



The "world centre of surgical equipment"?

The medical technology cluster in Tuttlingen

Group 7:

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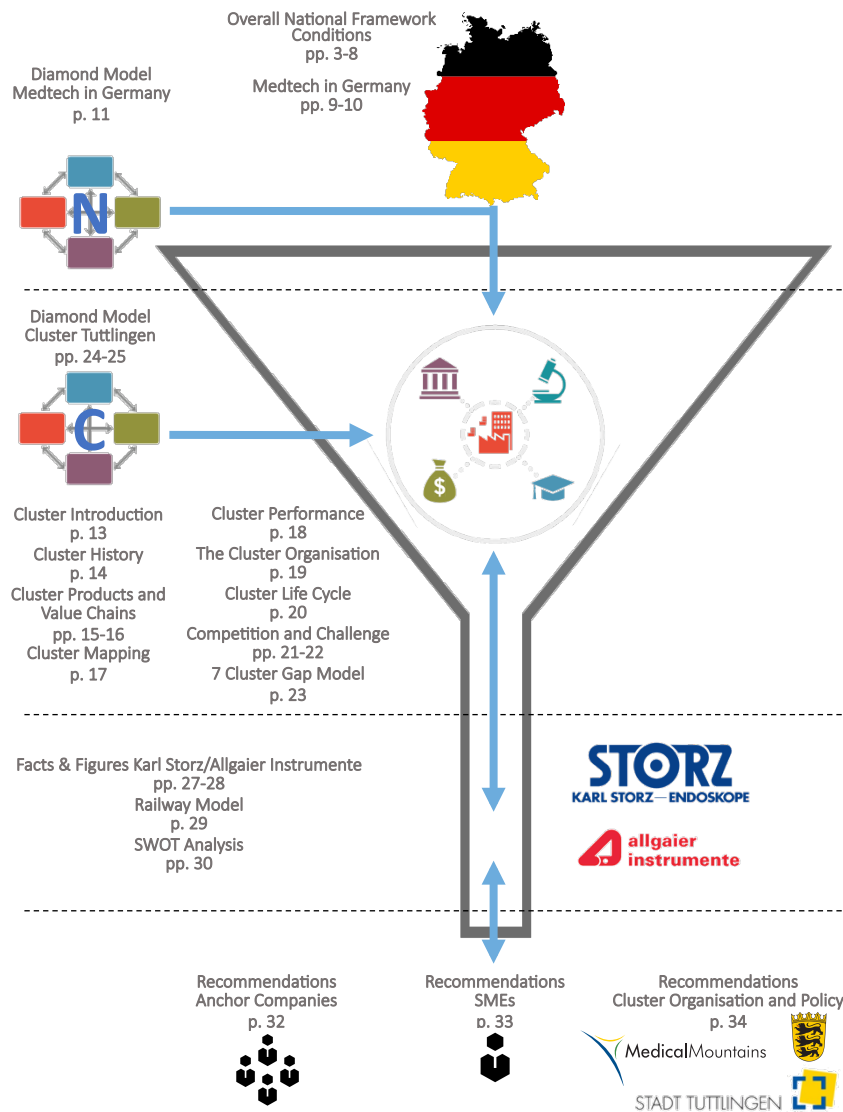
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Executive Summary

The development in the Tuttlingen cluster creates both – a chance and a challenge



NATIONAL

Germany offers good framework conditions for internationally competitive firms. The German economy is very advanced and grows faster than most other European economies. Stable politics and high investments in business sophistication are key drivers of this development. Unlike in more centralised countries, numerous world-leading clusters are spread across the country and constitute the backbone of the export-oriented German economy. Economic homogeneity is of high political interest, and public initiatives exist to promote clusters across the country. Since the 19th century, Germany has been a hub for research and innovations in medical technology (medtech). By now, Germany is the largest medtech market in Europe and the third-largest in the world. Nevertheless, medtech markets in the US as well as in emerging countries currently grow at faster rates and threaten to dilute Germany's global market share.

CLUSTER

Tuttlingen is located in the structurally strong federal state Baden Württemberg. Home of several world famous automotive, mechanical engineering, and medtech clusters, Baden Württemberg reaches the highest R&D intensity in Germany. Tuttlingen only has a population of about 35,000 inhabitants, but is often considered the world centre for surgical equipment. Its history dates back to the early 19th century, when artisan businesses specialised on knife-forging. Over the last century, the cluster has increasingly focused on the development of surgical equipment, and today approximately 600 related businesses operate within the cluster. While over 90% of these firms are considered SMEs, two large anchor companies exist: Karl Storz and Aesculap.

Along with technological progress, local firms dynamically updated their product portfolios and became globally known as innovative leaders, particularly in the field of minimally invasive instruments. The cluster was dynamic and globally successful. Nevertheless, over time a gap emerged between the two anchor companies and many SMEs. While the former increasingly invest in the development of highly sophisticated, integrated products, the latter struggle to keep up with the accelerating rate of change.

FIRM

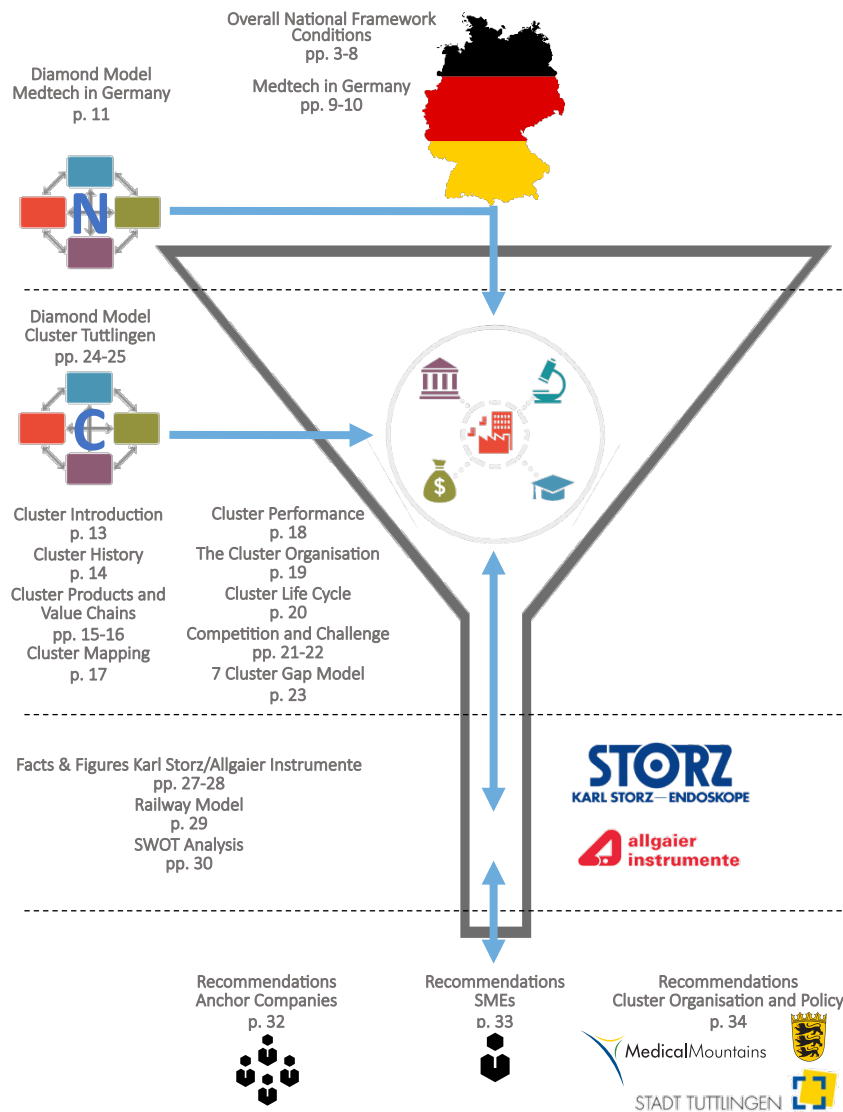
Analysing the individual situations of Karl Storz and Allgaier Instrumente, the widening gap between firms in Tuttlingen becomes apparent. While Karl Storz has grown into one of the world's largest medtech manufacturers, the firm faces increasing competition from internationally operating industry giants. For Allgaier Instrumente competition has intensified too; however, mostly from low-cost clusters, such as Sialkot. Different strategic changes in direction have separated the firms' paths, and now they face significantly different opportunities and threats.

OUTLOOK

In order to successfully tackle these challenges, we have developed customised recommendations for the four most significant actors within the Tuttlingen cluster: anchor companies, SMEs, the local cluster organisation, and policy-makers. In total, these recommendations aim at re-arousing a climate of collaborative rivalry and improving overall framework conditions for globally competitive firms.

National Level: Summary

Germany provides good framework conditions for the national medtech industry



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OVERVIEW:

The Federal Republic of Germany is Europe's largest economy and second most populous nation (after Russia) with a population of approx. 82 million people. The country is located in Central Europe, bordering the Baltic Sea and the North Sea as well as nine neighbouring countries. In total, Germany's population is distributed fairly evenly throughout most of the country. Germany's capital and largest metropolis is Berlin. Major urban areas include Ruhr, Hamburg, Munich, Cologne, Stuttgart, and Düsseldorf. Germany is a key member of Europe's economic, political, and defence organisations. In some fields it is also deemed a technological leader¹. The nation takes pride of being home to many influential scientists and inventors. But most of all, Germany is known for its political and cultural history.

Political



- Germany is a federal parliamentary republic consisting of 16 states since unification in 1990
- Angela Merkel (CDU) is the current head of government, leading a coalition of CDU and SPD
- The next general election takes place in late 2017
- Germany is a member of EU, EMU, NATO, OECD, the G8, the G20, the World Bank and the IMF

Social



- Germany has an ageing population with a median age of 46.8 years²
- Health standards are high and public health expenditures constitute 11.3% of the GDP²
- Good access to public (higher) education
- In 2015, over one million refugees (primarily from Syria) sought asylum in Germany³

Legal



- Germany's legal system has been shaped by the Grundgesetz from 1949 (constitutional law)
- Strong influences by the law of the European Union and by international law
- Legal stability attracts foreign companies and promotes entrepreneurial activity⁴
- Business law is based on competition principles

Economic



- Germany is the world's 4th largest economy by GDP
- Germany is a leading exporter of machinery, vehicles, chemicals, and household equipment, and benefits from a highly skilled labour force
- Germany achieved a budget surplus of 0.8% in 2015
- The economy currently suffers from low levels of private investments; state plans large scale subsidies

Technological



- German industry is very diversified and in many sectors it is a global technology leader
- Germany's most innovative sectors with above-average growth rate are renewable energies, IT, and bio-technology
- Specific research institutions are leading in fields such as materials science and biomedicine

Environmental



- Emissions from coal-burning utilities and industries contribute to air pollution
- The German government established a mechanism for ending the use of nuclear power by 2022
- Government is committed to adhere to international environmental agreements
- Chancellor Merkel backs EU Carbon Emission Tax

National level: General economic data

Germany is one of the most advanced economies in the world



Fundamentals:



- **Type of economy:** Advanced
- **Capital:** Berlin
- **Population:** 81.412.145 (2015)
- **Urbanization:** 75.3% (2015)
- **GDP (PPP):** \$3.356 Trillion (2015)
- **GDP/cap (PPP):** \$41,219 (2015)
- **Inflation:** 0.84%
- **Exports:** \$1.33 Trillion (2015)
- **Imports:** \$1.05 Trillion (2015)
- **Public debt (of GDP):** 77.8% (2016)
- **Household debt (of disposable income):** 92.9% (2016)
- **Unemployment:** 5% (2015)
- **Youth unemployment:** 7.5% (2015)
- **Business confidence index (BCI):** 101.17 (2016)
- **Consumer confidence index (CCI):** 100.68 (2016)
- **Corporate tax:** 15% (2016)⁵

Geography

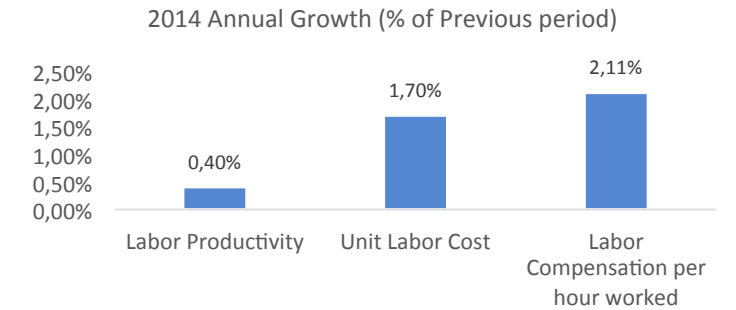


Human development

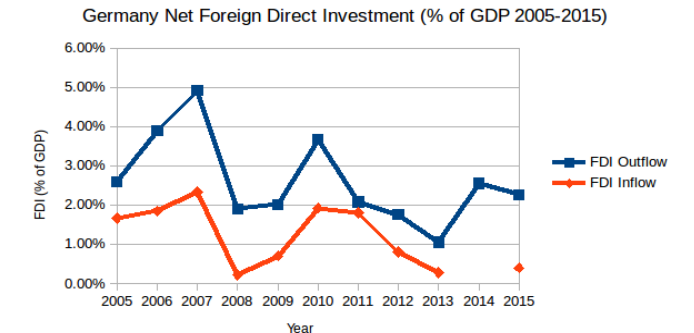


- **Human development index:** 0.916 (2014)
- **Life expectancy:** 80.844 (2014)
- **Mean years of schooling:** 12.2 (2012)
- **GNI/capita (PPP):** \$48,260 (2015)
- **GINI:** 30.13 (2011)
- **Average age:** 46.5 (2011)

Productivity growth



Foreign direct investment



Germany's medium-sized, aging population lives in an **advanced economy** and enjoys **high-quality and relatively equal living standards**. Compared to other European countries, Germany enjoys **relatively low unemployment rate and a strong economy** that has withstood the 2008 Financial Crisis and the subsequent Euro Crisis. Germany, moreover, **scores high on human development** as well as consumer and business confidence. However, it is alarming to see a trend of declining FDI coupled with a rise in labour cost that is higher than productivity growth.

National level: Locational advantages

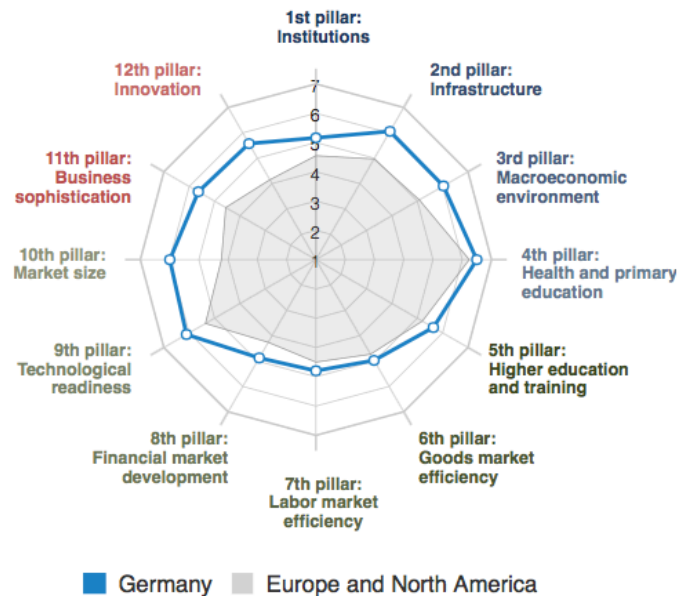
Germany's high competitiveness allows for a strong export orientation



A competitive nation⁶



- Extraordinarily high national competitiveness – 5th rank worldwide
Constant top-placement in the ranking over the last 5 years (always ranked <6)
- Most outstanding factors are **business sophistication (3rd)**, **innovation (5th)**, **market size (5th)**, and **infrastructure (8th)**



The market at the front door⁷



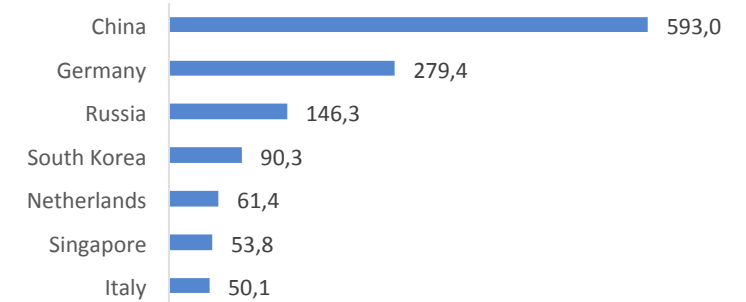
- Germany is the **largest economy in the European Union⁸**
- The economy is located centrally within the **world-largest single market** generating a **GDP of 15,16 Trillion € in 2015**
- The European single market includes **500 million citizens**



Made in Germany



- Products from Germany are perceived as **“high quality”** abroad⁹
- **High quality suppliers** of technology, parts and packaging due to sophisticated technical standards, good know-how and high delivery reliability¹⁰
- High Level of export orientation, Germany has the **second highest trade surplus worldwide:**



The 20 countries with the highest trade surplus in 2015 (in billion U.S. dollars)¹¹

Germany was the **“world champion of exporting”** for a long time and has only recently been overtaken by China. The country recovered quickly from the financial crisis in 2008/09 and is now the **economic powerhouse in its home market – the European Union**. The German economy shows **outstanding competitiveness** which is mainly driven by business sophistication and innovation capabilities, making the label **“made in Germany”** still one of the most renowned in the world.

National level: Locational disadvantages

Export-driven companies are challenged by high costs, technology piracy and bureaucracy



An expensive country



- Germany is the country with the **highest Energy costs** (0,149 € per kWh in 2015) for businesses in **Europe**¹²
- Corporate taxes in Germany are higher than the worldwide average. Moreover, the corporate tax system as municipalities can set tax levels individually. The average corporate tax level in Germany is approximately 30%
- Germany is among the 10 countries with the **highest labour cost in manufacturing** around the world¹³

Technology piracy¹⁴



- Germany, as leading supplier of technology, has repeatedly been target of **technology piracy**
 - 71 percent of all companies are affected by product or brand piracy
 - The estimated **accumulated damage to German mechanical engineering businesses lies at 7,9 billion €** annually
- The main origin of piracy is China**, primarily focusing on machinery and technologically sophisticated products

Bureaucratic business regulation reduce ease of doing business in Germany¹⁵



	Starting a business		Dealing with construction permits		Registering property		Paying taxes	
Rank (out of 190):	114		12		79		48	
Time required (ø days):	10.5	(OECD high income: 8.3)	96.0	(OECD high income: 152.1)	52.0	(OECD high income: 22.4)	27.25	(OECD high income: 20.44)
Cost (ø %):	1.9*	(OECD high income: 3.1)	1.1**	(OECD high income: 1.6)	6.7***	(OECD high income: 4.2)	48.9****	(OECD high income: 40.9)
Procedure (ø # of steps):	9.0	(OECD high income: 4.8)	8.0	(OECD high income: 12.1)	6.0	(OECD high income: 4.7)	9.0	(OECD high income: 10.8)

The benefits companies find in Germany come with a cost. **Labour and energy costs are high and challenge firms' competitiveness in manufacturing**. Many companies have therefore **offshored and/or outsourced their production to low cost countries**. Technology piracy also is of high cost for the high-tech site Germany and may be considered a **threat for long-term competitiveness if patents and copyrights cannot be protected**. Another locational disadvantage is Germany's high level of bureaucracy, which leads to a relatively low "ease of doing business" index.

National level: Importance of clusters

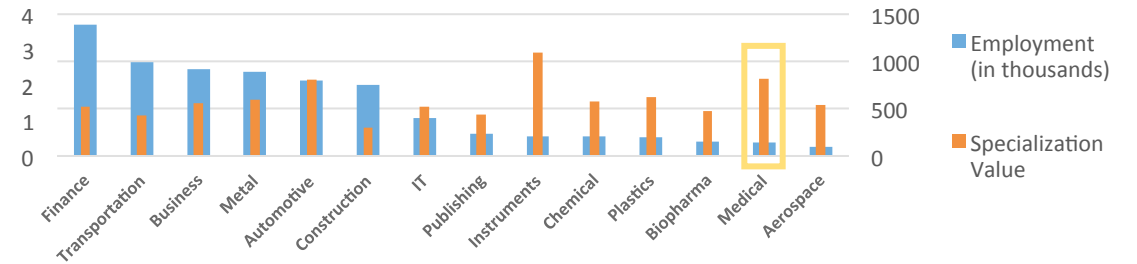
Highly sophisticated clusters are the backbone of the German economy



Overview

- Over the last centuries, clusters have been an important source of innovation and economic growth in Germany
- Along with technological progress, successful **clusters with high specialisation values** have developed for example in the **instruments, medical technology (medtech), and automotive industries**
- In order to promote national competitiveness, the German Federal Government has **initiated three large-scale cluster development initiatives**. The goal is to catalyse the emergence of international clusters of excellence in Germany and leverage innovation capacity

Employment and Specialization Value by Cluster Category¹⁶



“go-cluster” - Program ¹⁷



- Sponsor:** Federal Ministry of Economic Affairs and Energy
- Mission:** Support local cluster management organisations through a national cluster excellence program
- Target group:** Cluster managers and representatives from science and business
- Objective:**
1. Support the transformation of national innovation clusters into international clusters of excellence
 2. Increase international visibility of participating cluster
 3. Analyse trends of international cluster policy to work out recommendations for the German perspective
- Admission:**
- Each German innovation cluster can apply for admission

The Leading Edge Cluster Competition ¹⁸



- Federal Ministry of Education and Research
- Support the strongest regional associations in developing internationally competitive solutions and strategies
- Cluster managers and representatives from science, and business
1. Award the most innovative long-term cluster strategies
2. Provide up to one million euros per cluster to develop and test new forms of cooperation between research and business
3. Facilitate support for new talent, practical training, and the recruitment of international specialists and managers
- Each German innovation cluster can apply for admission

Entrepreneurial Regions Initiative ¹⁹



- Federal Ministry of Education and Research
- Support regions facing special challenges as a result of structural change and leverage innovation potentials
- Regional innovation alliances (primarily in eastern Germany)
1. Support regional alliances to form clusters of high standards and with strict market orientation
2. Observe the following principles: think laterally, collaborate, plan strategically, and act entrepreneurially
3. Create interdisciplinary partnerships in eastern Germany
- Admission criteria are dependent on individual funding programmes with different regional and functional foci

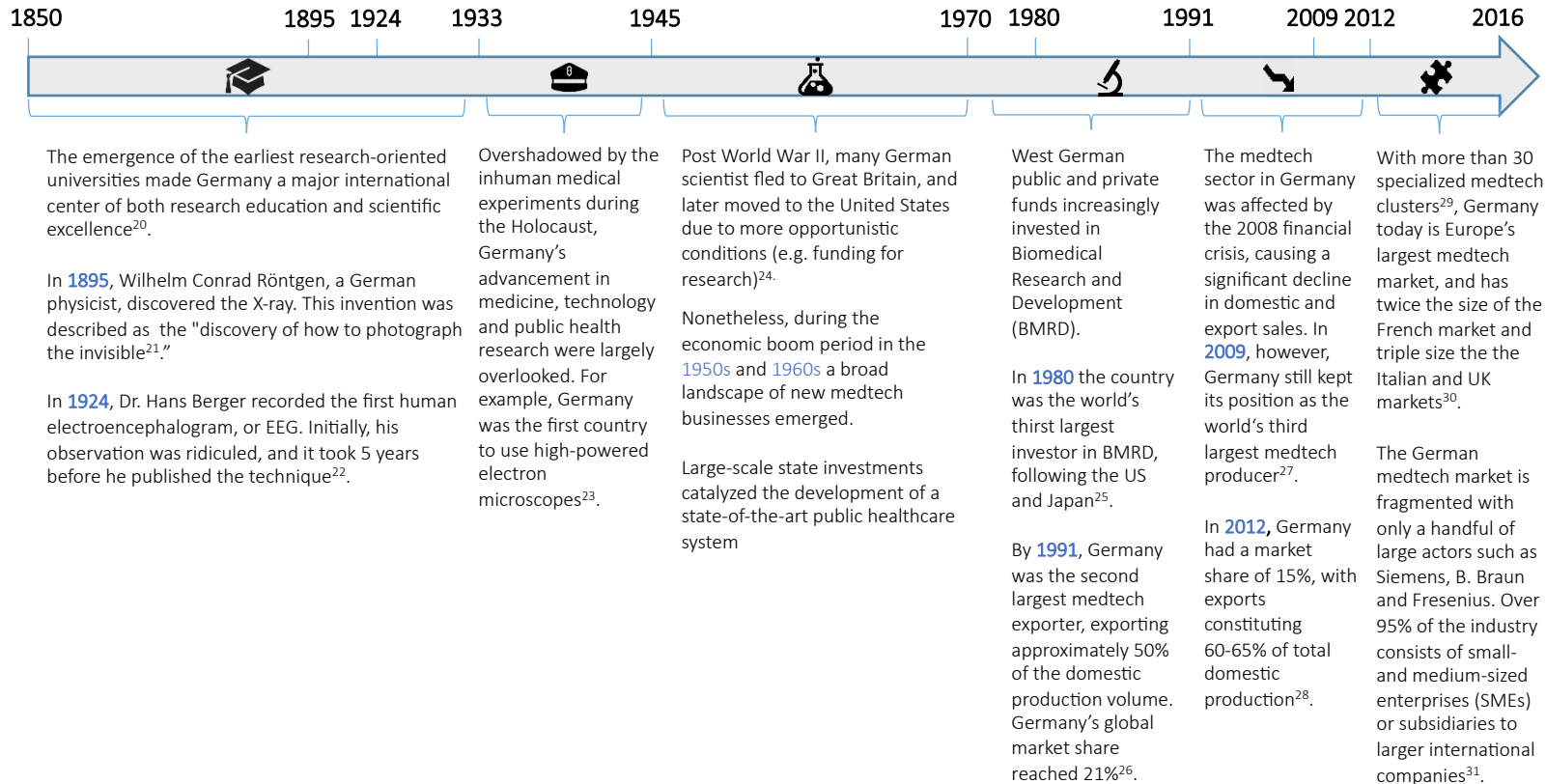
Clusters have played an **important role for the development of the German economy**. Over the last centuries, highly **sophisticated clusters** have emerged in **numerous industries** ranging from finance, transportation and automotive to medtech. Policy-makers have become increasingly aware of the significance of clusters for the country's economic performance and **initiated three major cluster development initiatives** on the national level. These programs are intended to **catalyse innovation and establish “international clusters of excellence”**. In total, several billions of euros are invested annually in the development of promising innovation clusters, including “the global centre for medical technology” Tuttlingen.

National level: The German medtech industry

Germany has a long history in medtech and an advanced (but bureaucratic) health care system



Historical development of science, technology and medicine in Germany



Benefits and challenges for German med-tech today³²

- ▶ Germany offers one of the most beneficial **cost-quality ratio for clinical studies** in the world³³
- ▶ The **average cost to develop an idea towards market maturity in Germany is 8-10 million €** and thereby significantly lower than in the US (approx. 80 million €)
- ▶ **Short approval times** exist for new technologies
- ▶ Long history of medtech in Germany has led to highly specialised technical expertise
- ▶ The German healthcare system is characterised by various **stakeholder groups with conflicting interests**
- ▶ **Interconnections of EU, state, and federal state legislations** complicate legal environment and hinder the new product development process for medtech providers
- ▶ Large **Statutory Health Insurance** companies represent 85% of German citizens and tend to be rather **bureaucratic**
- ▶ **Reimbursement processes** for new technologies is often **tedious and complicated**

Germany has a progressive medical history with both public and private **investments in universities, research departments and related businesses**. Since World War II, numerous new actors have entered the market and created a highly **fragmented market landscape**. As a result, domestic rivalry has spurred the **development of medtech products in terms of quality, design and innovation**. Today, medtech companies enjoy **distinct benefits** such as low costs for clinical studies but face **bureaucracy** in regards of approvals and reimbursement processes.

National level: The German medtech industry

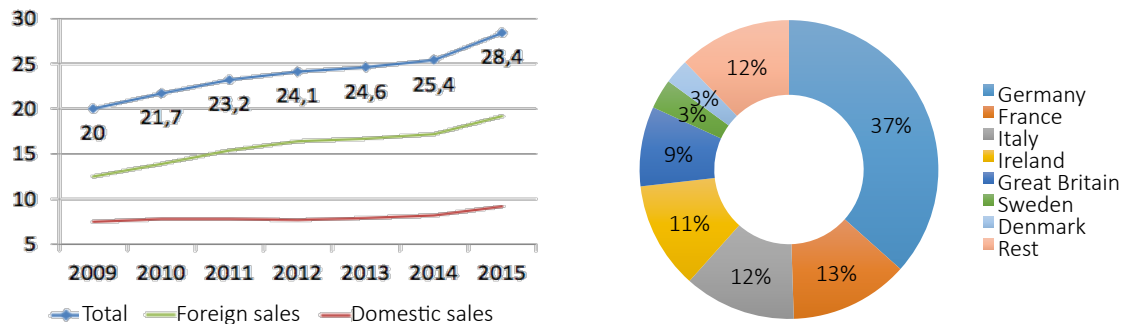
The German medtech industry is in good shape, but the future will bring challenges



Medtech industry Germany³⁴

- Germany is the **largest medtech market in Europe** and the **third largest in the world** (14.6%)
- Over 12,000 medtech companies with over **195,000 employees** are located in Germany
- Approximately **68% of all medtech products are exported** (general industry average: 40%)
- Largest export markets are USA (3.26 bn €), China (1.3 bn €), and France (1.2 bn EUR)
- Over **13,000 patents are filed annually**; highest value across all German industries and the second highest worldwide
- Approximately one third of general turnover is generated from products not older than 3 years
- **9% of industry turnover is re-invested into R&D** (general industry average: <4%)

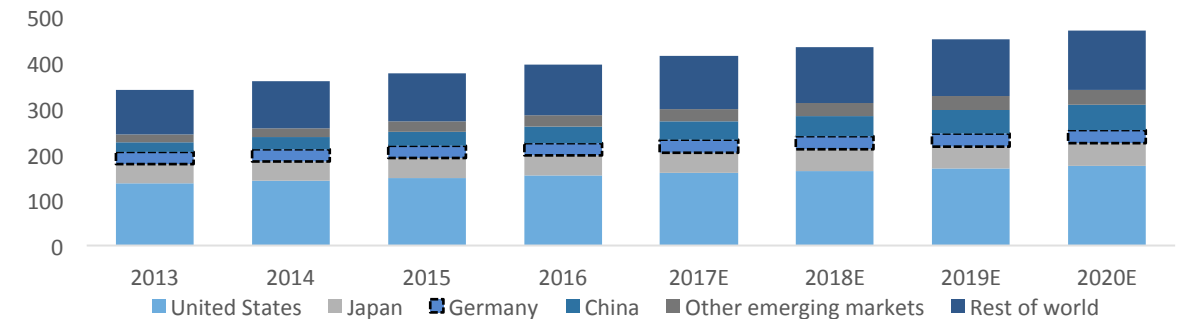
2015 sales medtech industry Germany and European Union (in bn €)³⁵



Drivers and influences

- **Demographic development:** Ageing populations in developed countries lead to increased demand
- **Technological progress:** Nano technology and modern production techniques boost innovative products
- **Surgical innovations:** Modern surgical methods allow more operations for more elderly patients
- **Increasing patients demands:** Health is increasingly perceived as a service patients are willing to pay for
- **Regulatory hurdles:** Continuous changes in (inter-)national legislation impact competitive environment
- **Price pressure:** European and US healthcare sectors suffer from increasing price pressure

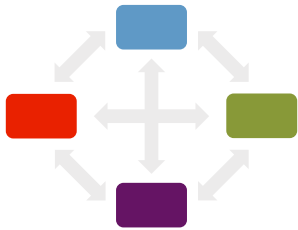
Expected global medtech sales 2013 – 2020E (in bn €)³⁶



The German medtech industry is **the largest in Europe** and has been **continuously growing** over the last years. The market is characterised by a **high degree of fragmentation** as well as a **strong export orientation**. In fact, 68% of all domestically produced medtech products are exported. **Innovation and R&D are of great importance** and are significantly higher than general industry standards. Over the next years, the German medtech industry will undergo **significant changes due to a variety of strong influences**. In addition, Germany's **global market share will continuously dilute** due to growing markets in the US, China, and numerous emerging countries.

National level: Conclusion

Germany offers fertile soil for competitive medtech businesses



Factor conditions

- ▲ Highly skilled and technically trained workforce
- ▲ Substantial scientific capacity to create knowledge
- ▲ Extensive and high quality transport infrastructure
- ▲ Good accessibility due to Central European location
- ▲ Good access to natural resources, incl. building materials, steel, plastics, etc.
- Moderate medtech labour market flexibility
- ICT infrastructure capable of development
- ▼ Difficult access to loans and poor availability of venture capital for entrepreneurial businesses
- ▼ Generally high level of labour cost
- ▼ Financial institutions are tarnished and significantly lost trustworthiness and confidence

Context of strategy and rivalry

- ▲ Very strong intensity of local competition and high degree of market fragmentation, safeguarded by the Act Against Unfair Competition and the Federal Cartel Office
- ▲ Low trade-weighted tariff rate facilitates cross-border trade
- Moderate “ease of doing business” in comparison to other advanced countries³⁷
- ▼ High degree of bureaucracy hinders entrepreneurial activities and leads to tedious processes
- ▼ Complex tax system and regulative environment limits rate of innovation

Demand conditions

- ▲ Very large home market (incl. EU) and export market size
- ▲ Relatively sophisticated home market buyers pressure firms to innovate and create more advanced products
- ▲ Strict regulative standards require high product quality
- ▲ Highly saturated domestic medtech market pushes industries towards entering foreign markets²
- ▼ Conservative German buying behaviour leads to low early adoption rates

Related and supporting industries

- ▲ Very high local supplier quantity and quality fosters close supplier relationships and shared research and development activities
- ▲ Very strong state of medtech cluster development (particularly in Baden Württemberg and Bayern) with numerous hidden champions in niche markets (“Mittelstand”)³⁸
- ▲ Manufacturers across all stages of value chain activities provide highly sophisticated products and services
- ▼ Weaknesses in domestic electronic and computer industries hinder competitiveness in some integrated medtech products and solutions³⁹

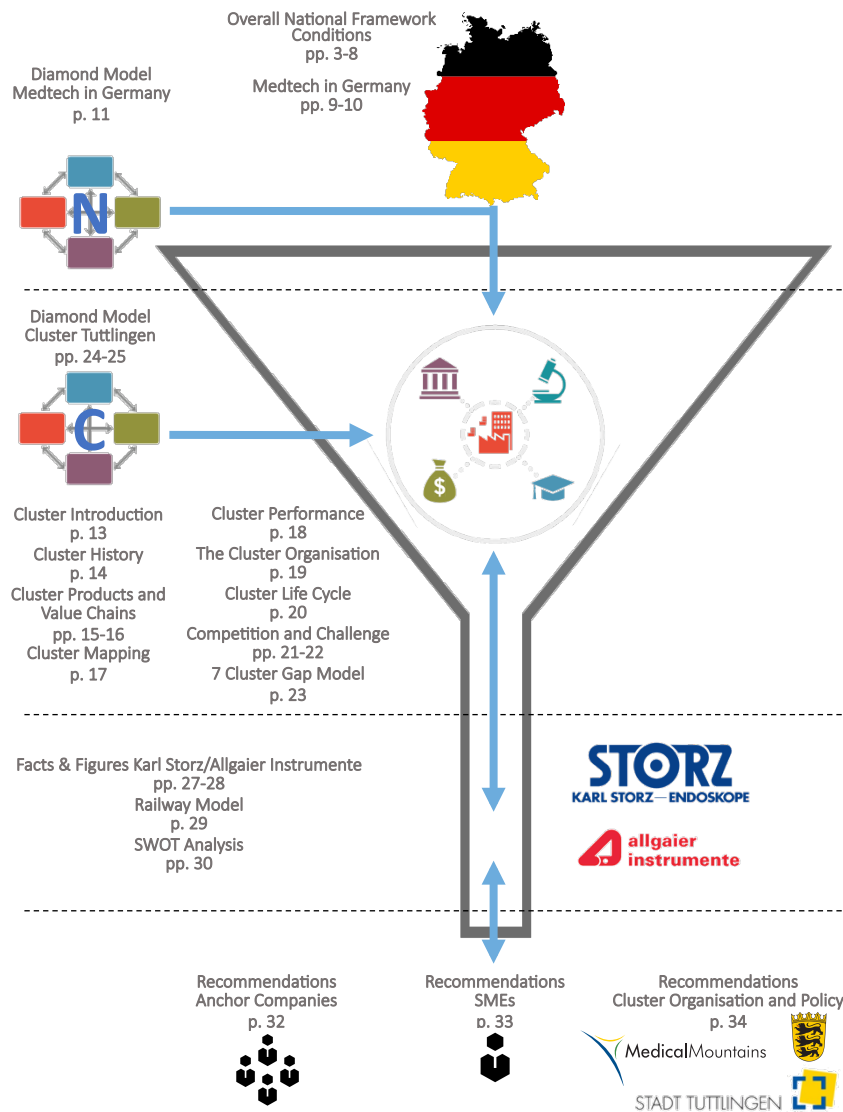
Government

- ▲ Very stable government with good diplomatic relations
- ▲ Key member state in the European Union, OECD, NATO, etc.
- ▲ Extensive government funds for cluster initiatives
- High degree of lobbyism from industry sectors
- ▼ Federal system leads to regulative particularities in individual federal state (e.g. corporate tax)

- ▲ Positive
- Neutral
- ▼ Negative

Cluster Level: Summary

The transition of the cluster threats to grow the gap between anchor companies and SMEs



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Cluster Level: Cluster introduction

The world centre of medtech is a small town in structurally strong Baden-Württemberg



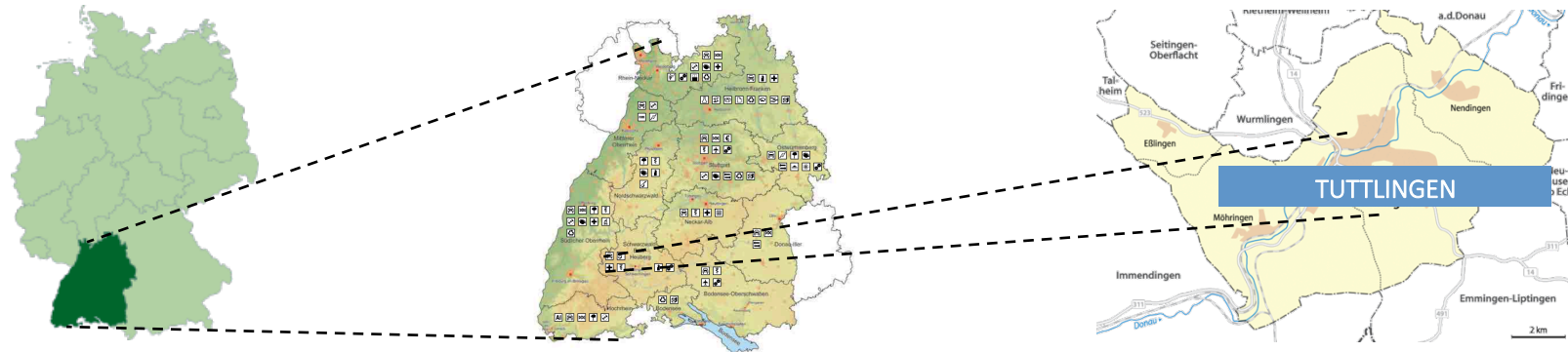
High Tech from Baden-Württemberg⁴⁰

- The South of Germany and especially the federal state of Baden-Württemberg (BW) is the **innovation centre** for the world famous German Automotive, Mechanical Engineering and Medical Technology industries:
 - BW reaches the **highest R&D intensity in Germany**
 - 30.2% of all German patent applications are from BW
- Very **strong academic research infrastructure**
 - 9 universities, 5 private higher education institutions, 8 colleges of arts and music, 6 colleges of education, 46 universities of applied sciences, thereof 22 public, and the cooperative state university (Duale Hochschule)
- High agglomeration of clusters in BW, well developed management systems and collaboration initiatives -BW is the **centre of the German medtech industry**, with four related clusters⁴¹

The world centre of medtech - Tuttlingen



- An unexpected world champion in medtech
- The Tuttlingen medtech cluster holds an estimated **market share of 55% in surgical instruments** (total market volume € 650 million)⁴²
- Approximately **600 companies in Tuttlingen are involved in medtech**⁴³
- Therefore, Tuttlingen calls itself **“the world centre of medical technology”**⁴⁴
- Tuttlingen is a small city in the south of Baden-Württemberg, between Wurmlingen and Neuhausen ob Eck
 - Population: **34,586 Citizens**⁴⁵
 - **High degree of Employment Specialisation in the area (7.5)**⁴⁶
 - **Unemployment Rate: 3.2%**⁴⁷ (German average 6.2%⁴⁵)



In an already highly competitive country, the federal state of **Baden-Württemberg is a role model** for research-density and innovation. **Leading technology companies and a good technological environment** are complementing and facilitating the development of each other. Therefore, it appears highly logical that some of Germany's most famous industries have their roots in in Baden-Württemberg. Yet, considering the city's size, **Tuttlingen is a surprising world champion in medtech.**

Cluster Level: Cluster history⁴⁸

A long history in surgical instruments faces a transition due to competition and diversification



17th Century
Duchy of Württemberg



1850s
German Industrial Revolution



1867
Gottfried Jetter founded Aesculap



1869: First train in Tuttlingen, connecting to
Württemberg Railway Network



1952: Karl Storz developed endoscopes
with traditional lens system



1958: Surgical Instruments Manufacturers
Association founded in Sialkot, Pakistan



2016
Tuttlingen Medical Cluster

1800-1900

Initially, the small town of Tuttlingen possessed geographical advantages such as convenient transportation along the Danube river, and abundant natural resources in iron-ore deposits and timber stock.

These natural advantages led the town to develop craft-based industry, centred by the tradition of iron-work of the Duchy of Württemberg by the end of the 17th Century. During this time, Tuttlingen competed on knife and scissor-forging against Solingen from the Rhur region, which was a major centre for iron and steel production.

By 1800, the artisan town had already 20 firms specializing in nail- and knife-forging. The number grew further after 50 years, during the German Industrial Revolution. Tuttlingen was home to more than 100 firms specializing in nail- and knife-forging in the 1850s.

In 1867, Gottfried Jetter, originally from Tuttlingen, brought back advanced manufacturing methods for medical instruments from Paris and founded a small workshop. Paris was the leading centre for medical research and surgical instruments production.

1867

The moment of [Gottfried Jetter](#) setting up his workshop and creating a standard manufacturing method for surgical instruments was seen as the beginning of the Tuttlingen medical cluster.

Jetter took an extensive trip across major hospitals in Europe and developed good network with these hospitals. He had an idea to standardize surgical instruments so he founded his workshop.

The workshop grew in size and was renamed to Jetter & Scheerer in 1887 and again to [Aesculap](#) in 1899. By the turning of the century, Aesculap had subsidiaries in Berlin and New York, and employed more than 440 workers. It is the largest company in Tuttlingen today.

1900-1955

At the beginning of the 20th Century, the number of surgical instrument types increased rapidly as surgery techniques developed further, leading to further [specialization](#) towards surgical instrument production in Tuttlingen. This development enabled craftsmen to shorten the production time of individual products and to obtain [economies of scale](#).

Despite the disruptions from two world wars and the Great Depression during the late 1920s, Tuttlingen continued to grow. By 1950, the town saw an increase of industrial firms from 3 to 23 and craft shops from 77 to 126.

In 1945, [Karl Storz](#) founded Karl Storz Endoscopy, which would become the second largest company in the Tuttlingen cluster. The company developed the first endoscopes with traditional lens systems in 1952.

1955-1999

By 1955, the city of Tuttlingen alone hosted 149 companies and over 3000 employees.

From 1955 to the end of the 20th Century, the cluster as a whole flourished due to the growth from the health sector, with a strong expansion of 84% in terms of the total number of companies.

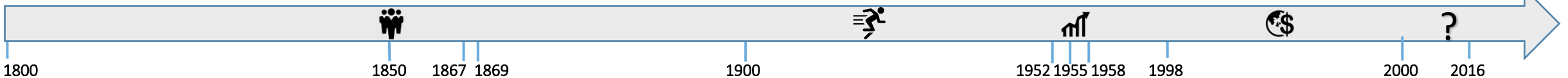
The surgical instruments cluster of [Sialkot, Pakistan](#) became a threat to Tuttlingen since late 1950s with lower cost of production.

1999-Today

By 1999, 87.5% of German surgical instrument firms were located in Baden-Württemberg, almost all in Tuttlingen. The town was literally the centre of surgical technology of the world.

During this time, the cluster entered its maturity stage, with industry associations forming quality controls and leading innovation. The cluster promoted [high product standards](#) and cluster [reputation of high-quality](#) instruments, as in contrast to Sialkot's low-price and low-quality products.

Marching into 21st Century, Tuttlingen faced the [competition from low-wage countries](#) (e.g. Sialkot) as well as the [emergence of new technologies](#) in minimally invasive surgery, surgical implants and advanced medical devices. In order to address both the competition of Sialkot and the new medical progress, many industrial firms in the cluster started to deviate from traditional, surgical instruments and [diversify](#) their business into [minimal invasive instruments, surgical implants, and various medical devices](#). Since then the cluster has been experiencing a phase of transition.



Cluster Level: Cluster products

The cluster transition led to a diversification of the cluster's product portfolio



The four medtech product segments of the Tuttlingen cluster⁴⁹

Surgical instruments



Tuttlingen had mainly produced knives (as other well-known sites such as Sheffield or Solingen) but started to specialize on surgical instruments in 1867, meeting the development of surgery.⁵⁰

Today there are thousands of specialized instruments for the most different operations. Instruments are developed for each operation method.

Some examples for instruments are Ribspreaders, Cardiovascular-, Surgical- and Dental Instruments.

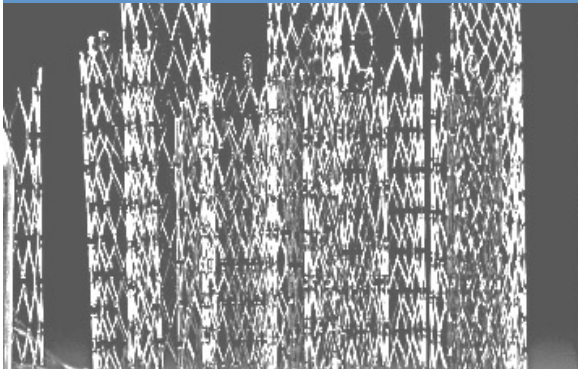
Minimally invasive instruments



In order to reduce surgical risks and scars after the operation, minimally invasive surgeries have become highly popular, strongly promoted by new imaging technologies such as CT or MRI.

Companies from Tuttlingen were first movers and offered the necessary instruments and endoscopes to work minimally invasive. The instruments usually consist of a pipe and a handle that controls the instrument at the end of the pipe.⁵¹

Implants



Companies in Tuttlingen met again the trend in surgery and used their existing know-how in metal treatment and diversified into implants. Yet, the production is more difficult and capital intensive (due to the needed machinery). Tuttlingen is still developing in this area and supplies currently only 17% of the German implant production.⁵²

Examples are knee-, hip- and spine-implants as well as self-expandable medical implant, such as stents.

Other medical devices



Reflecting the increasing diversification of the Tuttlingen cluster, big companies either started to look into related industries or manufacturers of medical devices that moved to Tuttlingen.

Just some examples are Lab Equipment, Therapeutic Devices, Lubricants, Polymers, fully integrated OR systems, Surgery carts, Desinfection, Catheters, software and a lot more.

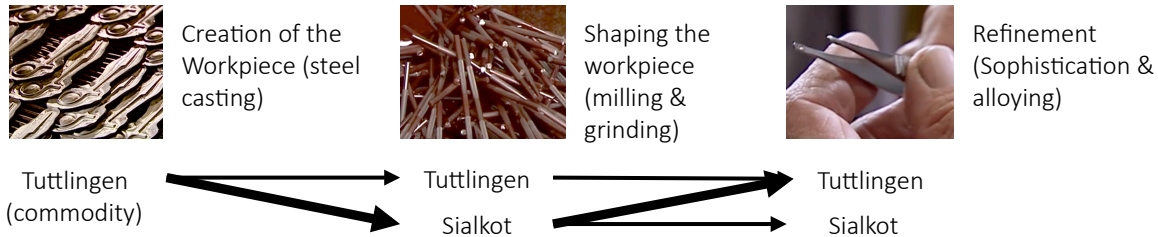
Cluster Level: Cluster value chains

The different product segments require distinct value chains with a trend towards globalisation



The value chains of the Tuttlingen cluster⁵³

Surgical instruments



The production of Surgical Instruments requires a high degree of manual work. Therefore, companies from Tuttlingen outsource the shaping to a large extent to Sialkot. Yet, the refinement for demanding instruments will usually be done in Germany. Batch sizes are small as surgical instruments are highly specialized for each operation, thereby reducing the potential for automation.

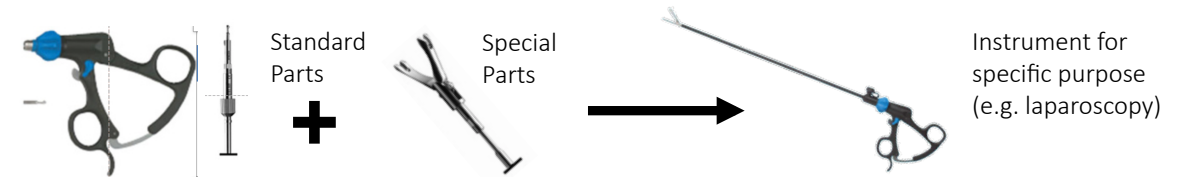
Implants



The production of implants is more reliant on machinery than on manual work and are therefore more capital-intensive. Tailor-made CAD drawings will be manufactured automatically. Humans supply know-how and work in finishing and assembly. All steps are made in Tuttlingen and companies built up on their existing knowledge about metal treatment.

The medtech cluster in Tuttlingen started with the simple 3-step production process of surgical instruments. Due to [increasing competition on the world market](#) and [high labour costs in Germany](#), companies started to [outsource parts of their production](#) to low-cost countries or even started to [buy the very low tech products for their portfolio](#). Additionally, companies started to [diversify into implants, minimally invasive instruments and all further types of medical devices](#). Yet, there are [limitations in terms of capital and know-how](#) for the small- and medium sized companies (<100 Employees) in the cluster.

Minimally invasive instruments



The capital intensity of minimally invasive instruments is higher due to higher automation in the production of standard parts. Furthermore, the technology tends to be more complicated (especially in case of endoscopes that require know-how in optics as well). Therefore, only a limited number of SMEs in Tuttlingen could switch to the production of minimally invasive instruments.

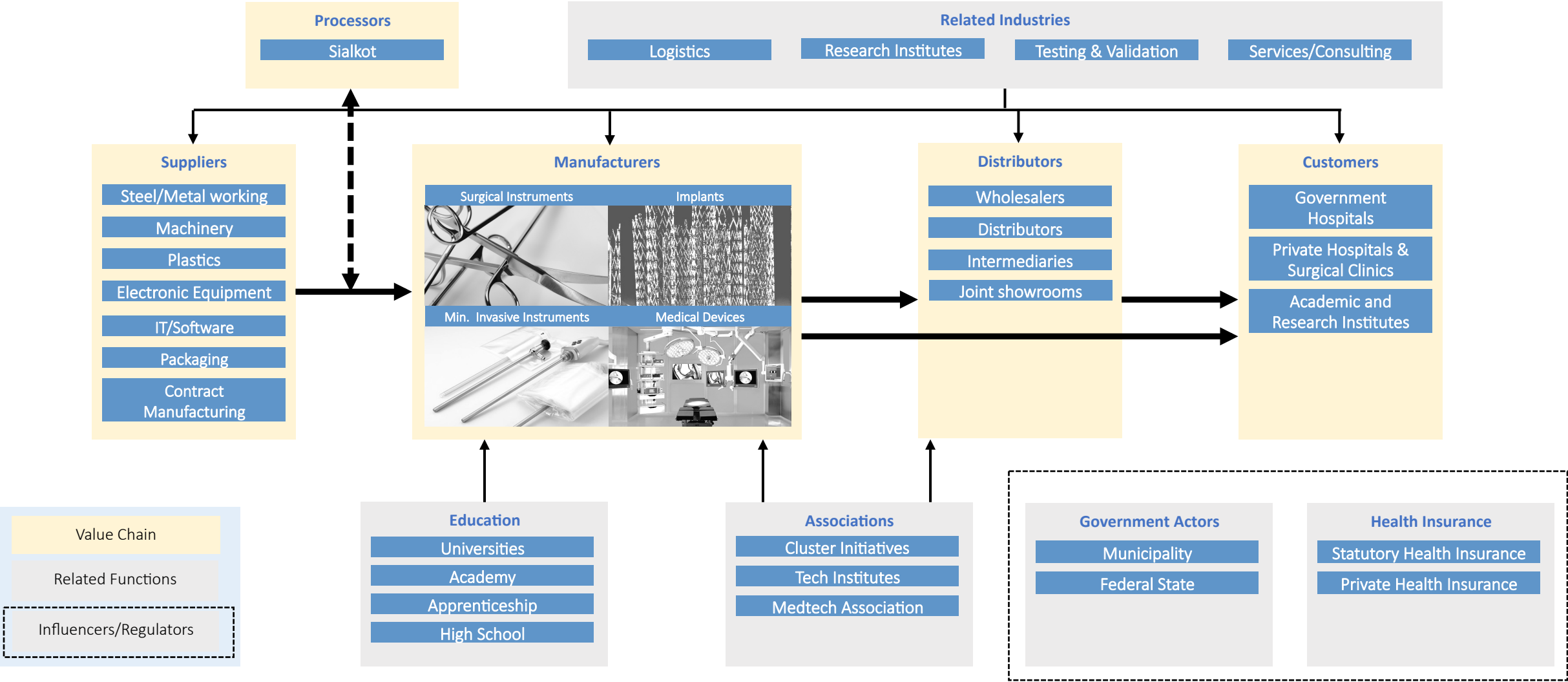
Other medical devices



Due to increasing diversification in the cluster, the value and production chains became more distinguished for each product. Due to the differences in technologies, supply and cost structure each of the exemplified products above has its own value chain.

Cluster Level: Cluster mapping

The Tuttlingen cluster shows high specialisation and sophisticated supporting industries



Cluster Level: Cluster performance

The cluster is characterised by two major players and numerous SMEs



Different manufacturers in the Tuttlingen cluster

The Anchor Companies

AESCULAP

10.600 Employees worldwide

STORZ
KARL STORZ – ENDOSKOPE

6700 Employees worldwide

Both anchor companies started as small handicraft companies: Aesculap with surgical instruments in 1867 and Karl Storz with endoscopes in 1949. Since then, both companies have managed to outperform their peers significantly and seized global market chances by introducing innovative technologies. Today, the companies employ more than 30% of Tuttlingen’s workforce⁵⁴ and offer diverse product portfolios. Aesculap provides almost anything from instruments to implants. Karl Storz broadened its product range from endoscopes to fully digitally integrated operating rooms. In order to save costs both companies outsourced a large degree of labour intensive manufacturing steps.

The small and medium sized companies

allgaier
instrumente
medical

18 Employees

Avellanus

5 Employees

mahemedical

110 Employees

90% of the companies in the Tuttlingen cluster are SMEs.⁵⁵ Most of them started as basement manufacturers or as spin-offs from other companies and are still family owned and run. The small companies increased their competitiveness on the global market through high specialisation and virtual horizontal integration(e.g. by using shared showrooms). Offering their products collectively, they address global customer needs from “one hand” and mitigate potential shortcomings in sales know-how.

Yet, as competition from low-cost countries increasingly closes the quality gap to Tuttlingen, small companies are under pressure. Most of them lack the financial resources to invest into machinery or the know-how to diversify their business towards high-tech products. Whereas nine of the ten largest firms sell endoscopes, implants and surgical apparatus, the small companies still rely on surgical instruments⁵⁴.

Performance

Facts and Figures about the Cluster Performance

Due to the structure of the Cluster (many SMEs), reliable data collection of the overall cluster performance is challenging. Nonetheless, the following facts and figures give an impression of the cluster performance:

20 million instruments produced and sold per year⁵⁵

Sales generated with surgical instruments: € 263 million⁵⁶

Total estimated annual turnover: € 600 million⁵⁸

World market share in surgical instruments: 55%⁵⁵

Export Ratio: 65%⁵⁷

17% of the overall German implant production⁵⁵

Production Volume of Endoscopes and minimally invasive instruments: € 200 million⁵⁵

The Cluster Initiative



Founded in 2011, the cluster organisation Medical Mountains connects medtech companies, universities, research institutes, politics and international medtech actors in Tuttlingen. The organisation aims to increase the competitiveness of the cluster by fostering innovation and reducing costs. Medical Mountains promotes networking in formal and informal forums for discussions as well as the involvement of the federal and state government in the cluster development. For further information, please see the following page of this report.

Cluster Level: Cluster organisation⁵⁸

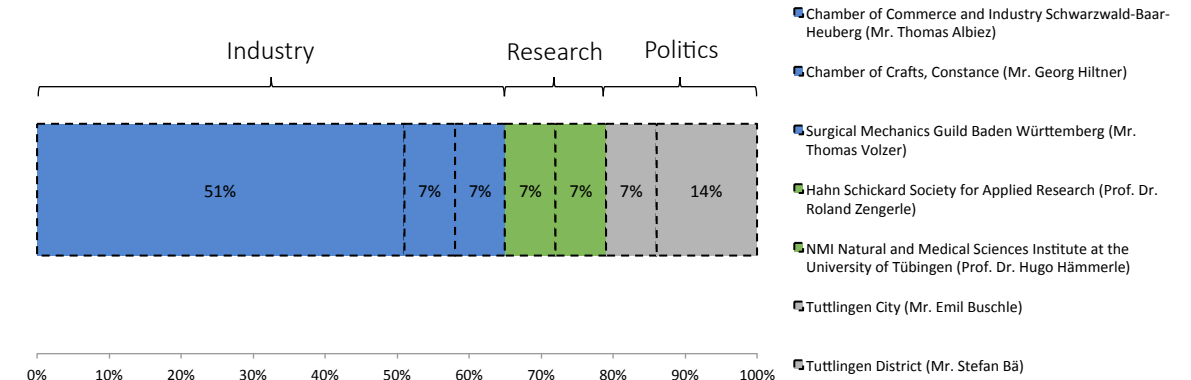
Medical Mountains is a powerful bridge builder between actors within and beyond Tuttlingen



Medical Mountains' fields of work

- Medical Mountains is involved in various **lobbying activities**, e.g. preparing a position paper together with industry experts for regulating the market for EU medical technology⁵⁹.
- **Innovation and technology development** are facilitated via Medical Mountains by hosting innovation forums, initiating R&D projects, and coordinating cross-company working groups called "Expert Tables"⁵⁹.
- Furthermore, a significant part of Medical Mountains' role is to **promote education** within the cluster. For example, by 2018 Medical Mountain will develop specific Bachelor, Master, and MBA programs for medtech students together with Hochschule Furtwangen University. The goal is to increase skills and knowledge of medtech, engineering, mechatronics and healthcare within the cluster. Medical Mountains also holds seminars for quality certifications and one-day courses within different fields of medtech⁵⁹.
- **Internationalization** is promoted by the cluster through various network events, partnerships with other international clusters and by hosting exhibitions in Tuttlingen. Information events such as "MedTech" and the "Impressday" (International Medical Press Day)⁶⁰ are initiatives undertaken by Medical Mountain to promote internationalization of the businesses in the cluster. Additionally, the cluster organisation prepares and distributes information material, e.g. catalogues.
- Members of the cluster obtain **discounts** (10%) for participating in fairs, training courses, and other events. Medical Mountains even provides members with special deals for staying at local hotels⁶¹.
- Medical Mountain in Tuttlingen is in close **collaboration** with the more technological inclined cluster Technology Mountains, which supports industries within micro technologies, metal and plastic processing and material engineering⁶².

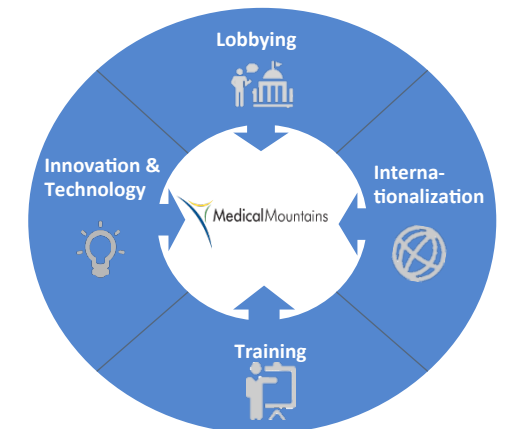
Shareholders of Medical Mountains⁵⁹



Cluster information and activities⁵⁹

Facts & figures

- 174 member companies
- 27,000 employees within the cluster
- 34 seminars held with around 300 participants
- 6 foreign delegations
- 2 fairs and community fairs
- 1 Innovation Forums Medical Technology with around 300 participants



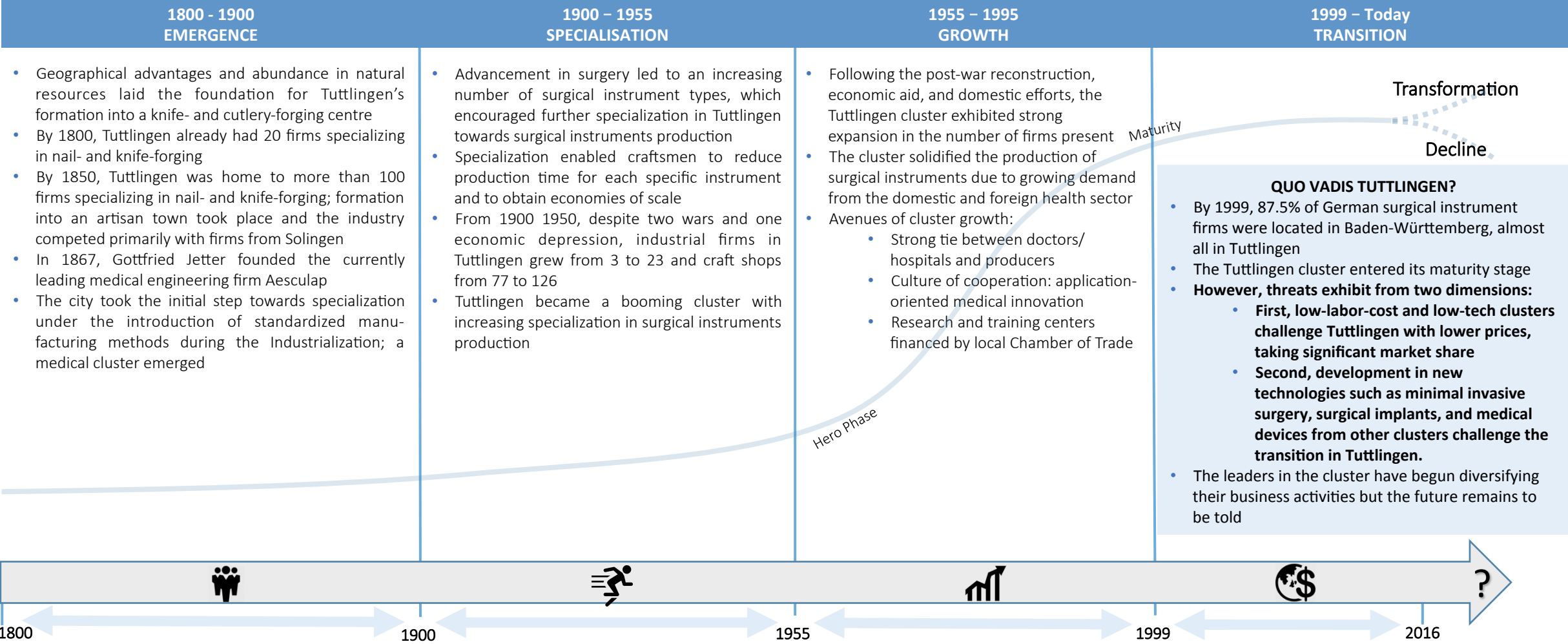
MedicalMountain aims at **facilitating exchange among SMEs** in order to increase **novelty through leveraging the skills, knowledge and capabilities of the firms**. To increase international recognition and cluster competitiveness, Medical Mountains strives for a state of "coopetition" among local firms.

Cluster Level: Cluster life cycle⁶³

The Tuttlingen cluster is on the verge of a transition



The inverted S Model for the Tuttlingen cluster



Cluster level: Global competitive landscape

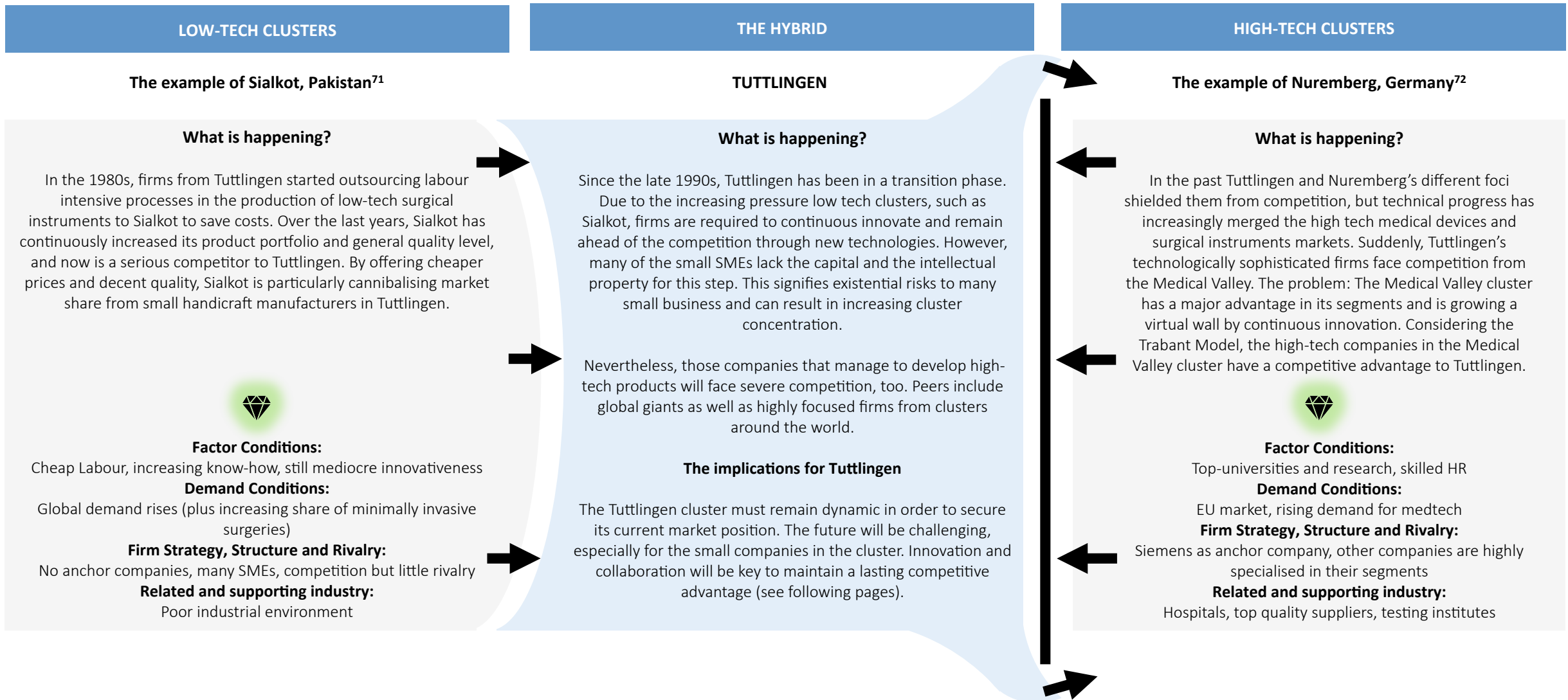
Tuttlingen grew into a special role in-between low- and high-tech competition



Cluster	Location	Anchor	Products	Four Lenses	Further Information	Technology
Surgical Instruments Manufacturers Association of Pakistan (SIMAP) ⁶⁴	Sialkot (Pakistan)		Surgical instruments	<p>Agglomeration Dynamics Life-cycle Construction</p>	<ul style="list-style-type: none"> The Sialkot cluster emerged more than 100 years ago. Its strong growth in 1980 was mainly fostered by companies from Tuttlingen that outsourced production steps due to lower labor costs in Pakistan. Because of low production cost and continuous quality improvements, Sialkot is now the major competitor for Tuttlingen in surgical instruments. Today, there are 2,200 surgical instrument manufacturers, mainly SMEs. 	LOW-TECH
The Baja Medical Device Cluster ⁶⁵	Tijuana (Mexico)		Basic Medical devices		<ul style="list-style-type: none"> This is a young cluster, which originated in the early 21st century. The cluster was planned to increase the regional competitiveness. Ca. 750 companies export 50% of the total output of the medtech industry in Mexico (main market US). Cheap labor and focus on efficient production processes put price pressure on established clusters. 	
TUTTlingen						HYBRID
Medical Valley ⁶⁶	Nuremberg (Germany)	Siemens	Medical devices		<ul style="list-style-type: none"> The cluster is known as an "Excellence Center for Medical Technology". Medical Valley is the leading cluster for medical devices in Germany. New products are developed in close cooperation with 40 local companies and hospitals. The focus lies on continuous product development and innovation of medical devices. 	HIGH-TECH
Medical Alley ⁶⁷	Minnesota (USA)	St Jude Medical, 3M, Medtronic	Surgical instruments, Medical devices		<ul style="list-style-type: none"> Medical Alley is the national leader in the world's largest medtech producing country. High capital investments lead to outstanding R&D spending. The Medical Alley Association consists of 700 corporations, employing more the 170,000 people. 	
Galway ⁶⁸	Galway (Ireland)	Boston Scientific, Medtronic	Medical invasive instruments, Medical devices		<ul style="list-style-type: none"> Ireland is the second largest medtech exporter in Europe. The cluster emerged as a result of global medtech giants locating their European headquarters in Galway. They were attracted by factor conditions such as the Irish corporate tax policy and the access to the EU. 	
The Medical Cluster ⁶⁹	Switzerland	Johnson & Johnson, Medtronic	Medical invasive instruments, Implants, Medical devices		<ul style="list-style-type: none"> The Swiss medtech industry developed from the watchmaking and machine engineering industry Switzerland offers a great environment for international competition. The medtech cluster benefits from mitigate knowledge from nearby-locations, such as Tuttlingen. 	
Utsukushima ⁷⁰	Fukushima (Japan)	Olympus Corp., Johnson & Johnson	Medical invasive instruments, Medical devices		<ul style="list-style-type: none"> The cluster was initiated in 2003 as the Next-Generation Medical Industry Agglomeration Project. 50 medtech companies operate in Fukushima today. The cluster very actively collaborates with educational and research institutes in the prefecture. 	

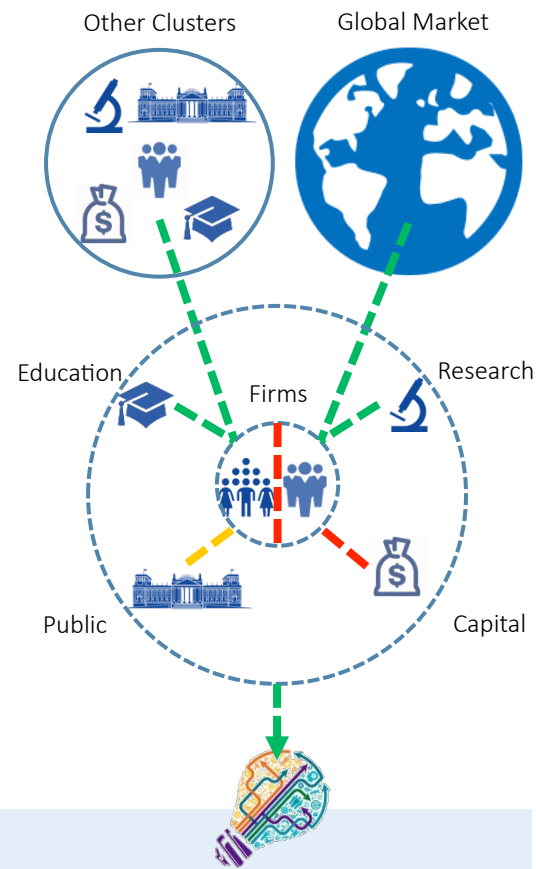
Cluster level: Challenges for the Tuttlingen cluster

Rising low-tech clusters and strong high-tech clusters pressure Tuttlingen's market position



Cluster level: 7 cluster gap model analysis

Growing firm-to-firm gaps and a lack of capital endanger limit innovativeness in Tuttlingen



The many bridges within the Tuttlingen cluster provide overall beneficial circumstances for innovation. Yet, a lack of capital and growing gaps between anchor companies and SMEs endanger the long-term competitiveness of the cluster.

	Cluster Gaps	Actors	Analysis
	Firm-to-Global Market	Clients and markets in different regions of the world	The gap barring interaction with global markets and value chains is very small : <ul style="list-style-type: none"> Tuttlingen is closely connected to the world with 65% export rate Strong collaboration with the competing cluster in Sialkot, Pakistan.
	Firm-to-Research	Research universities, Helmholtz Research Centers, Max Plank Institute, Innovationsallianz Baden-Württemberg, and other research institutes in the region	The gap barring interaction between firms and research institutes is very small : <ul style="list-style-type: none"> Tuttlingen is surrounded by some leading medical research organisations, centers, and laboratories of the world.
	Firm-to-Cluster	Sialkot Cluster, Medical Valley Cluster Nürnberg, and other related clusters around the world	The gap barring interaction between firms in Tuttlingen and other clusters is very small : <ul style="list-style-type: none"> Firms collaborate and communicate with partners and competitors in other clusters frequently.
	Firm-to-Education	International Business School Tuttlingen, Hochschule Furtwangen, and other universities nearby	The gap barring interaction between firms and educational institutes is small : <ul style="list-style-type: none"> Tuttlingen hosts 2 university campuses training specific business professionals and technical apprentices for the companies in the cluster It is also close to many top-notch educational institutes in Germany and Switzerland.
	Firm-to-Public	Local Chamber of Trade and Commerce; local Chamber of Crafts; cluster organisation; state and national government agencies	The gap barring interaction between firms and government/cluster organisations is medium : <ul style="list-style-type: none"> The public bodies provide ample support to the Tuttlingen cluster in establishing "commons" like Kompetenzzentrum Minimal Invasive Medizin (MITT), Landesinnung Chirurgie Mechanik, Medical Mountains, and Go-Cluster program But the overall bureaucracy of German public bodies is hampering the interaction.
	Firm-to-Firm	SMEs and larger companies	The gap barring interaction between SMEs and large firms is growing considerably : <ul style="list-style-type: none"> Larger companies are diversifying into emerging medical technologies Smaller companies stay on the traditional track, synergies are diminishing Competition pools for SMEs and large companies are diverging
	Firm-to-Capital	Venture capitalists, local banks	The gap barring interaction between firms , esp. SMEs, and capital providers , notably venture capitalists, is large : <ul style="list-style-type: none"> Insufficient and inefficient flow of capital into Tuttlingen to support entrepreneurship and R&D development.

Cluster level: Diamond model

Tuttlingen's competitiveness relies on relatively favorable factor and demand conditions



Factor conditions

▲ Access to world-leading technical expertise

Close proximity to clinical centers of excellence at University Freiburg, University Tübingen, University Ulm, and ETH Zürich (Switzerland)

Strong cooperation with world-class research, e.g. at Fraunhofer Institute for Manufacturing Engineering and Automation IPA in Tübingen as part of the "Cluster of Excellence" initiative of the German Federal Ministry of Education and Research

Long history of technical expertise and know-how within Tuttlingen area

▲ High levels of education and good alignment with business needs

Education system in Baden Württemberg generates good high school graduates (among the best in Germany according to PISA) as well as highly skilled university diploma holders

Furtwangen University's Tuttlingen campus specializes on medical technology education and cooperates closely with local businesses (partly financed by Medical Mountain initiative)

▲ State-of-the-art physical transportation infrastructure

Efficient transport infrastructure covering all modes of transportation ranging from road over rail and water to air

Baden Württemberg is one of Europe's largest and most important traffic hubs due to its central location and good infrastructure

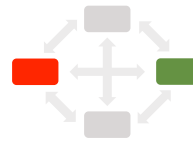
▼ Remote location is disadvantage in global war for talents

In the face of the global war for talents, Tuttlingen faces major problems to attract highly-qualified international professionals due to its remote location and low population

▼ Shortage of risk capital for local entrepreneurs

Local entrepreneurs have almost no access to venture capital

Local bank "Kreissparkasse Tuttlingen" offers tailored debt financing and facilitates access to governmental support, but processes are bureaucratic and often do not align with entrepreneurial needs



Demand conditions

▲ Very sophisticated buyer segments

Geographically close university hospital constitute very large and sophisticated buyers that are willing to cooperate and share research facilities

Local hospitals expect superior quality standards at competitive price levels, which leads to high pressure on manufacturers to continuously innovate products and processes

▲ High number of buyers within close geographical proximity

Germany not only records the highest number of hospital beds (666,000) among EU member states, but also by far the highest number relative to population size (823 beds per 100,000 inhabitants)

Europe constitutes the second largest market for surgical equipment after the United States

▲ Rising numbers of surgeries in due to ageing population as well as advances in diagnosis and therapy

Number of outpatient operations in German hospitals more than tripled from 2002 to 2015, and the highest increase was recorded in Baden Württemberg with approx. +320%

Similar developments in most neighboring countries, including France, Switzerland, and Austria

▲ Increasing numbers of specialized, private hospitals

Private hospital operators grow across all Western European healthcare markets. Private operators often differentiate from public hospitals through better quality and service add-ons. The resulting increase in competition leads to higher pressure on productivity and increased investments in the healthcare sector

► Increasing costs pressure when delivering health care

In Europe, as well as in the U.S. and in Asia, cost pressure and commercial risks dominate investment decisions made by hospital operators. As increased efficiency is becoming an existential concern for hospital operators, investment decisions are increasingly made based on TCO instead of quality.

- ▲ Positive
- Neutral
- ▼ Negative

In total, the medical technology cluster in Tuttlingen enjoys relatively favorable factor conditions as well as highly competitive demand conditions. Demand conditions are particularly strong due to the close relationships to numerous very sophisticated buyers within close geographic reach. Coupled with the cluster's favorable factor conditions, Tuttlingen benefits from the global rise in the healthcare sector.

Cluster level: Diamond model

The transition in the cluster is challenging the old structures and industries



Firm strategy, structure and rivalry

▲ Intense rivalry among local manufacturers and high investments in R&D

Due to Tuttlingen's small size of only 30,000 inhabitants, a tight network of relationships among actors exists. Over many decades, a culture of distrust existed and still today rivalry among local firms is intense. However, collaboration happens when it comes to improving the cluster's overall competitiveness. This extremely competitive culture puts high pressure on local firms to innovate and, as a consequence, prepares them optimally for the global competitive environment.

▲ No anchor company dominates cluster; instead a high fragmentation of SMEs exists

The Tuttlingen cluster is not dominated by single, large corporations but instead consists of a broad landscape of SMEs. While Aesculap and Karl Storz employ more than 1,000 employees, more than 90% of local enterprises have less than 100 employees. Nonetheless, a certain market consolidation structural transformation is observable and the number of local handicraft businesses has decreased from 277 to below 200 over the last two decades.

▲ High number of entrepreneurial spin-offs leverages innovative capacity

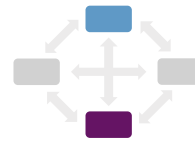
Tuttlingen's competitive landscape is characterized by entrepreneurial spinoffs. Very frequently, employees of local companies quit their jobs to launch their own businesses. While such entrepreneurs are mostly motivated by the prospects of better living quality and increased flexibility, such spinoffs leverage the clusters innovative capacity and keep it dynamic

▼ Several family-owned businesses have hard times preparing the succession by next generation

Within the next five years, a large number of ageing owners and managers of local enterprises will retire. Many family-owned business struggle to find and attract suitable successors and face an uncertain future

▼ Many small firms are locked into niche markets and cannot scale due to limited means of finance

Strong competition within the Tuttlingen cluster fosters innovation and has prepared many SMEs for global niche markets. Nonetheless, many of such firms still have equity ratios of 100% and are unable to access sufficient funding to continuously invest into new technologies and scale their businesses.



Related and supporting industries

▲ Dense web of local businesses has developed that offers products and services across the value chain

A vast number of highly specialized SMEs not only successfully supplies global medical technology markets but also delivers tailored parts and solutions to local manufacturers.

Circa 500 companies are located in the Tuttlingen cluster and act as manufacturers, suppliers and service providers. In total, they create a parallel existence of tradition and modernity, handicraft and high-tech

The proximity of suppliers and manufacturers allows for joint R&D activities, shared innovation, tailored solutions and short lead times

▲ Proximity to other world-leading manufacturing clusters facilitates knowledge transfer and innovation

Baden Württemberg's density of world-leading manufacturing clusters, e.g. the Stuttgart automotive cluster, contributes to Tuttlingen's high innovative capacity due to knowledge transfer and exchange of ideas. Frequent employee transfers bring in new perspectives and spread latest technological developments at a rapid pace across industries

▼ Cost pressure leads to increased market consolidation and increased imports from low-cost countries

The globalization of the medical technology industry on the one hand created new export markets, but on the other hand led to increased competition from low-cost countries. Especially, traditional handicraft businesses face strong competition from countries like Pakistan and China, leading to a higher market consolidation in Tuttlingen with focus on high tech manufacturing. One risk of this development is a decrease in innovative activity as those handicraft SMEs have traditionally accounted for a large portion of business ideas and inventions.

▼ Rather non-dynamic capital structures to do not promote innovativeness

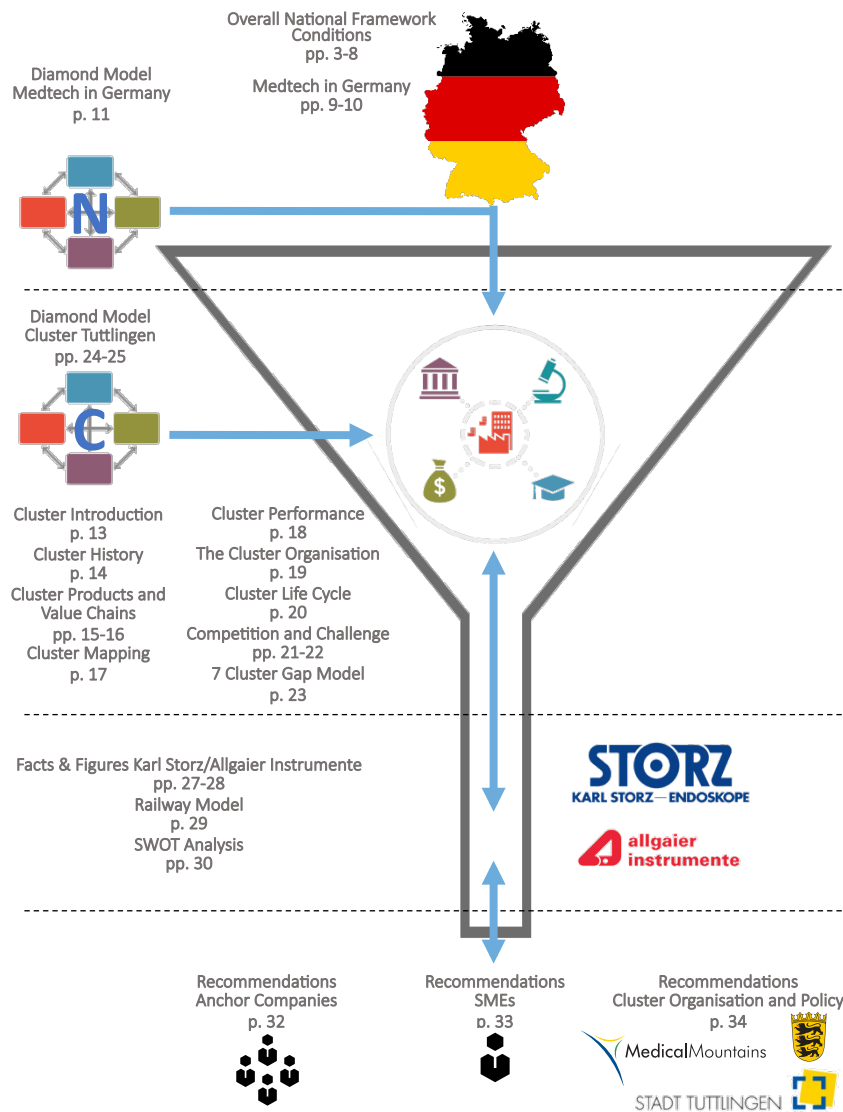
Main source of capital in Tuttlingen are local banks which are part of the old Handcraft structure. The transition of the cluster could be fostered by VCs or PEs Which support start-ups and new ideas rather than business as usual.

- ▲ Positive
- ▶ Neutral
- ▼ Negative

The strong rivalry among firms within the cluster paired with intense interaction among actors across related and supporting industries creates a fertile ground for globally competitive enterprises. Yet, the growing gap between the anchor companies and the SMEs within the cluster may endanger the overall cluster innovativeness and competitiveness.

Firm level: Summary

Different tracks cause a growing firm-to-firm gap within the Tuttlingen cluster



NATIONAL

Germany offers good framework conditions for internationally competitive firms. The German economy is very advanced and grows faster than most other European economies. Stable politics and high investments in business sophistication are key drivers of this development. Unlike in more centralised countries, numerous world-leading clusters are spread across the country and constitute the backbone of the export-oriented German economy. Economic homogeneity is of high political interest, and public initiatives exist to promote clusters across the country. Since the 19th century, Germany has been a hub for research and innovations in medical technology (medtech). By now, Germany is the largest medtech market in Europe and the third-largest in the world. Nevertheless, medtech markets in the US as well as in emerging countries currently grow at faster rates and threaten to dilute Germany's global market share.

CLUSTER

Tuttlingen is located in the structurally strong federal state Baden Württemberg. Home of several world famous automotive, mechanical engineering, and medtech clusters, Baden Württemberg reaches the highest R&D intensity in Germany. Tuttlingen only has a population of about 35,000 inhabitants, but is often considered the world centre for surgical equipment. Its history dates back to the early 19th century, when artisan businesses specialised on knife-forging. Over the last century, the cluster has increasingly focused on the development of surgical equipment and today approximately 600 related businesses operate within the cluster. While over 90% of these firms are considered SMEs, two large anchor companies exist: Karl Storz and Aesculap.

Along with technological progress, local firms dynamically updated their product portfolios and became globally known as innovative leaders, particularly in the field of minimally invasive instruments. The cluster was dynamic and globally successful. Nevertheless, over time a gap emerged between two anchor companies and many SMEs. While the former increasingly invest in the development of highly sophisticated, integrated products, the latter struggle to keep up with the rate of change.

FIRM

Analysing the individual situations of Karl Storz and Allgaier Instrumente, the widening gap between firms in Tuttlingen becomes apparent. While Karl Storz has grown into one of the world's largest medtech manufacturers, the firm faces increasing competition from internationally operating industry giants. For Allgaier Instrumente competition has intensified too; however, mostly from low-cost clusters, such as Sialkot. Different strategic changes in direction have separated the firms' paths, and now they face significantly different opportunities and threats.

OUTLOOK

In order to successfully tackle these challenges, we have developed customised recommendations for the four most significant actors within the Tuttlingen cluster: anchor companies, SMEs, the local cluster organisation, and policy-makers. In total, these recommendations aim at re-arousing a climate of collaborative rivalry and improving overall framework conditions for globally competitive firms.

Firm level: Facts & figures

The analysis of Karl Storz and Allgaier Instrumente reveals widening firm-to-firm gaps



OVERVIEW¹

Karl Storz⁷³

Year of foundation: 1949
Headquarters: Tuttlingen
Ownership: Family-owned
Global presence: >50 subsidiaries in over 40 countries; production locations in five countries
Product range: Endoscopes; minimal invasive instruments; systems solutions (>8,000 products)

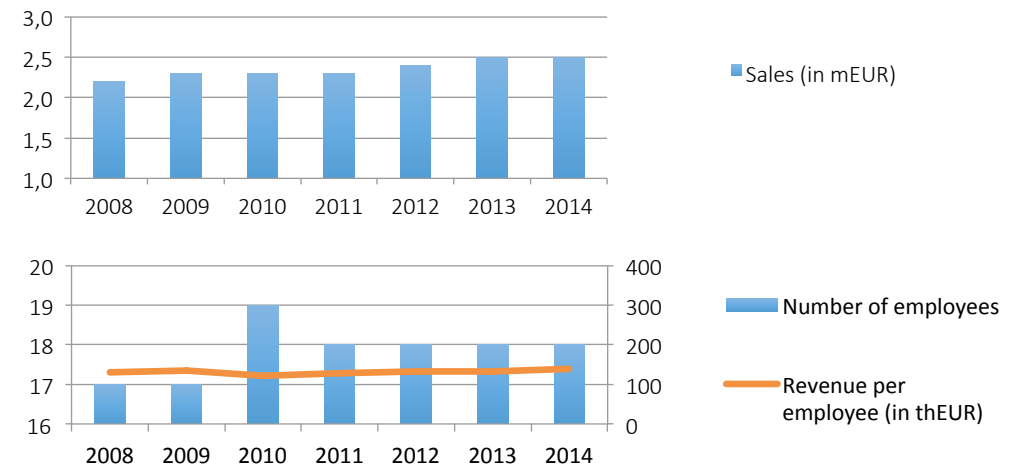
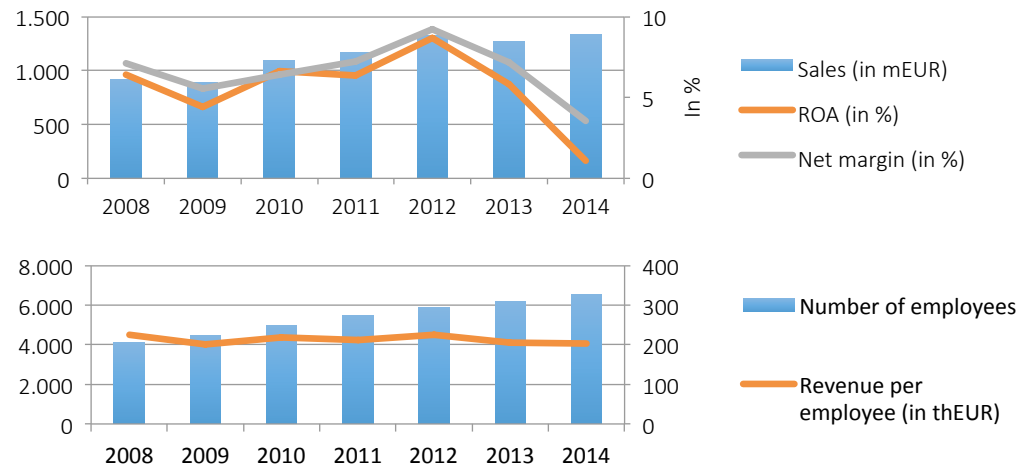


Allgaier Instrumente⁷⁴

Year of foundation: 1953
Headquarters: Frittlingen (District of Tuttlingen)
Ownership: Family-owned
Global presence: Central administration from headquarters, sales to >80 countries
Product range: Endoscopes, surgical instruments



FINANCIALS²



Karl Storz and Allgaier Instrumente were both founded by young local entrepreneurs soon after World War II. Initially, **both companies produced endoscopes and mechanical surgical instruments**. Nonetheless, the firms' paths separated soon although their headquarters have stayed within walking distance. While **Allgaier Instrumente, as the vast majority of local firms, has remained a highly centralised small family business**, **Karl Storz** has emerged to a **large global medtech corporation** with over 50 subsidiaries in more than 40 countries. In fact, **Karl Storz has become an anchor company** for the Tuttlingen medtech cluster and the second largest employer within the municipality. **Allgaier Instrumente, instead, represents a typical small size local manufacturer.**

Firm level: Facts & figures

Large and small firms face threats from rising global competition, but from different peers



ROLE IN THE CLUSTER

Karl Storz⁷³

- Karl Storz constitutes an **anchor company** for the Tuttlingen cluster
- After Aesculap, Karl Storz is the second largest company within the cluster
- Karl Storz's strong **brand promotes Tuttlingen** within the German market and around the globe
- As a major local tax payer and employer, Karl Storz is of high **significance for the municipality**
- Karl Storz largely invests into local R&D, innovation and infrastructure, improving the overall **competitiveness of the cluster**
- Member of the Medical Mountain cluster initiative

CURRENT SITUATION

- Sybill Storz, the founder's daughter, took over as CEO in 1996 and has since then managed the firm
- Karl Storz has grown internationally and the German market now accounts for only 9% of total sales
- This growth has been achieved through a **strong global expansion**, primarily to North America (42% of total sales), the rest of Europe (24% of total sales), and Asia (20% of total sales)
- At the same time, Karl Storz has **continuously innovated its product portfolio** and moved on from its traditional focus on endoscopes toward minimally-invasive instruments, implants, and integrated operation room systems
- R&D expenses amount approx. 5% of annual revenues and each year hundreds of new products are launched
- As revenues have grown over the last years, this increase came with the price of **lower profitability**
- Karl Storz has evolved from a hidden champion toward a global competitor, and, hence, also **changed its peer group**
- The new **competitive environment includes global giants**, such as Medtronic (€27 bn sales) and Siemens Healthcare (€13 bn sales), and **financial pressure increased significantly**

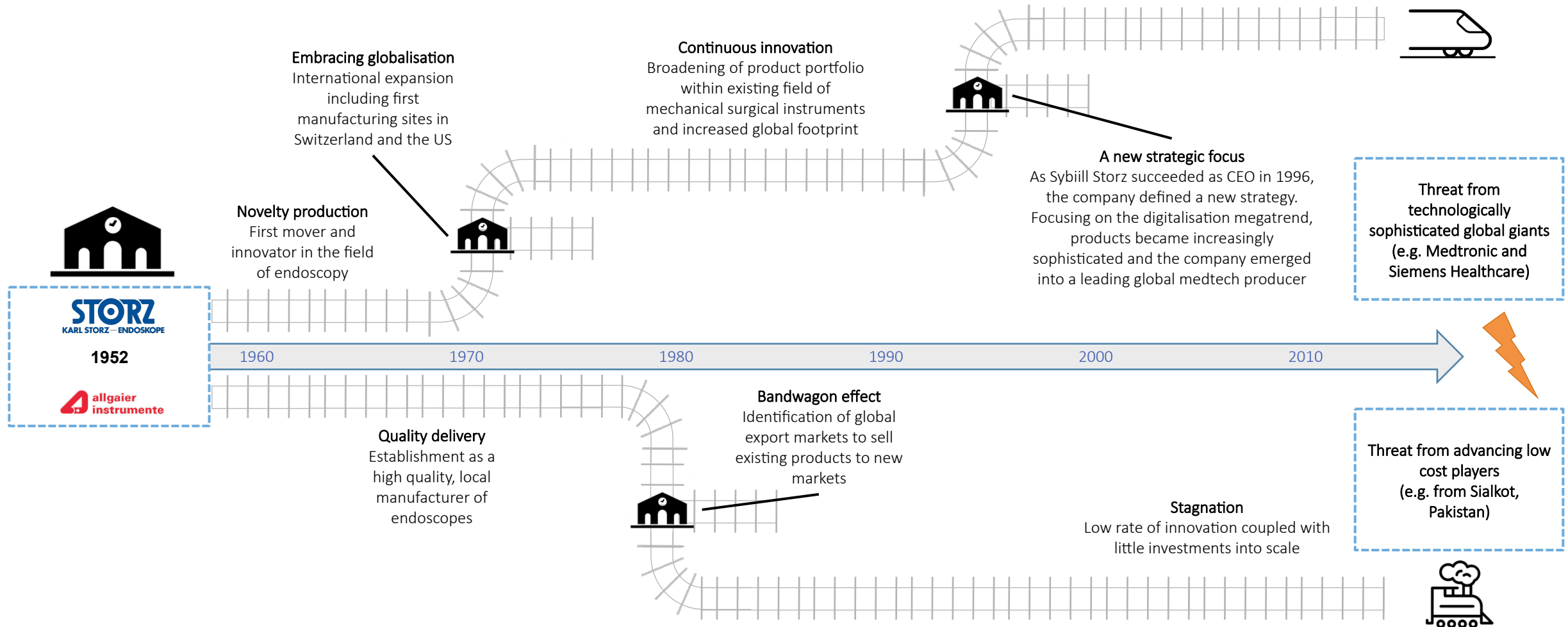
Allgaier Instrumente⁷⁴

- Typical representative of the **numerous family owned medtech SMEs** in the Tuttlingen cluster
- Similar to many other firms, Allgaier Instrumente was founded in the 1950s and **initially focused on metal printed surgical instruments**
- With growing specialisation over time, Allgaier Instrumente **followed its peers' paths** and increasingly exported its surgical instruments **to global markets**
- Typically for many firms, **products are characterised by functionality, ergonomics, and high quality**
- Member of the Medical Mountain cluster initiative
- Allgaier Instrumente is led by Rolang Allgaier in the second generation, and grandson Jonas Allgaier is destined to soon take over the family business
- **Business** has been **relatively stable** for Allgaier Instrumente over the last years and annual sales range between €2.3 and €2.5 mn
- Allgaier Instrumente has a broad product focus and offers **over 26,000 different surgical instruments**
- Exports are shipped to over **80 countries worldwide** and constitute the majority of the firm's sales
- Nonetheless, **global competition** and the rising need for digitisation are **risks to the firm's future**
- **Manufacturers from low-cost countries** (e.g. from Sialkot Pakistan) have significantly improved product quality and have become **significant competitors** on global markets
- Due to limited economies of scale, Allgaier Instrumente is forced to increasingly focus on **niche markets** and offer highly specialised instruments
- Allgaier Instrumente **lacks resources** to invest in modern technologies and keep up with the speed of digitisation

According to their different sizes, Karl Storz and Allgaier Instrumente have **traditionally played different roles** within the Tuttlingen cluster. While **Karl Storz soon emerged to an anchor company**, which promotes Tuttlingen around the world and invests large sums into Tuttlingen, **Allgaier Instrumente and the majority of the local firms remained small family businesses**. While both firms have embraced the trend of globalisation, only Karl Storz has truly emerged into an international company with local subsidiaries. Remarkably, however, **Karl Storz and Allgaier Instrumente now simultaneously face the challenge of increasing global competition - but from different peers**. It will be a **challenge for the Tuttlingen cluster to avoid that local firms diverge too far from each other** and to keep up the pace of innovation, which has long been the backbone of the cluster.

Firm level: Railway model

Stops at different train stations have separated the paths of Karl Storz and Allgaier Instrumente



Karl Storz and Allgaier Instrumente both started as producers of endoscopes, but soon their **routes separated due to different paces**. Karl Storz has always been a high speed train of innovation, while remaining focused to **stop at train stations and change tracks when needed**. Allgaier Instrumente, instead, moved at a significantly slower pace and remained on the same tracks for longer periods of time. These days, the two firms act in very **different markets, but simultaneously face the threats from new competitors**. Another stop at a train station may be of high value for both.

Firm level: SWOT analysis

Despite a shared history, the firms' future outlooks differ significantly



Karl Storz

S

- **Location:** At the heart of the Tuttlingen medical cluster with established global reach
- **Product:** Global leader in high-end endoscopy products
- **Brand Image:** Long, legendary history and high quality associated with the brand

W

- **Cost:** Regulations, standards, and labour costs lead to higher priced, albeit higher quality, products
- **Technology:** Lacks advanced technology know-how in fields outside its traditional core activities in endoscopy

O

- **Diversification:** Push R&D on emerging technology such as integrated surgical instruments and solutions, and diversify the product range to grasp growth opportunities

T

- **Entry barriers to new markets:** High entry barrier to become competitive against high tech players with more capital, more sophisticated technology, and established customer base
- **Required competencies:** Technological progress has increased the importance of IT expertise, which cannot be considered a core competence at Karl Storz

Allgaier Instrumente

- **Location:** At the heart of the Tuttlingen medical cluster with strong ties and network along the value chain
- **Product:** Wide range of product offerings in traditional surgical instruments and endoscopy (approx. 26,000)
- **Brand Image:** Traditional family business known for its high-quality surgical products

- **Capital:** Lack of funding for investment in R&D or for keeping up with new technological trends
- **Production:** Limited economies of scale prohibiting product cost reduction
- **Human Resources:** Lack of innovative talents

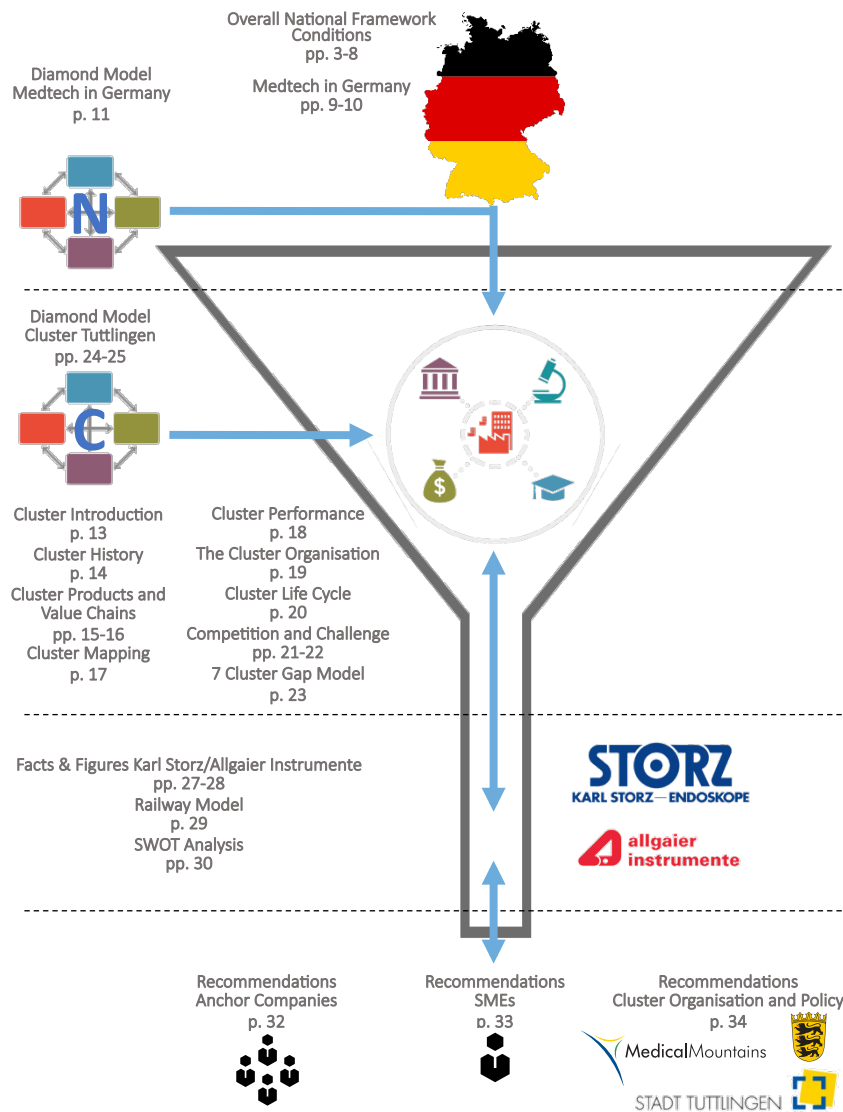
- **Collaboration:** Active communication and cooperation with peer companies within the cluster
- **Transition:** Pursue further specialization in sophisticated surgical instruments and serve as vendor, buying cheaper components from Sialkot and manufacturing high-end instruments to offer full packages tailored to the needs of clients

- **Low-cost competitors:** Pressure from manufacturers in low-wage countries with lower prices, most notably those in Sialkot, that decreases the company's price competitiveness in global market
- **Scale:** Possibility that peer competitors develop better products at lower unit cost with larger economies of scale, completely eliminating competition

Despite sharing similar beginning in the same cluster during the same period, Karl Storz and Allgaier represent two different types of companies with **different business foci and future outlooks**; their individual strengths and weaknesses present them with **different opportunities and threats** facing increasingly different groups of competitors, both domestically and internationally.

Outlook: Summary

The development in the Tuttlingen cluster is both – a chance and a challenge



NATIONAL

Germany offers good framework conditions for internationally competitive firms. The German economy is very advanced and grows faster than most other European economies. Stable politics and high investments in business sophistication are key drivers of this development. Unlike in more centralised countries, numerous world-leading clusters are spread across the country and constitute the backbone of the export-oriented German economy. Economic homogeneity is of high political interest, and public initiatives exist to promote clusters across the country. Since the 19th century, Germany has been a hub for research and innovations in medical technology (medtech). By now, Germany is the largest medtech market in Europe and the third-largest in the world. Nevertheless, medtech markets in the US as well as in emerging countries currently grow at faster rates and threaten to dilute Germany's global market share.

CLUSTER

Tuttlingen is located in the structurally strong federal state Baden Württemberg. Home of several world famous automotive, mechanical engineering, and medtech clusters, Baden Württemberg reaches the highest R&D intensity in Germany. Tuttlingen only has a population of about 35,000 inhabitants, but is often considered the world centre for surgical equipment. Its history dates back to the early 19th century, when artisan businesses specialised on knife-forging. Over the last century, the cluster has increasingly focused on the development of surgical equipment and today approximately 600 related businesses operate within the cluster. While over 90% of these firms are considered SMEs, two large anchor companies exist: Karl Storz and Aesculap.

Along with technological progress, local firms dynamically updated their product portfolios and became globally known as innovative leaders, particularly in the field of minimally invasive instruments. The cluster was dynamic and globally successful. Nevertheless, over time a gap emerged between two anchor companies and many SMEs. While the former increasingly invest in the development of highly sophisticated, integrated products, the latter struggle to keep up with the rate of change.

FIRM

Analysing the individual situations of Karl Storz and Allgaier Instrumente, the widening gap between firms in Tuttlingen becomes apparent. While Karl Storz has grown into one of the world's largest medtech manufacturers, the firm faces increasing competition from internationally operating industry giants. For Allgaier Instrumente competition has intensified, too; however, mostly from low-cost clusters, such as Sialkot. Different strategic changes in direction have separated the firms' paths, and now they face significantly different opportunities and threats.

OUTLOOK

In order to successfully tackle these challenges, we have developed customised recommendations for the four most significant actors within the Tuttlingen cluster: anchor companies, SMEs, the local cluster organisation, and policy-makers. In total, these recommendations aim at re-arousing a climate of collaborative rivalry and improving overall framework conditions for globally competitive firms.

Outlook: Recommendations for anchor companies

Diversifying the product portfolio entails new market opportunities



- By diversifying their product portfolio [Karl Storz](#) and [Aesculap](#) outgrew their traditional markets of endoscopes and surgical instruments, respectively. Their new products meet new competitors and new markets. Referring to the [Radio model](#)⁷⁵, elaborate market entry strategies are required to secure long-term success.



- **Why should the anchor companies enter new markets?**
 - Exploit economies of scale and grow market share
 - Former low-cost/low-tech competitors (e.g. from Sialkot) are improving their while keeping cost low and thereby endanger the market positions of established companies in the surgical instruments and endoscopes markets. Hence, the anchor companies are forced towards offering more technologically sophisticated products (as explained on page 22).
- **What can the anchor companies bring into the market?**
 - Both companies have started diversifying their product portfolios against the background of strong market position in their traditional markets, which serve as a reliable cash cows. New products are built on their core competencies in medtech, allowing economies of scope in R&D. Yet, when tapping into very sophisticated markets, e.g. that of high-tech medical devices, the companies may lack the experience and know-how to introduce truly innovative products. Therefore, both companies need to strongly invest in R&D.
- **What are the anchor companies meeting in the new markets?**
 - Even though the medtech industry is rather fragmented, Tuttlingen's anchor companies will compete with global industry giants. Those powerful companies are highly capable in terms of HR, R&D and capital and possess strong networks in their respective market environments.
 - On a cluster level we see the danger of the "Trabant effect". Tuttlingen, historically focused on the rather manual production of surgical instruments may not be the most competitive environment for high-tech innovations in new markets (e.g. in comparison to the Medical Valley cluster (see page 21)). Especially considering the growing gap between SMEs and the anchor companies (see page 23), Karl Storz and Aesculap may become lone warriors that compete with dynamic high-tech clusters. If necessary, the companies need to evaluate how "locked-in" they are (Railway Model) and consider to change their home cluster.
- **How should the anchor companies enter and act in the new markets?**
 - Digitalization is one of the major trends in the industry and a big chance for the anchor companies to grow their market positions. Yet, it is key to understand customer needs through vertical collaborations with leading hospitals all around the globe. Assessing surgical procedures and working processes of some of the most prominent clinics would allow these anchors to form a better understanding of required product developments outside of its traditional markets. The companies should take advantage of the overall beneficial conditions for medtech in Germany (see page 9) and exploit them to compete against the global competition.
 - In order to overcome a potential Trabant effect, the firms need to bond with outside actors in global events, fairs, and conferences. By showing commitment within Tuttlingen and actively supporting the transition of the cluster, the anchor companies have the potential to re-establish the desired state of cluster dynamism.



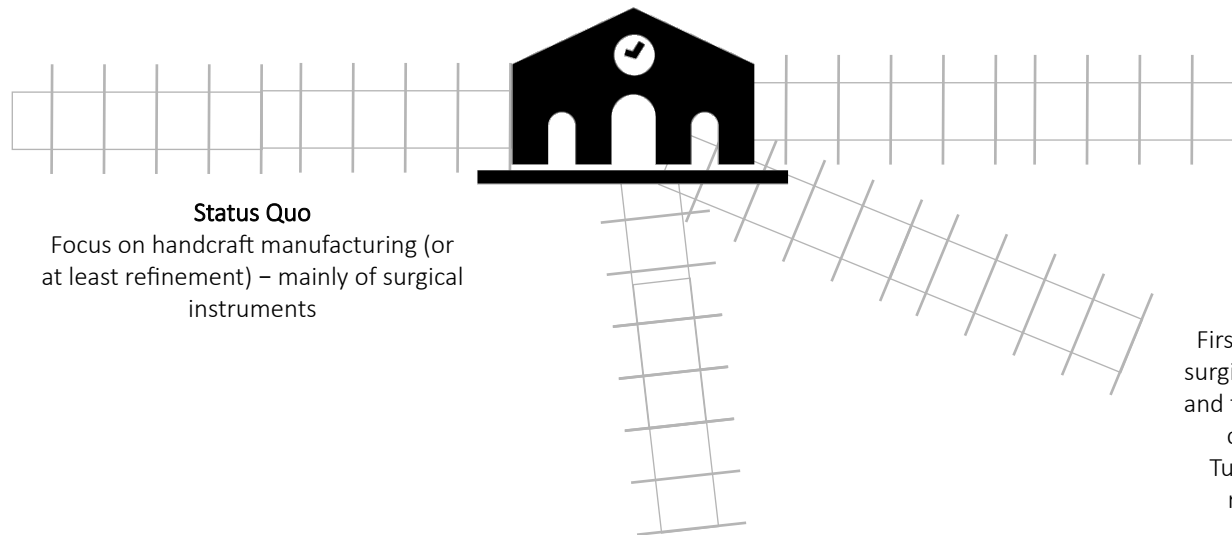
Anchor companies must **align their "bring" and "meet"** to the new market conditions as they will face new competition and new customer demands when launching new products. **Technical sophistication** must be prioritized, and reaching beyond Tuttlingen's borders may be crucial in order to **remain competitive and meet customer demand**.

Outlook: Recommendations for SMEs

SMEs are challenged to stay ahead of the global competition



- Forces from low-tech clusters - such as SIMAP in Sialkot and Baja Medical Cluster in Tijuana - are pressuring SME's in Tuttlingen due to cost advantages and continuously improving product quality. This development in the medtech industry forces SMEs to adapt their business strategies⁷⁶. As part of our analysis we identified three strategic options to cope with the low-cost competition. Nonetheless, these approaches require the capital, the know-how and finally the braveness to change tracks.



Status Quo

Focus on handcraft manufacturing (or at least refinement) – mainly of surgical instruments

Option 1 - Stay on the tracks (but with adjustments)

Companies can follow their current strategy and try to advance their products step by step to stay ahead of the competition, but remaining chased. Vertical collaboration combined with further specialization and shared showrooms allow the small companies to use synergies (see page 18). Portfolios may even include imported products from low-cost suppliers. This way, end customers can purchase larger bulks conveniently from Tuttlingen.

Option 2 – Quit manufacturing and become service providers

First formerly manufacturing businesses have already quit producing and now focus on trading surgical instruments from low-cost countries. They use their brand name, their product expertise and the existing customer network. Thereby, they even embrace the growing supply from former competitors. Considering the already existing supply relationship with Sialkot companies, Tuttlingen firms can become valued intermediaries for end customers. This option, however, requires good business skills and is connected to drastic changes in the operating model.

Option 3 – Diversify and change product portfolio

Small companies can consider to follow the examples of the anchor companies and grow their business vertically or even change their main focus. Introducing the next generation into the often family run businesses can be good opportunities for change and contribute new views and know-how. Digitization is an important trend in medtech and consistently creates new business opportunities.

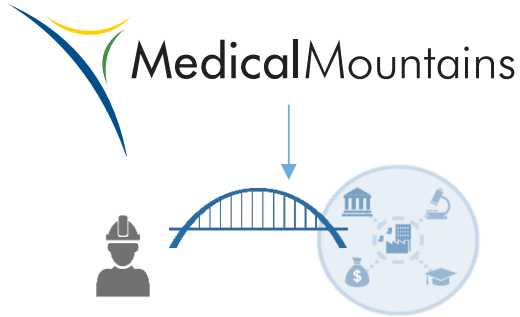
SMEs in Tuttlingen are mainly **pressured by low-tech companies** in emerging countries, where cheap labor constitutes the main reason for cost advantage. **Changes in strategy to avoid lock-in effects** will be vital to keep Tuttlingen's SMEs alive. We see three options to ensure long-term competitiveness; the right option depends on each company's context in terms of HR, capital, know-how and risk-affinity.

Outlook: Recommendations for cluster organisation & policy makers

Policy and cluster organisations need to actively support the cluster transition



- One of the most important tasks of the [cluster organisation Medical Mountains](#) is to function as a [bridge builder](#). Especially the growing gaps between anchor companies and SMEs as well as the limited access to capital may endanger the long term competitiveness of the cluster (see page 23). Medical Mountains must not be exclusive but open to all actors related to medtech. Furthermore, it should act as an “antenna” by gathering information from outside clusters, compiling the data and communicating it into the Tuttlingen cluster.



- [Start-Ups](#) within the cluster should be provided with [training, capital and helpful networks](#). The number of new start-ups in Tuttlingen is decreasing, which endangers the cluster’s innovativeness.
- [Synergies](#) can emerge when Medical Mountain increases its efforts in formal and informal discussion forums where manufacturers, doctors and researchers get together and discuss the future of medtech. Moreover, inviting global medtech leaders to inspire Tuttlingen’s actors could potentially contribute to catalyzing strategy development among firms.
- Medical Mountains should listen to the needs of all involved parties (firms, hospitals, educational institutes, etc.) and critically [assess the cluster’s performance](#). Currently, the cluster initiative could not provide reliable overall sales and performance data. [Benchmarking](#) of a number of KPIs, such as innovativeness, sales, exports, profitability etc. would provide a solid foundation for future evaluation. Moreover, Medical Mountain should communicate the information to create a transparent picture of the cluster’s performance and attract even more investors.

- Policy makers on national (Germany), federal (Baden-Württemberg) and municipal level (Tuttlingen) can [positively impact](#) the long-term competitiveness of the cluster by setting the right circumstances (see page 11 & 24,25). Although our analysis shows that Germany provide favourable framework conditions for medtech businesses in general, the Tuttlingen cluster faces severe future threats that demand policy makers’ attention and action.



- On a national level, it is important to keep the [development cost](#) for new products as low as possible. Furthermore, the state needs to [constrain the power of health insurance companies](#) and ensure fair approval and reimbursement processes, while [keeping bureaucracy low](#). Finally, incentives and support for entrepreneurs should be improved in order to re-establish a [climate of dynamism and innovativeness](#) in clusters like Tuttlingen.
- On a more local level, policy makers need to be aware that the romantic basement handcraft manufactures in Tuttlingen will face increasing price pressure in the future and may at some point disappear. In collaboration with the cluster organisation it is necessary to on the one hand support them in their transition (see page 33) and on the other hand create alternative job opportunities.

[Medical Mountains’](#) role is essential for the future of medtech in Tuttlingen: it must continue to [bridge the gaps](#) between cluster actors and also extend its activities to reach outside Tuttlingen. Involvement of all actors in the cluster is necessary to foster innovativeness and thereby ensure the long-term [competitiveness of the cluster](#). [Policy makers](#) need improve the ease of doing business for existing and new organisations and should prepare support for Tuttlingen’s small businesses in their very challenging process of change.



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