



SPACE CLUSTER ANALYSIS

the Gothenburg Region



BUSINESS REGION
GÖTEBORG

Gothenburg – Sweden’s innovation powerhouse

The Gothenburg region is one of the world’s most inventive and resourceful regions, and Sweden’s innovation powerhouse. The region possesses a vibrant, growing business community with well-established collaboration focused on world-leading innovation and research.

The region boasts cutting-edge expertise in a range of industries, two top-ranked universities, research institutes such as SEEL, AI Innovation of Sweden and RISE Research Institutes of Sweden, the national research institute and innovation partner, and a city that works actively at every level to address future societal challenges and contribute to sustainable development.

Gothenburg is a leading research region characterised by large knowledge-intensive companies and close collaboration between the private, public and academic sectors. The Gothenburg region is ranked as one of the most innovative regions in the EU, according to the European Commission, and in terms of patents per capita, Gothenburg is among the top 15 most inventive cities in the world.

One third of Sweden’s total R&D investments within the private sector are made in the Västra Götaland county, which is the highest among Swedish counties and a significant portion of this is in the Gothenburg region. It’s therefore fair to say that Gothenburg is the innovation powerhouse of Sweden. The majority of Sweden’s testbeds are also located in the region. This has helped to transform Gothenburg from a predominantly industrial city into a fast-growing and globally connected hotspot for innovation and sustainable development

Clusters and business development

Amidst global competition, it is becoming increasingly important for the Gothenburg region to support strong clusters and create shared innovation environments, which are also attractive to the outside world. Experience shows that well-functioning collaboration between business, academia, and the public sector is the key to successful industry development. Collaboration between all operators in the cluster model needs to be well-functioning.

We work for the Gothenburg region’s business community by stimulating the emergence of clusters and strengthening collaboration in industries with growth potential.

Collaboration methods may vary depending on the different conditions in the industries.

We identify which relationships and partnerships must be established or strengthened for an industry to develop and create growth. This can involve collaboration and contact between companies and research or investors, as well as between small and large companies and with other clusters – not least internationally to increase competitiveness in the global market.

Clusters enable companies and even the public sector to be more innovative than they can be on their own.



The cluster model.

1.

What is the space cluster?

The space cluster covers research, development, manufacture and use of space-related products and services. Overall, the space cluster contributes to exploring the unknown; creating products and services for society and engendering indirect positive effects.

Actors in the space cluster help us understand the most fundamental questions about our existence. They contribute with services such as telecommunications and positioning systems and create innovations that are subsequently taken up in other ways by society (e.g. mobile cameras, ear thermometers, Velcro, Tempur® pillows, scratch-resistant optical lenses and wireless headphones¹).

Segments and value chain

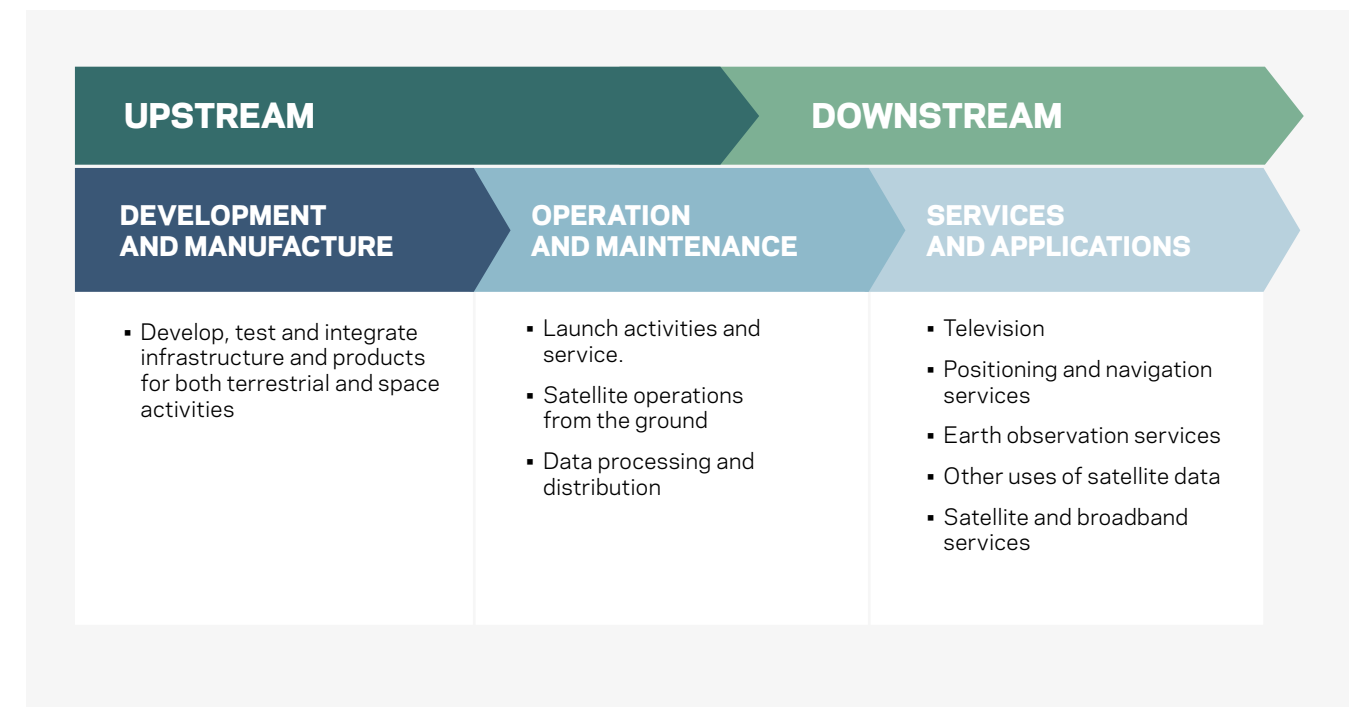
The space industry primarily comprises three segments: (1) development and manufacturing, (2) operation and maintenance and (3) services and applications.

Development and manufacturing include the businesses that develop, test and integrate infrastructure and products for both terrestrial and space activities. Some examples are the development and manufacture of products for launch platforms, carrier rockets, support systems, sensors and appertaining services.

Operation and maintenance include businesses centred on rocket and satellite launch and ground control for monitoring, controlling and communicating with satellites and other orbiting spacecrafts.

Based on launched satellites and spacecrafts, **services and applications** are subsequently created and used in society. Television, positioning services and other uses of satellite data are just a few examples.

Space businesses are often described using the terms upstream and downstream. Upstream is providing technologies that enable terrestrial and space activities, while downstream is using these technologies for commercial and societal benefit. Operation and maintenance (i.e. launches, data processing, etc.) are necessary for exploiting the developed and manufactured technologies.



¹ <https://rymdkollenlive.hbgdesignlab.io/visste-du-att/>

2.

Trends and challenges affecting the cluster

There are a number of global factors affecting the space sector. Standardisation of components, increased percentage of private operators and space becoming an ever more political arena are just a few that are judged to be significant for its future development.

Technological development

As regards technological development, the standardisation of components and products is playing a major role, as also the streamlining of manufacturing and integration processes (because they contribute to development and manufacture that are more cost-efficient). Cost reductions are helping more operators and countries to become active in the space sector. Access to space exploitation is increasing and it is becoming cheaper to launch rockets and satellites.

Commercialisation

Lately, primarily owing to enabling technologies, commercialisation of the space sector has taken an upswing with an increased percentage of private operators. Getting into space is becoming both cheaper and easier. Consequently, commercial operators are choosing to get involved in space businesses. The financial potential inherent in connection and data is constantly increasing and attracting private investors.

Political interests

Space is becoming an increasingly political arena with many countries showing great interest in participating in the space industry's development and enjoying the societal benefits this creates. As things now stand, certain areas of space are already crowded and the question of entitlement to launch new satellites has become more pressing.

Furthermore, issues regarding security are becoming increasingly urgent. Earth observations can be used for, amongst other things, following military actions and refugee movements. Images of these gained global dissemination through Maxar's detailed satellite pictures during the invasion of Ukraine. Additionally, recent years have seen the start of initiatives for military defence in space. For example, Sweden's Air Force has been put in charge of designing and developing a Swedish space defence system. Just one of the things to be contended with is the increasing threat of the development of systems that can neutralise satellites and thereby knock-out vital societal functions in other countries.

Furthermore, as it is now possible to carry out space tests that affect other nation's interests, there are currently more discussions regarding issues of consideration than was previously the case. Questions around how certain incidents should be handled and how space is to be regulated have become more topical.

Other challenges that generally affect technology-intensive industries (e.g. shortage of semi-conductors and certain minerals for production) also impact the space industry.

New operators changing the playing field

In recent times, the space industry has attracted greater interest from commercial operators, SpaceX being one of the most well-known cases. Commercial operators have now started to establish themselves in everything from transport and the International Space Station (ISS) to preparation of moon bases, space tourism and exploitation of resources in space. Increased interest in space has contributed to increased competition, increased innovation and lower costs for developing and launching satellites and spacecrafts. It is also contributing to more jobs in the space industry. This is leading to greater knowledge and expertise and more company start-ups.

Space tourism, with private individuals being able to buy space voyages, is just one thing to have attracted greater interest in recent years. There are three generally recognised types of space tourism: (1) short voyages to experience space, weightlessness and the view; (2) trips to existing space stations, or in the long term, the moon and Mars; and (3) private individuals staying a few days in space hotels, i.e. modules orbiting Earth.

With the planning of long space voyages (e.g. to Mars), the requirements in respect of space capsule interiors are sterner. Long distance space voyages generally bring all sorts of new perspectives and requirements regarding: how we are to look at space voyages; and, how people are to live either in space during long trips or, ultimately, on other planets. Several operators have started exploring these issues, which has provided a basis for new thinking and innovation.

Starlink, a satellite project initiated by SpaceX, is something else affecting the playing field. The project aims to provide the whole world with internet connection by linking up more than 40,000 satellites. Using this technology, private individuals can have internet even in oppressed countries with limited internet access or countries with poorly developed internet infrastructure. The large number of satellites required has hastened launch developments.

Market and customer changes

Viewed historically, large long-established companies and public authorities have pushed development in the space sector and then commercialised the results. However, things have now evolved so that commercial innovations are also a driving factor for traditional space activities. It is said that the space sector has split into two areas, i.e. **Traditional space** and **NewSpace**.

Traditional space is powered by the investments of a handful of countries. It predominantly comprises large long-established companies and public authorities that develop solutions for state organisations (e.g. defence, NASA, etc.). This area largely centres around developing and carrying out complex missions.

NewSpace is driven by both commercial and state investments and companies that, partly or wholly, work independently of public authorities and major entrepreneurs. The area is characterised by technology and business model innovations that enable considerable cost reductions and the development of new products and services. The products and services developed within NewSpace are now also used in traditional space business (e.g. defence). This has resulted in standardisation and greater cost-efficiency.

Traditional space, its infrastructure and the technology it has developed, are the basis of NewSpace. Even if private investment is increasing ever faster, state investment remains important for the space sector's development and success.

Important conditions for the cluster

State investment in space exploration and development is important for initiating commercial space businesses. State funding is important for the industry and, historically, has often been the impulse behind today's major commercial operators. Especially at the start of initiatives, state funding is important for promoting innovative systems and new innovations. Additionally, many private companies depend on state space programmes in the shape of customers such as NASA and ESA. At the same time, state operators are becoming increasingly dependent on private organisations to supply technology and services. Getting into international collaborations is seen as essential not only for established companies, but also for the creation of growth and development opportunities for small and medium-sized enterprises.

However, getting into European initiatives run by ESA (where financing is merit-based) is regarded as difficult. At the same time, admission to ESA projects (with their access to expert know-how) is also seen as good marketing. ESA member countries assess that for each SEK 1 invested in ESA, national companies reap a return of SEK 1.4 - SEK 4.8 in increased turnover (e.g. via technology dissemination).

Space trends

One ongoing trend is increased launching of satellites to satisfy downstream services, i.e. business and societal applications and services made possible by satellites. It is estimated that, in 2021, the global space industry's turnover was USD 395 billion, around USD 317 billion of this being linked to the satellite industry and the services, applications and indirect effects flowing from said industry². Simultaneously, satellite industry growth of over 200% by 2040 is expected.

The space industry also creates favourable conditions for other sectors where several synergies can be found. For example, development and service provision in the space industry can create opportunities for the vehicle and aircraft industries as well as for drone manufactures. Possible synergies here can play a major role in future development of the space industry, for instance collaborations for resource acquisition and development needs. However, due to difference in needs, inter-industry collaborations has proved difficult.

New ventures under way

It is expected that, between 2019 and 2029, global state investments in space research and development will exceed USD 250 billion, an increase of USD 167 billion on the period 2010 to 2019. Put into, amongst other things, infrastructure, state funding will continue to play an important part in the space sector's development and growth. Despite rising state investment, the commercial percentage of the total space economy is, simultaneously, growing even faster. At the same time, a major rise in state investments in space research is expected over the next few years, primarily in the areas of space transport, orbital infrastructure and expeditions to the moon and Mars.

Global challenges and trends

There are four main global challenges and trends affecting the space sector's future:

1. Increased access to data and connection

Demand for data is growing exponentially. This is primarily driven by:

- Growth of new market segments (e.g. 5G applications and mobility).
- The ambition to provide internet access in parts of the world that are served inadequately or not at all.

In its turn, this increased demand is driving an increased need for launch activities and satellites.

2. Increased focus on sustainability in space

- Active initiatives (monitoring of space debris, traffic management, situation awareness and handling of worn-out units) to ensure the future sustainability of the space sector, even with increased traffic.
- Development of sustainable production methods and fuels to minimise the negative climate impact of the space sector's operations.

3. Planetary missions and space exploration that are more complex

- Interplanetary missions are becoming ever more complex and expensive. We are voyaging further and further away.
- Many new operators, in both state and commercial sectors, are showing interest in crewed missions with a focus on space tourism, interplanetary transport and the exploitation of various resources in space.

4. Increased use of Earth observations

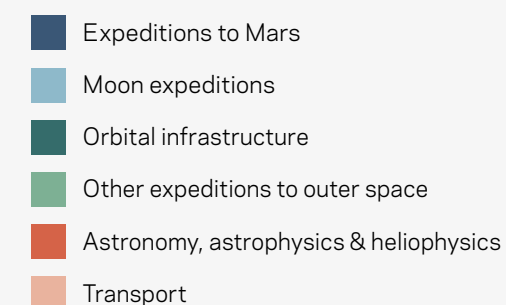
- Partly because of climate and humanitarian challenges, demand for Earth observations is rising.
- Said observations are increasingly being used for societal benefit (e.g. linked to weather, water resources, biological diversity, ecosystems and agriculture).

Important European collaboration platforms for Swedish operators

European Space Agency (ESA)	With 22 member countries, this is an intergovernmental organisation that coordinates space research and space activities in Europe. ESA is most often in charge of implementing the EU's various space programmes.
Copernicus	Copernicus is the EU's Earth observation programme. Via satellite and field data, it offers information services based on Earth observation data. Within Copernicus, there are, for example, the Sentinel missions. These cover the development and launch of a series of satellites for radar and hyperspectral imaging for land, ocean and atmosphere monitoring. Companies in the Gothenburg region have been directly involved in this.
Ariane	A European series of rockets for launching satellites and spacecraft. It is run by Arianespace, a private operator with shareholders from the European space industry.
Galileo	Galileo is Europe's Global Satellite Navigation System (GNSS). Its positioning and navigation data are used in a wide range of industries (e.g. the vehicle industry).

New ventures under way

Government investments linked to space research and development are expected to increase globally in the coming years.



² Euruconsult & Statista

3.

The space industry in Sweden

A relatively large “space nation” in relation to population size, with a geographically very well placed space base and two strong clusters in Northern Sweden and Western Sweden.

West Sweden	Other parts of Sweden
1. GKN Aerospace AB	
2. Beyond Gravity	
	3. Metria AB
	4. Sweco Sverige AB
5. RISE Ivf AB	
6. Qamcom Research and Technology AB	
	7. OHB Sweden AB
	8. Spectrogon AB
9. Carmenta Geospatial Technologies AB	
	10. Swedish Space Corporation (SSC)

The figure shows the 10 largest (based on employee numbers) space companies in Sweden and that 5 of them are in West Sweden.

In 2019, Swedish space companies employed just over 4,000 people. However, not all of these were involved with space business (i.e. they could be parts of industries that also supply services and products to other business areas). Two strong clusters, Northern Sweden and West Sweden, predominate in Sweden. The cluster in Northern Sweden’s primary distinction is the infrastructure surrounding Esrange, Sweden’s space base for launches, research and training. West Sweden is characterized by production and research and education, mainly in technology and material development. Based on employee numbers, five of Sweden’s ten largest space companies are in West Sweden.

Characteristics of the cluster in Sweden

Sweden’s space strategy designates several groups of goals that should be prioritised and lead development in Swedish space businesses. Said groups include: “International cooperation for peaceful and sustainable use of space”; “Space Data”; Agenda 2030; “Security and defence”; “Infrastructure”; and “Space legislation”.

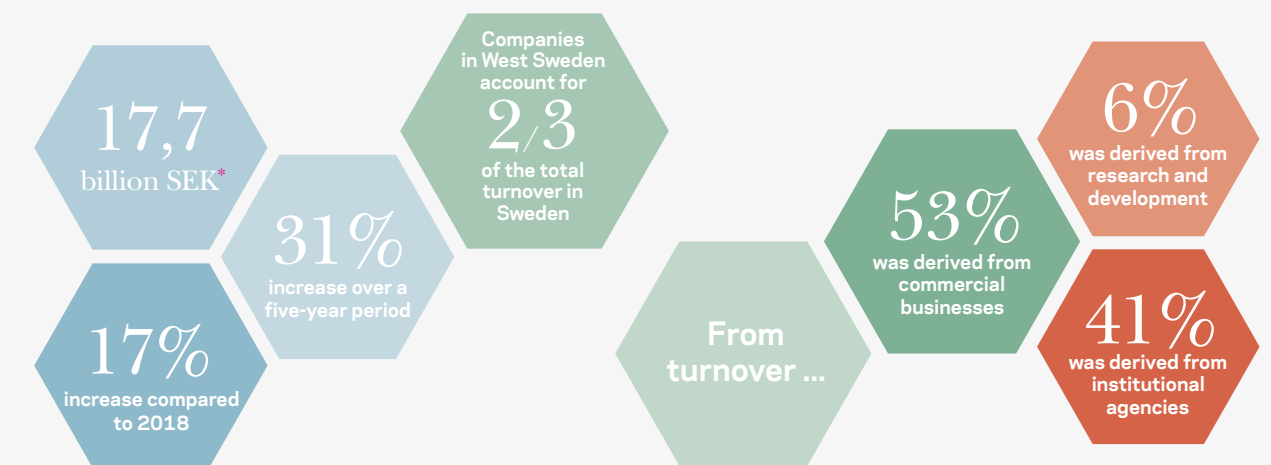
In relation to its population size, Sweden can be considered a relatively large “space nation”. In the 1980s and 1990s, Sweden was (after the superpowers) one of the leaders in satellite development and launches.

For example, the Odin and SMART-1 projects at the turn of the millennium were major successes. The Odin satellite is still supplying researchers with climate and ozone layer data. Development of Mats, a research satellite that is to investigate atmospheric waves and their impact on the climate, is also currently in progress. This project is a collaboration between several universities and public authorities. It is helping to keep Sweden at the forefront of atmospheric physics. Sweden’s space industry is generally regarded as being of an extremely high standard. For example, Beyond Gravity (formerly RUAG) is a world leader in satellite operation systems.

In the form of Esrange, with its favourable northern location, Sweden has an excellent space base. Besides the possibility of valuable polar satellite orbits, Esrange also offers the capability of serving as an important communication and coordination centre for many space missions. As Esrange in Kiruna is one of the world’s most versatile space bases and enjoys a favourable geographic position for launching spacecraft, Sweden may also occupy a decisive position in future space development. It is also expected that activity around Esrange will increase. This space base is currently being expanded as Swedish membership of NATO may lead to several missions.

Swedish space industry in numbers

Turnover in 2019



* Calculation is based on companies connected to space operations which may also be commercially active in other areas

4.



The space industry in West Sweden

West Sweden has wide industrial expertise, strong human capital and well-established companies in the space sector. Several actors within the spacecluster in West Sweden already have a world-leading position in the global space sector.

The space sector in West Sweden started in the aircraft industry and then developed towards space. Today, the cluster comprises a triple helix of strong space initiatives between public and private operators as well as academia. This is leading to multidisciplinary collaborations and innovation. The region also has wide industrial capability and know-how linked to the space sector. Roughly two thirds of Sweden's space sector workforce is located in the region, as also the country's two largest space companies, GKN Aerospace and Beyond Gravity (former RUAG).

Most of the jobs are in the region's large organisations. Around 73% of West Sweden's space sector employees work in organisations with over 250 workers. These organisations have also shown most growth since 2012 (they have grown by over 500 people). At the same time, the pandemic hit the large organisations hardest. Between 2018 and 2020, companies with at least 250 employees lost almost 200 workers. Small organisations state that, in the same period, they did not see any job reduction.

Conditions for building a strong cluster in the region

The strong position of the space industry in West Sweden has been achieved by far-sighted and long-term initiatives, both national and international. Close collaboration between public sector, academia and industry have contributed to the prominent position.

At the same time, major European programmes such as Copernicus and Ariane have been significant for West Sweden's space sector. Both Ariane 4 and Ariane 5 have been commercially successful. This has resulted in various of the region's space companies having stable production volumes for several years.

In the region, the relationship between number of employees and organisation size is as follows:



Operators in the cluster

In the region, there are operators in all central parts of the space cluster.

Societal stakeholders

National and international financiers such as the EU, the ESA, the Swedish National Space Agency, the Swedish Agency for Economic and Regional Growth and Vinnova (Sweden's innovation agency) play a major role in the space industry's development. Support for development programmes and projects is important for enabling international involvement. A great deal of space activity, research and development takes place at a European level. This is why it is important to be part of international development programmes. The Swedish National Space Agency has prime responsibility for ensuring the development of Swedish space-related research and development. Organisationally, it is under Sweden's Ministry of Education and Research. The Swedish National Space Agency is also an interface for international collaborations. At a more regional level, there are, above all else, collaboration operators who can create good conditions for the space industry. Areas in which said operators may help include: start-up issues; contact intermediation; arranging events; and, initiating and supporting creative environments for technical development and collaboration (e.g. incubators, science parks and testbeds).

Key operators in research and development

The Gothenburg region has a long history of research and technical development. The Onsala space observatory was founded here in 1949 and became Sweden's

national radio-astronomy facility in 1990. There was also technical development within region in connection with the setting up of Ericsson Microwave Systems and Saab Space (acquired by RUAG Space, which is now Beyond Gravity). With its Department of Space, Earth and Environment, Chalmers University of Technology has a strong position in space research. The university is also the host of the Onsala space observatory, which takes part in major international radio-astronomy projects. Research is important for industrial growth and has contributed to the development of several operators (Cobham Gaisler, GKN Aerospace, etc.). Research at Chalmers has generated a number of spin-offs, e.g. Low Noise Factory (LNF), Omnisys Instruments, Cobham Gaisler, Gotmic, Wasa Millimetre and Molflow.

Education

Within education too, Chalmers is a strong operator with courses and space-related engineering programmes at bachelor, master and doctor levels. Additionally, the University of Gothenburg offers astronomy courses and there are projects at University West. A further training operator is Universeum (the national science centre of Sweden), which has an exhibition centred on travelling and living in space.

Finance and capital

In finance and capital, there are also several operators who, to a high degree, impact on the space cluster and its possibilities. There are several sources of support functions (incubator's, business development, science parks, etc.) aiding the cluster's operators. In a number of different forms (e.g. public venture capital, regional

funding and private venture capital), access to financing and capital is another of the region's strengths. At a national level, Swedish investment company Rymdkapital has been around since 2020. Its vision is to "propel a sustainable and multi-faceted space ecosystem".

Networks, testbeds and science parks

As regards to networks, testbeds, science parks and collaboration interfaces, the Gothenburg region once again offers many favourable conditions. Jointly, these actors contribute to a lucrative innovation climate that increases the region's expertise and promotes important start-ups and new initiatives. In the long term, these can affect the space cluster in several ways. For example, collaboration projects raised the issue of a national space data lab with AI Sweden as a facilitator. The objective of the Swedish Space Data Lab is to increase Sweden's, the EU's and international collaborations' use of satellite data to achieve societal development that is more sustainable.

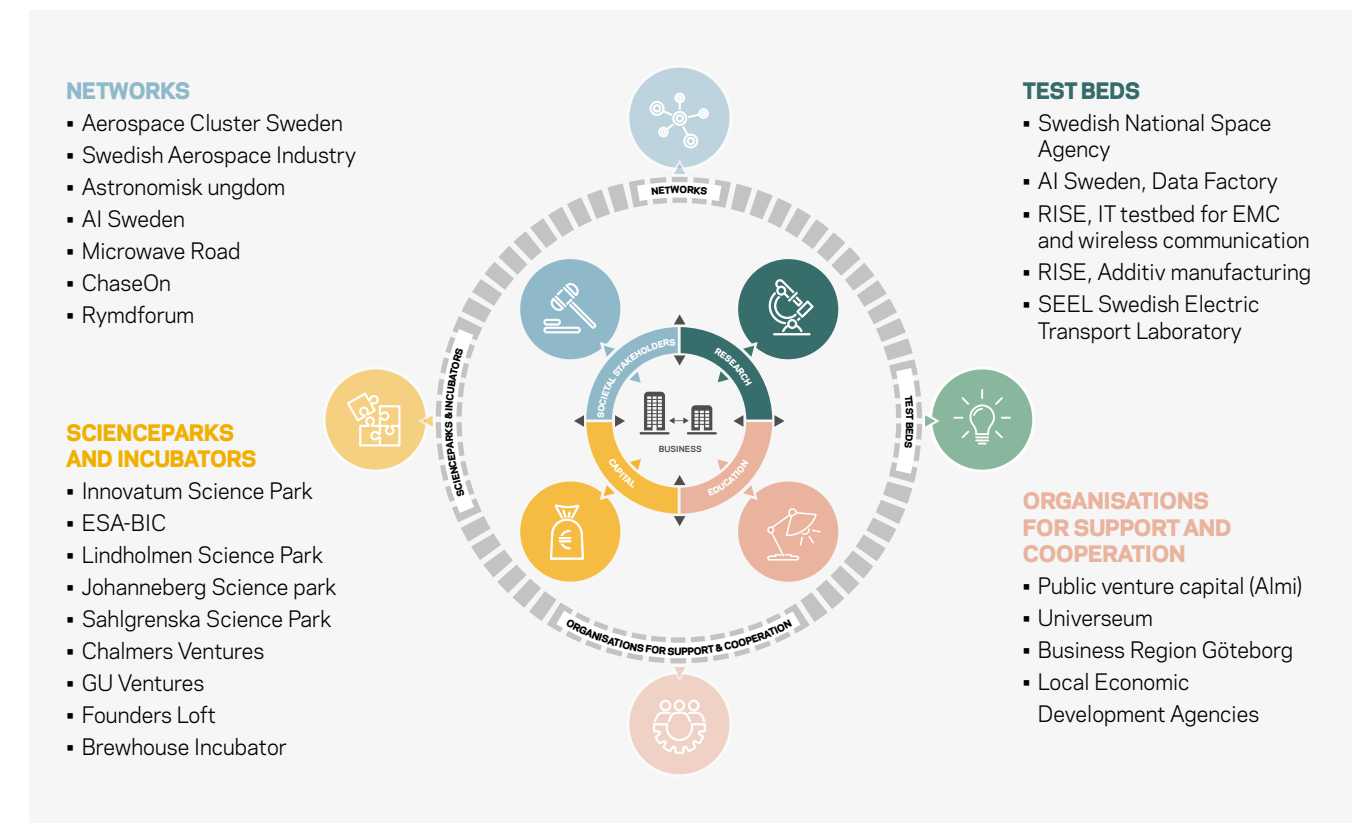
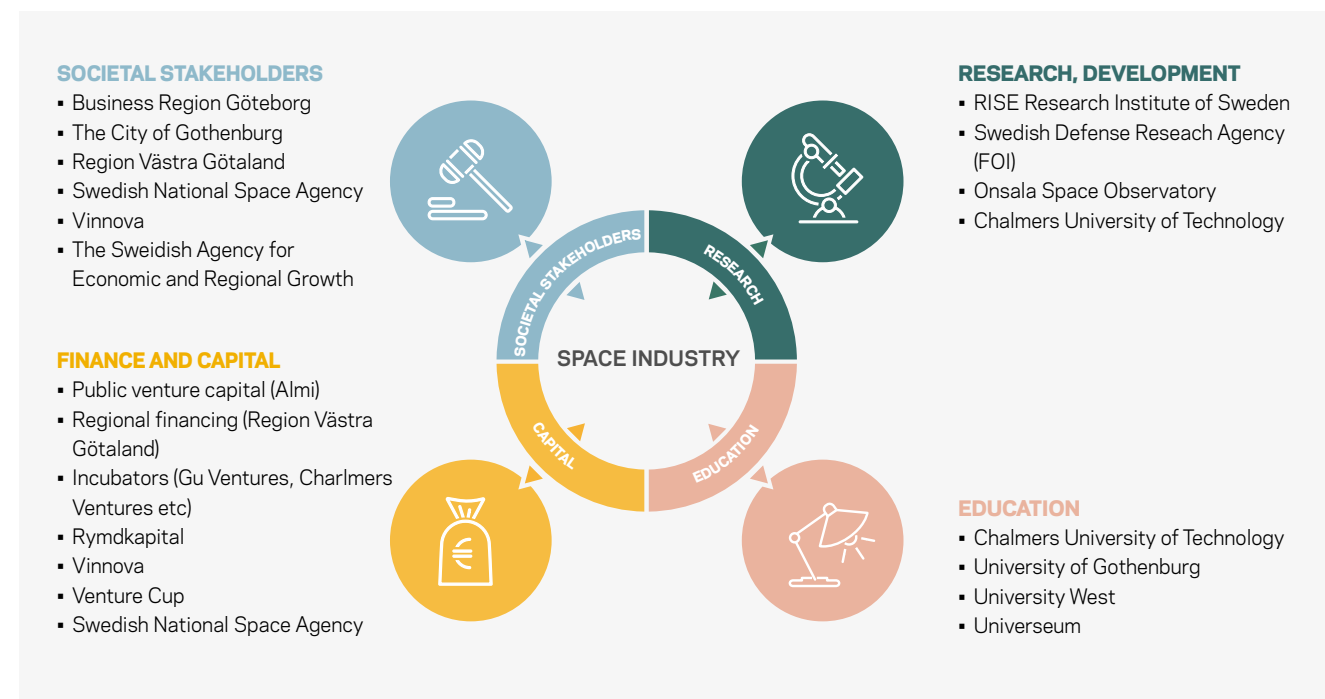
Important networks for the space industry include Swedish Aerospace Industries, a non-profit association representing the civil aviation and space industry in Sweden. The association focus on industry-wide issues, both in national and international contexts. Another significant network is Aerospace Cluster Sweden, which is an economic association working for internationalisation, talent provisioning and the opportunity to influence the development of the Swedish aerospace

industry. It is, part of the European Aerospace Cluster Partnership (EACP).

There are also powerful research and development operators contributing to the region's climate of innovation. RISE IVF is, for example, conducting research and development in time transmission and time synchronisation using fibre-optic communication networks, global navigation satellite systems (GNSS) and the internet.

Synergies with other industries

Other factors that play a part include the Gothenburg region being a strong industrial city. It has a strong vehicle industry and a prominent history in shipping. Advanced electronic equipment in, amongst other things, life science is yet another strong industry in the Gothenburg region. This well-established industrial ecosystem promotes both an enterprise climate and strong innovation throughout the region. There are also opportunities for synergies between various industries and the space sector. For example, the aircraft industry provided the basis for the space sector's development in West Sweden. Furthermore, cross-boundary collaborations, innovations and expertise are a source of great benefit. One example of this is the region's research into how the body of an electric vehicle can be a part of the the vehicle power supply. If this innovation can be applied to satellites, it will lead to considerably lower total weight and many new possibilities.



The figure shows the space industry ecosystem with reference to networks, science parks, testbeds and support organisations.

Development of the space cluster in Gothenburg

The space cluster in the Gothenburg region is showing strong economic growth. Between 2012 and 2020, West Sweden's space sector expanded with a compound annual growth rate of 3.0%. This equates to roughly twice the growth rate of Sweden's GNP (an average of 1.5% per year). At the same time, the number of employees has grown by more than 700 full-time positions since 2012. Today, over 5,000 people work in West Sweden's space cluster*. Between 2012 and 2020, the region's operators increased total value added by more than SEK 2.5 billion. In 2020, total value added amounted to around SEK 7.5 billion. Despite the COVID-19 pandemic affecting the cluster negatively in the past few years, the overall development of the cluster is strong.

At the moment, there are many new initiatives in the region. Some have a direct link to the space sector, others generally promote our enterprise, innovation and

collaboration climates. To strengthen their competitiveness, the region's space enterprises are continually investing in new components, products, services and processes. On top of this, there are also other initiatives to push development onwards.

Combined with the region's strengths, the growth trend in the space sector is creating great potential. Given the global trends, the cluster's strengths and the excellent conditions, West Sweden's space cluster can contribute to the overall goal of creating 120,000 new jobs by 2035. It can also help with the subsidiary goals linked to talent provisioning and attractiveness; enterprise climate; and, innovation energy. New enterprises are being formed in the region and international operators are acquiring Swedish companies. This is due to the latter's cutting-edge expertise and the good growth opportunities.

The region's space cluster has not only industrial and space-specific expertise. It also has strong human capital and well-established companies. The strong

space initiatives (inter-industry and between various operators in academia, industry and society) have led to an business climate that promotes innovation, growth and collaboration.

Primarily powered by the downstream side of business and the indirect effects this will have, the entire space industry is expected to grow rapidly in the coming years. To capitalise on the great growth potential in this area, it is essential that support organisations (e.g. incubators, Rymdkapital and public operators) back the region's start-ups.

Associations, events and trade fairs

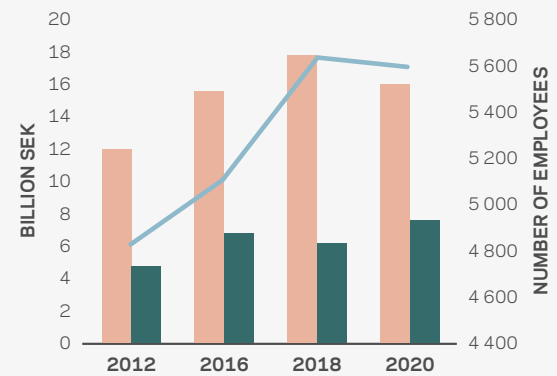
Sweden's space sector has both recurring events and specifically arranged one-off initiatives (e.g. Space Week, Gothenburg, 2019). One of the recurring events is Rymdforum. In 2021, the conference was held in Gothenburg and featured discussion of space business trends and innovations. The conference seeks to put space business into a wider context that includes sustainability and widens the circle of organisations and people involved in the area. Another event is Warp Space, which was held in Linköping in 2021. It too was targeted at all those who want to be part of creating mankind's future in space. Its goal is to show how all those who so desire can be a part of pushing development towards mankind becoming multiplanetary.

The space sector is global and there are many major events, trade fairs and conferences in which Swedish operators can take part.

Development of the cluster

Figure showing the development of the space industry in West Sweden. The graphic includes organisations with space sector links in Västra Götaland. Certain manual adjustments were made for individual organisations whose data showed space operations that were unreasonably large in relation to the real situation.

- Turnover
- Value added
- Number of employees



*By way of comparison, these figures are considerably higher than those in the Swedish National Space Agency's annual mapping of the space industry at large. This is due to said mapping adopting wider definitions of "space sector". These include peripheral space-related activities in the entire cluster.

Examples of new ventures

Private financing

More and more private investments are made in the space industry. Rymdkapital is a new Swedish investment company from 2020 with the vision of running a sustainable and multifaceted space ecosystem. Rymdkapital is currently raising its first fund to invest in ten to twelve early-stage companies.

Arena for growth

The Yard is a new arena for start-ups and scaleups within the tech industry. The initiative is an investment to create a thriving environment for growing technology-driven companies, which need to exchange experiences, make contacts and attract talent and capital.

Cross-border research

A survey has been carried out by Chalmers University of Technology to identify potential cross-border collaborations between different research areas. The aim is to connect the business, use existing resources and competences more effectively and create better collaborations between industry, academia and society.

Cluster

There are various types of cooperation within the space sector, both in the Gothenburg region and nationally. Among other things, Business Region Göteborg is in dialogue about forming a "physical" cluster to strengthen regional actors and capitalize on the infrastructure and experiences that exist in the region.

International events, trade fairs and conferences

Space Tech Expo Europe

Is regarded as the largest, dedicated, space technology fair in Europe. <https://www.spacetecheurope.com/>

World Satellite Business Week

Has been held by Euroconsult since 1997 and assembles a broad range of operators in the space industry (decision makers, industrial operators and academics included therein). <https://wsbw.com/>

SpaceCom

A global conference predominantly focused on commercial operations in space. <https://spacecomexpo.com/>

European Space Conference

Assembles space industry decision-makers and company managers to discuss future space development in Europe. The European Commission, the European Parliament and other European space authorities are conference partners. <https://spaceconference.eu/>

Global Space Technology Convention

This focuses on space industry development in Asia. Despite this, almost 50% of the participants are from Europe. <https://www.space.org.sg/gstc/>

International Astronautical Congress

A large and venerable international space congress that annually attracts participants from all around the world. <https://www.iafastro.org/events/iac/>

Women in Space

This conference raises the profiles of female researchers and industry employees. Amongst other things, it offers mentorship, recruitment and networking. It is arranged by Professional Martian LLC. <https://www.womeninspacecon.com/>

Space industry linked start-ups in West Sweden

Forsway	Forsway has developed ground-breaking technology that delivers innovative hybrid satellite-internet solutions that combine the advantages of satellite and existing terrestrial networks.
Satcube	Satcube is a satellite communication company that manufactures terminals and offers data services to enable high-performance broadband.
Low noise factory	Low Noise Factory specialises in premium-class low-noise microwave amplifiers, particularly for cryogenic applications.
New Century Information (NCI)	New Century Information (NCI) has developed a new, world-leading concept in "high precision outdoor tracking". Amongst other things, it focuses on real-time positioning.
Equilab	Equilab is an equestrian sport application that automatically measures a horse's movements in a riding session and plays this back after the session to provide the rider with valuable information.
Mooringo	Mooringo is an app that helps boat owners find and book guest berths in harbours and at boat clubs. Berths can also be booked from private individuals who would like their vacant berths to be used.
Eningo	Eningo is a company seeking to automate and, thereby, decentralise the process of locating subterranean mains, etc. Its products have been developed to streamline this.
Fureho	Fureho designs, develops and produces tailored 3D fabric pre-forms for optimised mechanical properties and thermal conductance of composite materials.
Procada	Procada provides engineering services and tailored process control solutions enabling the manufacture of functionally optimised and light structures.

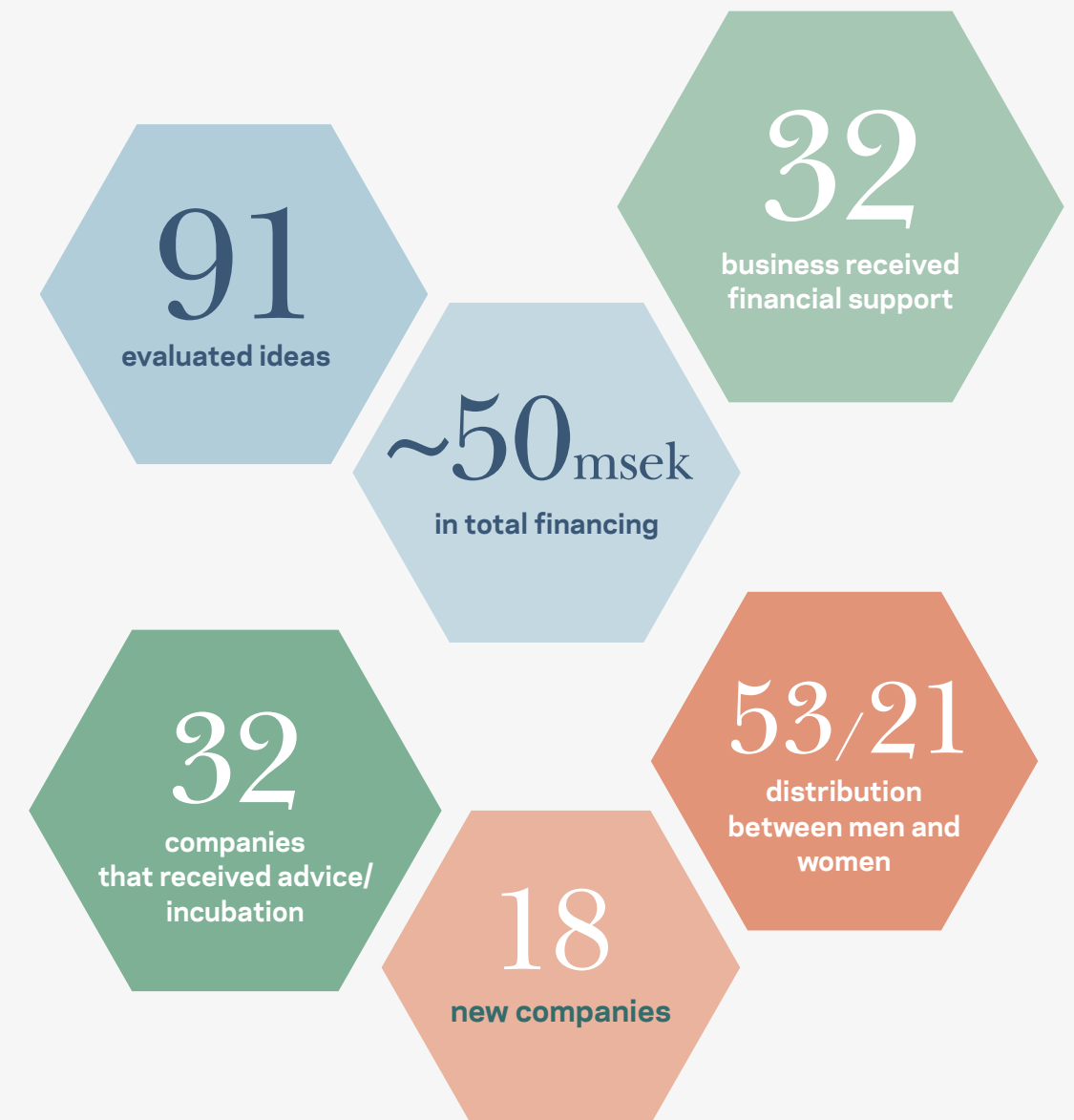
Industry start-ups

West Sweden boasts several innovative start-ups that, in different ways, link to both the space industry (via product or service developers) and operations that develop products and services based on space activities.

Support to start-ups

The region offers good conditions for start-ups in the space sector. Innovatum is one of four nodes in Sweden behind the national space incubator, ESA-BIC. This is aimed at companies that use existing space industry technology or which develop new technologies and solutions for the space industry. Besides ESA-BIC and Innovatum there are a number of incubators that support start-ups in space-related disciplines (artificial intelligence, additive manufacturing, etc.).

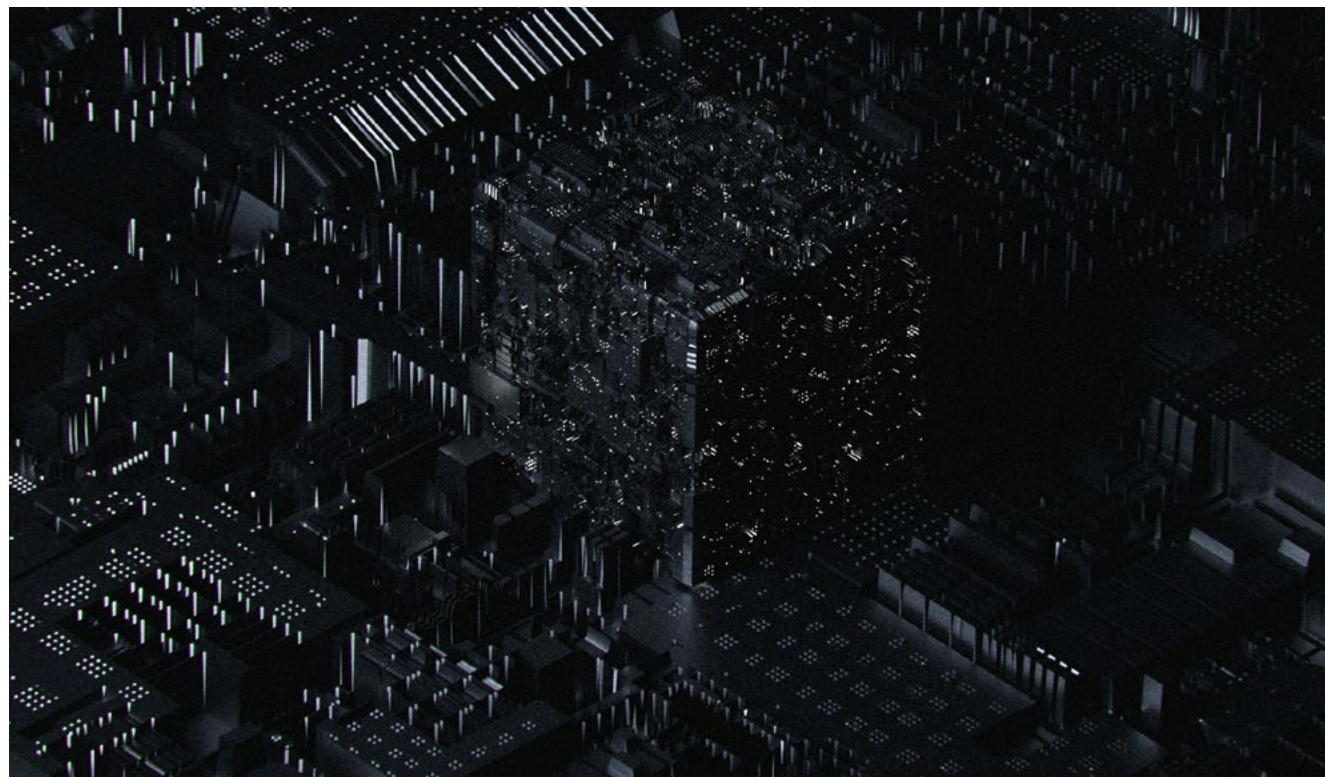
Space start-ups at Innovatum and ESA BIC (2017-2021)



Miscellaneous

Methodology

- Commissioned by Business Region Göteborg AB, mapping of the space cluster was carried out by LTU Business AB and Stenholm Consulting AB.
- For the qualitative elements of this publication, primary data was collected via ten semi-structured interviews with space operators, primarily within Västra Götaland.
- For the quantitative elements, secondary data was collected via a number of sources, primarily the following:
 - Statista
 - Euroconsult
 - Statistics Sweden
 - NASA, ESA, the United Nations
 - The Swedish National Space Agency
- Certain manual adjustments were made for individual organisations whose data showed space operations that were unreasonably large in relation to the real situation.
- To identify employee numbers, turnover and value added, a search using the Swedish Standard Industrial Classification (SNI codes) was carried out. In total, 255 organisations with space industry links were identified. The following SNI codes were included:



Chosen SNI codes

SNI code	Description
22210	Manufacture of plastic plates, sheets, tubes and profiles
23999	Manufacture of various other non-metallic mineral products not elsewhere classified (n.e.c.)
25110	Manufacture of metal structures and parts of structures
25610	Treatment and coating of metals
25620	Machining
25730	Manufacture of tools
26110	Manufacture of electronic components
26200	Manufacture of computers and peripheral equipment
28410	Manufacture of metal forming machinery
28990	Manufacture of other special-purpose machinery n.e.c.
30300	Manufacture of air and spacecraft and related machinery
33130	Repair of electronic and optical equipment
33160	Repair and maintenance of aircraft and spacecraft
46699	Wholesale of other machinery and equipment n.e.c.
46769	Wholesale of other intermediate products n.e.c.
51101	Scheduled passenger air transport
52230	Service activities incidental to air transportation
61200	Wireless telecommunications activities
62010	Computer programming activities
62020	Computer consultancy activities
70100	Activities of head offices
71121	Construction and civil engineering activities and related technical consultancy
71122	Industrial engineering activities and related technical consultancy
71123	Electric engineering activities and related technical consultancy
71200	Technical testing and analysis
72190	Other research and experimental development on natural sciences and engineering
85420	Tertiary education



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