation attractiveness and there is further potential in ICT research in general and especially field of blockchain. As a high cost country Switzerland's value creation proposition is based on the combination of unique knowledge resources and the strength of this capability can be evaluated by looking at factors like scientific papers and patent registrations (Reve & Sasson, 2012).

Blockchain. The high research interest in blockchain is highlighted by a VC firm's directory that contains 34 research and education institutions as being active in blockchain research (CVVC, 2019c). Swiss universities have dedicated attention to blockchain research and started to establish blockchain research programs. An issue which was indicated in an interview is that research could still be better coordinated and research results more rigorously shared between the different institutions.⁴ However, since there is only few data available regarding blockchain research in Switzerland, the analysis will rely on the highly-related information and communication sector as an indicator for the R&D and innovation attractiveness of the blockchain cluster.

ICT. As outlined in the first section of this paper, Switzerland is an outstanding country in research and innovation in general which is granted by high levels of scientific papers and patent registrations per capita. Although information and communication technology (ICT) is a minor part of Switzerland's research areas, Switzerland's impact in ICT research measured by citations is quite high and approx. 3.2% of Swiss Ph.D. holders have an ICT background (SERI, 2018, p.12, 29). In 2015, Switzerland's ICT research accounted for 0.7% of global scientific publications in ICT and has achieved a growth of 35% compared to the period 2011-2015 (SERI, 2018, p.51, 53). Between 2012 and 2015, 15.1% of Swiss patents had a relation to ICT which corresponds to a 1.5% increase compared to the period from 2002 to 2005 (SERI, 2018, p.51). Nevertheless, there is room for improvements in Swiss ICT research indicated by Swiss firms spending only 17.6% of expenditures for ICT R&D which is below the OECD average (SERI, 2018, p.51).

6.7 Knowledge Dynamics

While the Swiss blockchain cluster is establishing active connections and linkages to international blockchain ecosystems and correlating clusters in Switzerland, such as the FinTech cluster, the collaboration between the companies within the cluster itself shows potential for improvement.

Collaboration within the Cluster. The analysis revealed that there seems to be potential for improvement, when it comes to collaboration and knowledge linkages between the companies and organizations within the cluster itself. While the concept and potential of blockchain as a decentral, disruptive technology is based on the idea of active knowledge exchange and open source development, there are indications that this idea is not yet accepted and realized by various players in the cluster.⁵ While there are projects between individual companies and research institutions, there seems to be only limited collaboration between larger groups of the cluster. The main reasons for this might lie in diverging interests and business directions of the different companies when it comes to

⁴ Insight from the interview with Stefan Klauser (ETH Zurich: Lead Digital Society/ Finance 4.0; Board member of BlockchainX Initiative; Co-founder of Blockchain School of Sustainability) on April 16, 2019.

⁵ Insight from the interview with Stefan Klauser (ETH Zurich: Lead Digital Society/ Finance 4.0; Board member of BlockchainX Initiative; Co-founder of Blockchain School of Sustainability) on April 16, 2019.

the usage of blockchain technology e.g. banks and startups. In practice there have been efforts by associations to foster knowledge exchange and to unite the interests of different industry groups that faced difficulties in the execution. However, current developments in blockchain technology offer the industry a new opportunity for knowledge transfer, such as the nature of employment of blockchain developers. Working for companies on a project basis rather than on fulltime employment allows for a high labor mobility in the blockchain industry. This gives firms the opportunity to draw on a wide range of experience from blockchain developers all over the world (Lee, 2019).

Complementary Clusters. The Swiss blockchain cluster has strong linkages to the FinTech ecosystem, which is primarily located in the region of Zurich. With FinTech being a main area of application for blockchain technology a variety of companies in the blockchain cluster focus on the development of the technology in the financial industry. Two FinTech associations account to the blockchain ecosystem, that link blockchain technology to the financial industry with the objective to drive innovation and collaboration in the two sectors and to share industry-specific experience and expertise (Swiss Fintech Innovations, 2019). To achieve that, associations from both ecosystems organize and support projects and events, for example the CV Summit in Zug. There is potential for similar collaborations with other Swiss clusters, such as the HealthTech cluster located in Lausanne and Geneva.

International Collaboration. The Swiss blockchain cluster is currently establishing active connections to other major blockchain ecosystems. Looking at international partnerships with global blockchain hubs in Singapore, New York and London, associations in the Swiss blockchain cluster play a major role in establishing these connections for knowledge exchange and collaboration. In 2018, the Swiss-based Global Blockchain Business Council, with locations in Geneva, Washington, and New York, participated in over 50 events across the globe to discuss and improve the development of blockchain technology with global entrepreneurs and regulators (GBBC, 2019). The same year Crypto Valley Association hosted the Crypto Valley Conference on Blockchain Technology in the city of Zug that attracted over 650 Swiss and international visitors (Crypto Valley Association, 2018). In addition, companies and associations of the Swiss blockchain cluster increased their presence in global blockchain events, such as at the Singapore FinTech Festival, to foster and strengthen the connections to Southeast Asia (SG-E, 2018).

6.8 Recommendations for the Cluster

Challenges	Recommendations
Absent Value Creation <ul style="list-style-type: none"> ▪ Flagship projects needed to underline value potential for 3rd parties ▪ Arising impatience among investors 	<ul style="list-style-type: none"> ▪ Foster the main idea of innovation, entrepreneurship and open-source development ▪ Leverage on and promote blockchain industry flagship projects that show the potential value addition of blockchain technology for business applications and society
Research Coordination <ul style="list-style-type: none"> ▪ Lack of communication and collaboration among academic institutions regarding research activities 	<ul style="list-style-type: none"> ▪ Establish a cluster association that is dedicated to: <ol style="list-style-type: none"> a) Coordination of research between different institutions; b) Establishment of research/development projects across institutions/firms c) Fostering of communication and collaboration between research institutions and cluster firms.
Capital Access for Blockchain Startups <ul style="list-style-type: none"> ▪ Access to/Lack of competent VC capital ▪ Shift from ICO to STO might reduce capital availability due to higher restrictions (“end of the hype”) 	<ul style="list-style-type: none"> ▪ Startups should attract competent capital from VC firms by: <ol style="list-style-type: none"> a) Providing clear information about their blockchain vision; and b) Providing a fundamental concept for the development phase; ▪ Advisory firms should provide consulting services for the STO fund raising approach
Number of Cluster Associations <ul style="list-style-type: none"> ▪ Numerous associations complicate representation of cluster interest and international participation 	<ul style="list-style-type: none"> ▪ Establish an ultimate cluster organization with the following mission: <ol style="list-style-type: none"> a) Consolidation of interests among existing associations; b) Creation of a vision and milestones; c) Representation of the cluster in international contexts and Coordination of events/activities

7 Concluding Remarks

For us, the authors, this project was a great opportunity to apply course concepts to a novel and widely unexplored cluster. Due to the emerging character of the ecosystem, data access was limited, and our evaluation of the cluster’s competitiveness was subject to intense group discussions on how to link available data from other contexts to the cluster. In addition to the analysis of industry reports, newspaper articles and databases, interviews served as an important source. We especially want to thank *Stefan Klauser* and *Christian Flasshoff* for interesting and relevant insights into the Swiss blockchain ecosystem and the overall blockchain industry.

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9 Appendix: The Swiss Blockchain Tech Cluster – PowerPoint Presentation



The Swiss Blockchain Tech Cluster

Overview Switzerland ▪ Switzerland's Competitiveness ▪ Blockchain Cluster ▪ The Cluster's Competitiveness & Recommendations

Presentation by:
Daniel Becker, Fabian Spieß, Jonathan Rau

Prepared for:
Torgler Reve

GRA 6829 - Strategies for Industrial Competitiveness



Country Overview Switzerland

Prosperous, Modern and Liberal Market Economy Based on a Strong Service Sector



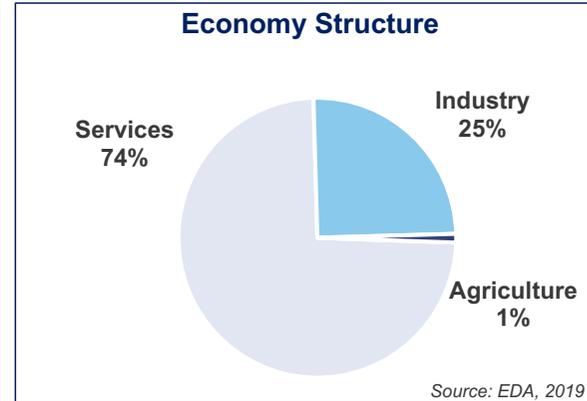
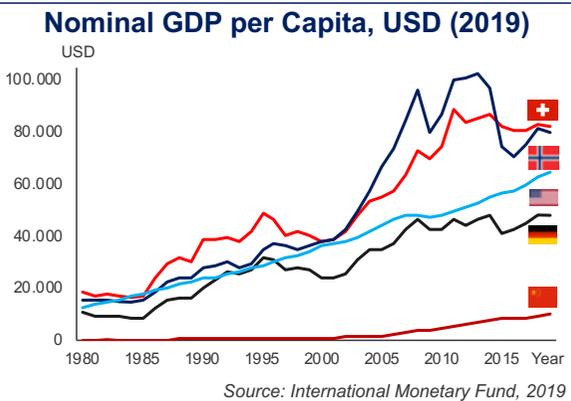
General Information

- **Federal state** divided in 26 independent and sovereign cantons
- Capital: Bern
- Population of **8.48 million**; 37.2% migration background
- **Non-EU member** but in the Schengen area
- Bordered and landlocked by Germany, Austria, Lichtenstein, Italy, and France
- **4 Official languages:** German, French, Italian, and Romansh



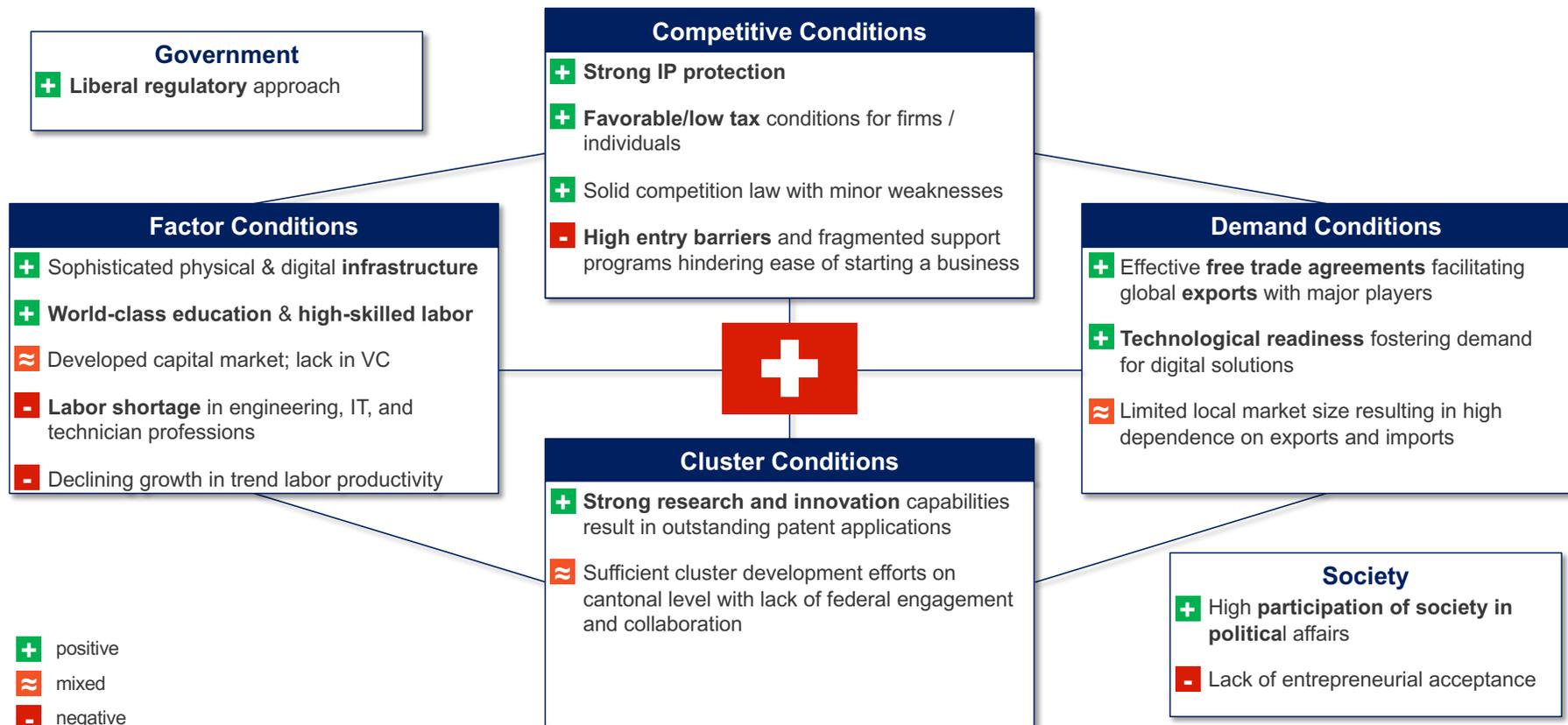
Economic Information

- Per capita GDP of USD 82,412 (2019)
- Major industries: **Finance, life sciences, manufacturing**, watch production
- **Exports** generate ~65% of GDP (2017)
- 99% SMEs with less than 250 employees but few famous global players



Diamond Model: Assessing Switzerland's Competitiveness

Favorable Environment for Digital Industries Beyond Tax Advantages



Challenges and Recommendations for Switzerland

Attract Skilled Labor, Foster Entrepreneurship, and Establish Federal Cluster Policy

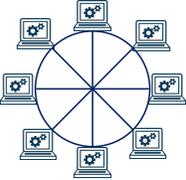
Challenges	Recommendations	Urgency
<p>Labor Shortage</p> <ul style="list-style-type: none"> Acute shortage of skilled labor in engineering, technician and IT professions 	<ul style="list-style-type: none"> Establish an immigration program attracting skilled people Simplify formal immigration procedure Abolish rules requiring employers to prioritize Swiss citizen over EU citizen Abolish third-country immigration quotas for skilled labor 	
<p>Below OECD average productivity growth</p> <ul style="list-style-type: none"> Declining trend productivity growth Two-speed economy due to high R&D and innovation concentration in few firms 	<p>Foster Innovation & Entrepreneurship</p> <ul style="list-style-type: none"> Reduce and simplify bureaucratic processes of starting a business Initiate entrepreneurship programs in schools to increase and foster early acceptance of entrepreneurship in society Establish uniform information point that of contact that informs about governmental support for entrepreneurs 	
<p>Entry Barriers and Entrepreneurship</p> <ul style="list-style-type: none"> Administrative obstacles to start a business Low Public Acceptance of Entrepreneurship Fragmented governmental support programs 	<ul style="list-style-type: none"> Make cluster development a priority in federal economic policy Establish federal cluster policy to provide financing and training initiatives to foster cluster development Create national cluster platform as an information source for cluster firms in Switzerland to improve collaboration 	

Crash Course: Blockchain Technology

A New technology with Potential to Disrupt Entire Industries – [Clip](#)

What is Blockchain Technology?

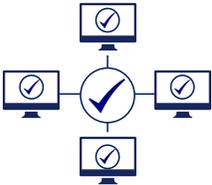
Decentralized, Distributed Ledger



Chain of Blocks with Transactions

123 939 871 049 098 234 870 374 087 989 123 200 102 409 393	123 939 871 049 098 234 870 374 087 989 123 200 102 409 393	123 939 871 049 098 234 870 374 087 989 123 200 102 409 393
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Transaction Validation by Consensus Agreement of Network Participants



Auditable, Persistent, and Anonymous Ledger



An Exemplary Blockchain Transaction



Two parties agree on a transaction and request its validation



The network validates and authenticates the transaction

Once verified, the transaction with others is stored in a block



The new block is persistently added to the chain



The Swiss Blockchain Cluster at a Glance

An Emerging Cluster with Significant Growth in the Recent Years

Cluster History

1921: Canton of Zug established "holding privilege" in tax system

2009-2013: Companies start to move operations to Switzerland

2017: "Crypto Valley" spreads from Zug across Switzerland

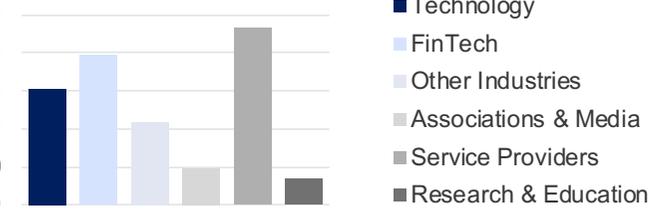
2008: Introduction of Bitcoin initiates rising interest in blockchain

2014: Ethereum locates headquarters in Zug



Cluster Composition

of firms



Source: Own analysis based on CVVC (2019c)

Key Figures

- **Over 50%** of the cluster's companies are based in the canton of Zug
- In Q4 of 2018 the number of companies in Crypto Valley **increased by 20%**
- The **average rating** of all companies in the Crypto Valley is **USD 27 million**
- The **top 50 companies** value at a total USD 20 billion
- In the top 50 companies include **four unicorns**
- The Swiss blockchain cluster **employs > 3,300 people**
- The top 50 companies account for almost **20% of the global blockchain market**

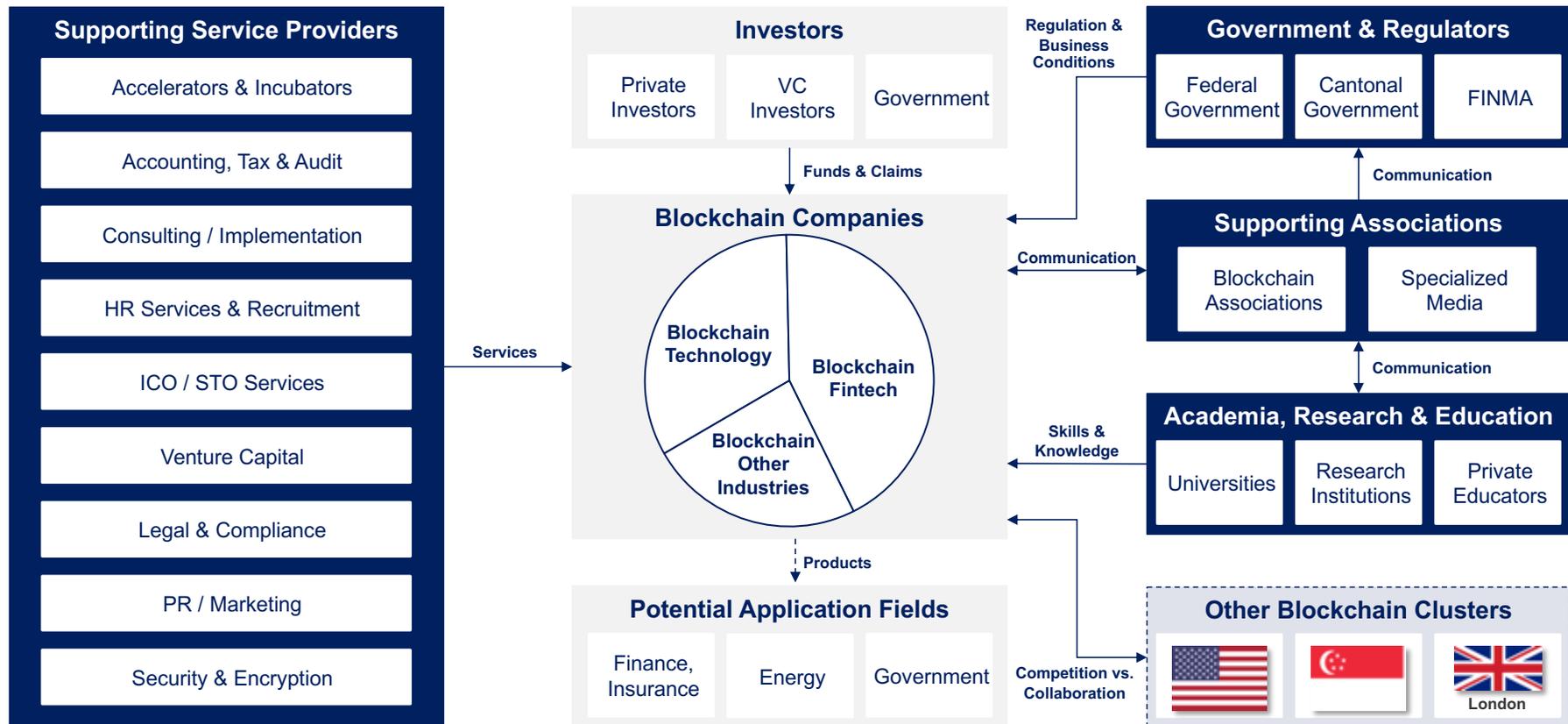
Geographical Firm Concentration



Source: CVVC (2019b)

The Swiss Blockchain Cluster Map

Ecosystem Comprising of many Supporting Firms and Stakeholders



Emerald Model: Assessing the Cluster's Competitiveness

Lack of Visible Value Creation, Decreasing ICO Trends, and Limited Collaboration in R&D as major Obstacles

Cluster Attractiveness

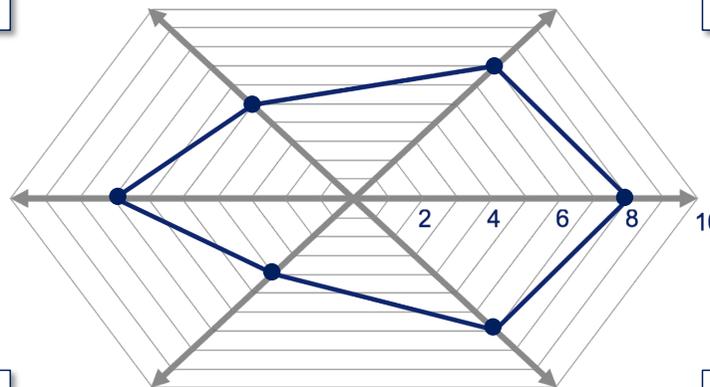
- + High degree in **cluster completeness**
- + High potential of blockchain technology
- As yet **absent value creation** of blockchain

Educational Attractiveness

- + **World-class institutions** in computer science
- + Increase in national and foreign students in the field of ICT
- Potential in the field of blockchain

R&D & Innovation Attractiveness

- + Many research institutions engaged in blockchain technology
- + Above avg. **position in ICT research**
- Lack of **coordination** between different **research institutions**



Talent Attractiveness

- + **Blockchain hype**
- + High and intensive **media coverage**
- + Individual success stories of Swiss blockchain entrepreneurs

Environmental Attractiveness

- + Potential to improve efficiency and reduce energy consumption
- Enormous current **energy consumption** based on data available for crypto currencies

Ownership Attractiveness

- + Formerly good capital access by ICOs
- + Initiatives to attract traditional VC
- Shift from ICO to STO **weakens ease to get access to capital**

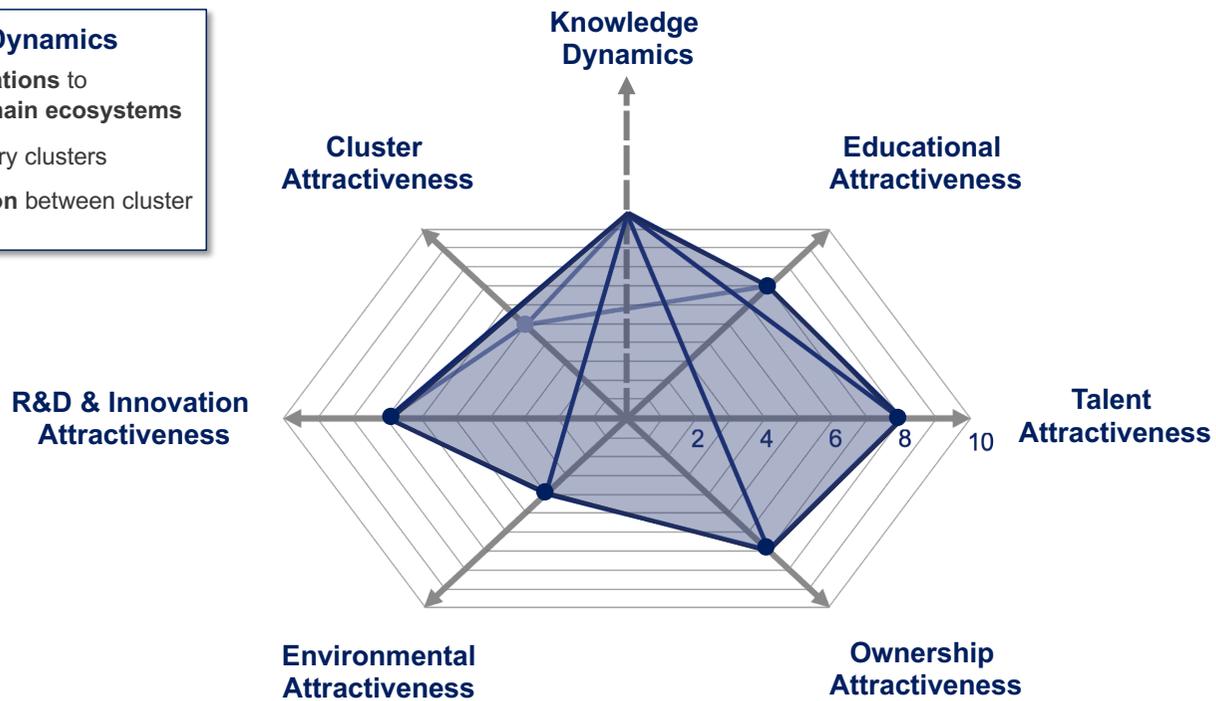
+ positive
- negative

Emerald Model: Assessing the Cluster's Competitiveness

Moderate Knowledge Dynamics with Potential for Improvement

Knowledge Dynamics

- + Establishment of **relations** to international **blockchain ecosystems**
- + Ties to complementary clusters
- **Lack of collaboration** between cluster firms



+ positive
- negative

Challenges and Recommendations for the Swiss Blockchain Tech Cluster

Establish Ultimate Cluster Organization, Collaborate on Flagship Projects and Explore New Sources of Funding

Challenges	Recommendations	Urgency
<p>Absent Value Creation</p> <ul style="list-style-type: none"> Flagship projects needed to underline value potential for 3rd parties Arising impatience among investors 	<ul style="list-style-type: none"> Foster the main idea of innovation, entrepreneurship and open-source development Leverage on and promote blockchain industry flagship projects that show the potential value addition of blockchain technology for business applications and society 	
<p>Research Coordination</p> <ul style="list-style-type: none"> Lack of communication and collaboration among academic institutions regarding research activities 	<ul style="list-style-type: none"> Establish a cluster association that is dedicated to: <ol style="list-style-type: none"> Coordination of research between different institutions; Establishment of research/development projects across institutions/firms Fostering of communication and collaboration between research institutions and cluster firms. 	
<p>Capital Access for Blockchain Startups</p> <ul style="list-style-type: none"> Access to/Lack of competent VC capital Shift from ICO to STO might reduce capital availability due to higher restrictions (“end of the hype”) 	<ul style="list-style-type: none"> Startups should attract competent capital from VC firms by: <ol style="list-style-type: none"> providing clear information about their blockchain vision; and providing a fundamental concept for the development phase Advisory firms should provide consulting services for the STO fund raising approach 	
<p>Number of Cluster Associations</p> <ul style="list-style-type: none"> Numerous associations complicate representation of cluster interest and international participation 	<ul style="list-style-type: none"> Establish an ultimate cluster organization with the following mission: <ol style="list-style-type: none"> Consolidation of interests among existing associations; Creation of a vision and milestones; Representation of the cluster in international contexts and Coordination of events/activities 	