





### Resilience in Industry Clusters

John Hobbs Munster Technological University

**FOUNDATION Partner:** P1 Munster Technological University

Hybrid Workshop / Webinar 28/9/21





















FOUNDATION will provide a framework and roadmap for regions facing industrial closures, job losses and uncertainty, to develop economic resilience through collaboration.









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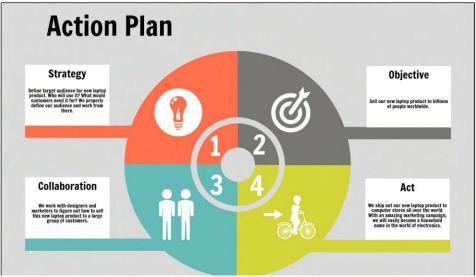
### Foundation Objectives







Good Practice)





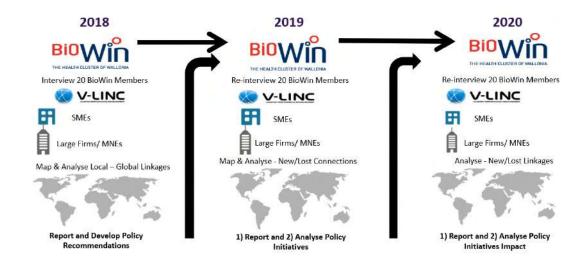
#### Introduction



Longitudinal research to record, measure and visualise BioWin's evolution and business relationships developed, maintained and lost over 3 years using V-LINC analysis (Byrne, Hobbs, and Doran, 2018).

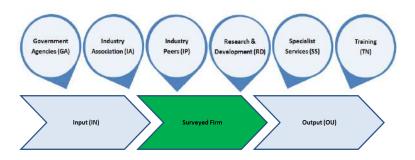




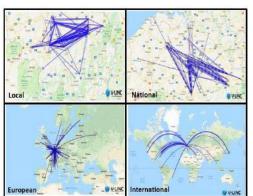


#### **Analyse Linkages**





+ Assess Linkages Business Impact



#### Cluster Linkage Growth / Decline?



Between 2018 – 2020 seventeen firms were interviewed each year

| Category                    | 17 Firms 2018 | 17 Firms 2019 | 17 Firms 2020 |
|-----------------------------|---------------|---------------|---------------|
| Government Agencies (GA)    | 49            | 56            | 60            |
| Industry Association (IA)   | 49            | 56            | 57            |
| Industry Peers (IP)         | 28            | 24            | 20            |
| Input (IN)                  | 69            | 82            | 84            |
| Output (OU)                 | 89            | 109           | 11 2          |
| Research & Development (RD) | 49            | 57            | 54            |
| Specialist Service (SS)     | 53            | 57            | 53            |
| Training (TN)               | 18            | 18            | 18            |
| Total                       | 404           | 459           | 458           |

17 Respondents (4 x Micro (<10), 6 x Small (<50), 4 x Medium (50-250) and 3 x Large (>250). 11,500 Employees

This suggests that there was growth between 2018 and 2019 (55 new Relationships) and between 2019 and 2020 (during the beginning of the Pandemic) only one link was lost

### Geographic Scope

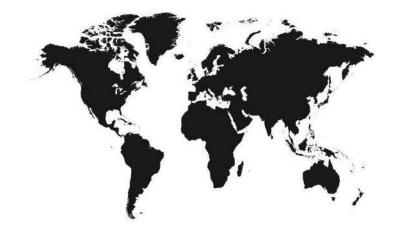


#### If we assess the scope at which these linkages occur we can see

| Scope         | 17 Firms 2018 | 17 Firms 2019 | 17 Firms 2020 |
|---------------|---------------|---------------|---------------|
| Local         | 126           | 135           | 142           |
| National      | 119           | 124           | 119           |
| European      | 98            | 122           | 123           |
| International | 61            | 78            | 74            |
| Total         | 404           | 459           | 458           |







### **Business Impact**



When business impact is assessed – it is interesting to see how linkages are becoming more important over time

| Business Impact | 17 Firms 2018 | 17 Firms 2019 | 17 Firms 2020 |
|-----------------|---------------|---------------|---------------|
| High            | 57            | 77            | 95            |
| Medium          | 250           | 258           | 268           |
| Low             | 92            | 121           | 92            |
| Tenuous         | 5             | 3             | 3             |
| Total           | 404           | 459           | 458           |



#### Change between 2019 and 2020





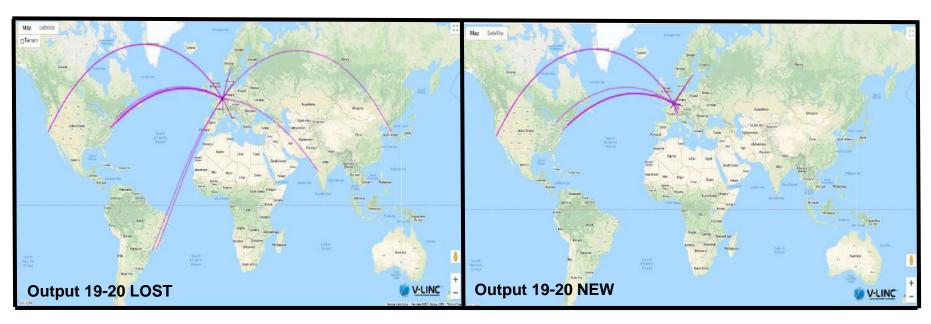
If we delve more deeply into where linkages are gained and lost we gain further insights

|                                 | Linkages<br>2019   | Linkages<br>2020   |  |
|---------------------------------|--------------------|--------------------|--|
| Category                        | 17 Firms<br>(2019) | 17 Firms<br>(2020) |  |
| <b>Government Agencies (GA)</b> | 56                 | 60                 |  |
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| Research (RD)                   | 57                 | 54                 |  |
| Specialist Service (SS)         | 57                 | 53                 |  |
| Training (TN)                   | 18                 | 18                 |  |
| Total                           | 459                | 458                |  |



#### Focus on Output Linkages





- 27 Lost customers in USA, South Korea, India, Brazil, Italy, France and Norway
- 30 Gained Customers in USA, Sweden, Central Europe



......

#### Conclusions



This research really looks at the evolution of business relationships developed, maintained and lost and this presentation just scratches the surface on how connections evolve or disappear over time.

This type of information can support the remit of cluster organisations as their membership evolves – changing the supports and focus of the cluster over time – allowing clusters to be a more effective cooperation partner.



**Note:** very little turnover of Industry Association linkages (96% retained each year) thus if a cluster works hard to gain a member in the first instance, they are easier to retain longer-term.



# FOUNDATION

**Interreg** Europe

#### **Thanks**

To Christian, Elmar, Florian and Nora thanks in advance for your contributions and we hope everyone enjoys the workshop / webinar and made some valuable contacts.





Project Manager - Dr John Hobbs,
Senior Lecturer, School of Business,
Munster Technological University. Bishopstown, Cork.

Mobile: 00353 86 8091294 Email: john.hobbs@cit.ie

Office: 00353 21 4335149

Skype: jhobbs.cit





























### Seminar "Industry Clusters & Resilience"

Hybrid

Tuesday, 28th September 2021

























Presentation of cluster initiatives and moderated discussion with Cluster-Managers





















### Agenda



- Foundation and Basic Principles of Cluster Initiatives in (Upper)
   Austria
- Cross Company Collaboration and the Effect on Value Chain Resilience
- Smart Specialization Strategies with Smart Clusters
- Facing the Covid-19 Pandemic Contributions of Cluster
   Initiatives to overcome the Crisis



# Mid of the 1990thies Upper Austria faced multiple crisis...

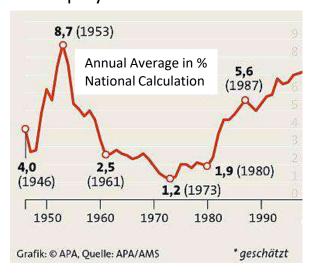






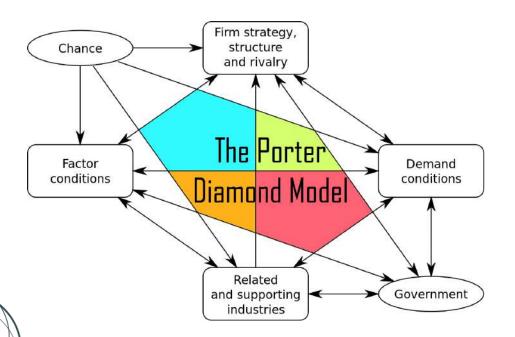


#### Unemployment Rate in Austria



# ...when a delegation of Upper Austrian Politicians and Stakeholders visited UK and got aware of a new concept







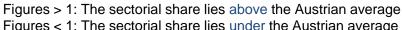


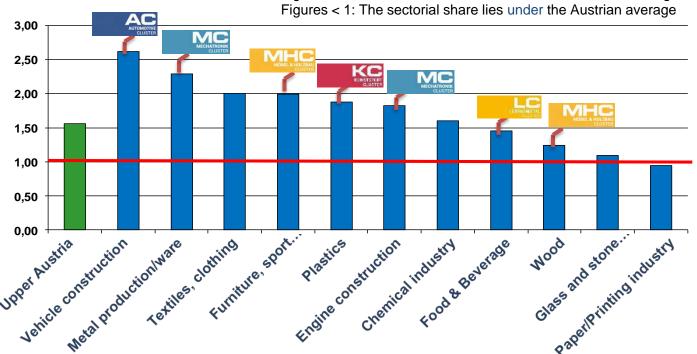




# Regional Specialization Patterns Analysis of Upper Austria beginning of 2000...

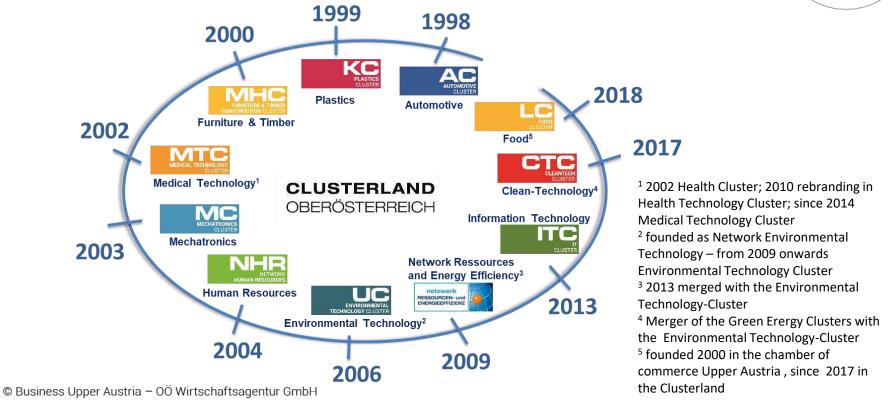






### ...led to consecutive Founding of Cluster Initiatives





# Top Down & Bottom Up Approach in Cluster Policy facilitated...



**Set-up** Tow-Down

Strategic
Programming
via RIS-3
Strategies

Public "Seed Financing"
in the beginning –
"Public-PrivatePartnership Financing"
in the Long Run



Focus on Customer Intimacy and Cross Company Cooperation

Sectoral
Advisory
Boards for
Agenda Setting

**Operations**Bottom Up

### ... Creation of a long lasting Vision and Mission and...



#### Mission

Initiation & support of Cross-Company Innovation

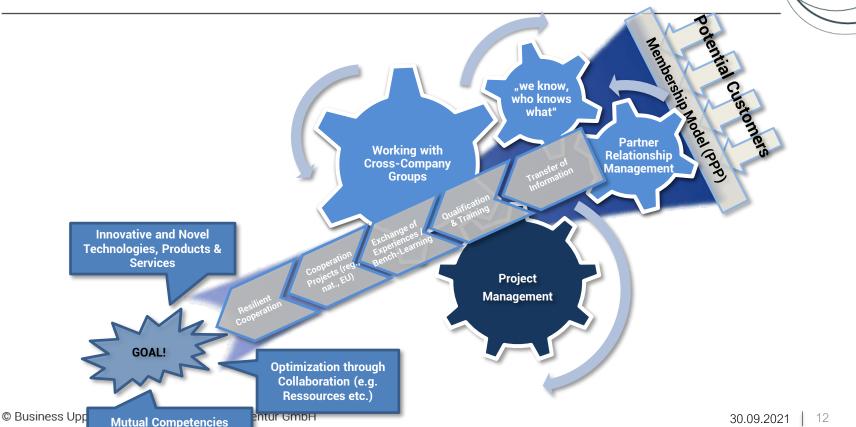
#### Vision

Competence Center for Cross-Company and Interdisciplinary Cooperation

Innovation through Cooperation

Our Claim

### ... Elaboration of a Differentiated Business Model which...



business

pper austria

### ...result in Facts and Figures - I



2.210

**Committed Members** 

81%

Small and Medium Sized Enterprises



813



Regional Cluster Cooperation Projects with

2.992 involved Companies &

€ 170 Mio. Project Volume

- > 2.200 collaborative Measures without Public Subsidies
  - > 25 onoing European Projects

Customer Intimacy

> 2.200

Customer Visits at Site

- > 300 Events and Tranings,
  - > 500 Speakers,
- > 10.000 Participants,
- > 100 Bench-Learing Gropus per Year
- 162 Representatives in 10 different Advisory Boards,
- > 30 Advisory Board Meetings for Agenda Setting per Year

#### Main Topics



Efficient Processes, Connected and Efficient Mobility, Internationalization



Digitalization of plastics production, lightweight construction, circular economy, toolmaking



Industrial Services, Smart Engineering, Intelligent Production, Robotics4KMU



Smart Home Architecture, Smart Construction/Craft 4.0, Smart Building



Medical Engineering, Digital Health, Medical Materials



Energy & Resource Efficiency, Circular Economy, Bio-based Industry



Information Security Network, Industrial Data



Innovative food technologies, food safety, qualification



Location Management, Prescriptive Analytics, Information Security

### ...result in Facts and Figures - II

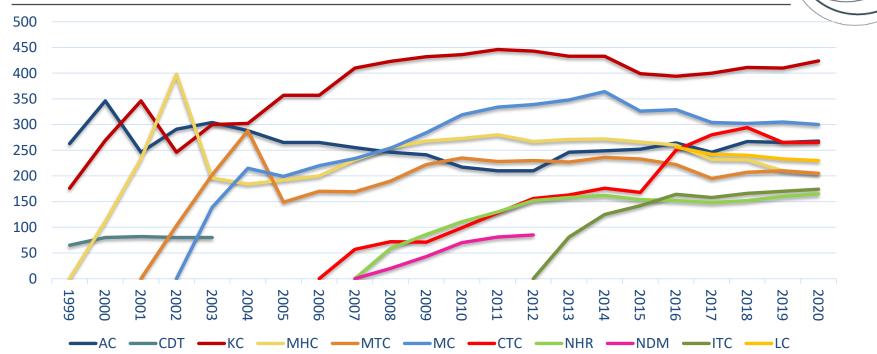


| Department Cluster & Coope | erationen                    | Start   | Partner | SME (~in<br>%) | Turnover<br>Mrd. EUR | Employees<br>(in K) | Ø R&D<br>Quote in % |
|----------------------------|------------------------------|---------|---------|----------------|----------------------|---------------------|---------------------|
| Automotive                 | AC<br>AUTOMOTINE<br>D.LET DR | 07/1998 | 258     | 68             | 30,6                 | 85,8                | 7,0                 |
| Plastics                   | KC<br>KINGTS OF              | 04/1999 | 425     | 80             | 16,7                 | 55,5                | 4,6                 |
| Wood and Timber            | MHC                          | 01/2000 | 187     | 97             | 2,9                  | 11,3                | 0,6                 |
| Medical Technology         | MTC                          | 03/2002 | 206     | 82             | 4,6                  | 16,2                | 5,4                 |
| Mechatronics               | MC                           | 01/2003 | 306     | 86             | 17,8                 | 58,9                | 8,9                 |
| Cleantech                  | CTC                          | 01/2006 | 256     | 86             | 9,2                  | 22,7                | 2,7                 |
| Information Technology     | ITC<br>man                   | 01/2013 | 174     | 89             | 2,9                  | 9,3                 | 2,6                 |
| Food                       | LEFESSORIES.                 | 01/2000 | 231     | 94             | 16,1                 | 58,4                | 1,1                 |
| Human Capital Management   | NHR                          | 01/2004 | 167     | 51             | 18,3                 | 61,0                | 4,3                 |
| SUMME (kum.)               |                              |         | 2.210   | ø 81           | 119,1                | 379,3               | ø 4,10              |

31.12.2020; Figures from Structural Survey - Statistics Austria 2019

# ...result in Facts and Figures - III Development of committed Cluster Members

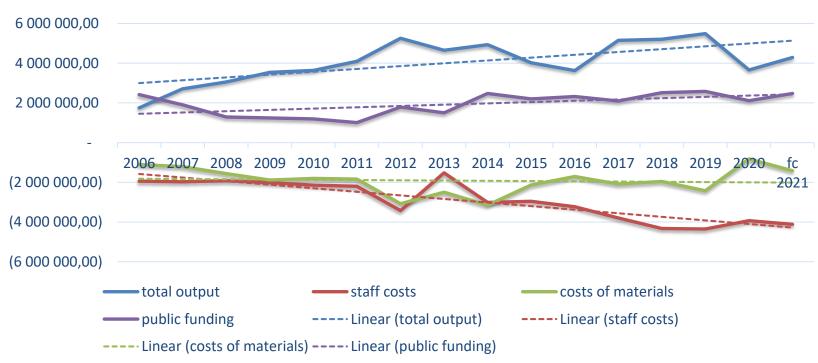




2.210 Cluster Members (31.12.2020)

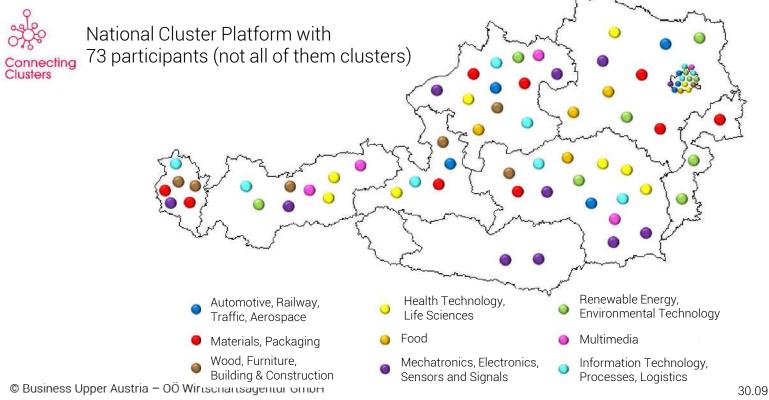
# ...result in Facts and Figures - IV Financial Development of Upper Austrian Clusters





### **Even in small Austria, no two cluster initiatives are the** same...





### ...but you can divide the clusters into 4 basic typologies



| Clusters being part of a<br>Regional Development or   | Clusters acting as their own legal entity  | Clusters being part of a (non) University or Research  | Clusters as Associations of Private Companies or   |
|---|--|--|--|
| Location Agency   |  | Center   | Persons  |
| Examples: Cluster Initiatives<br>managed by Business Upper<br>Austria, ecoplus (Lower Austria),<br>Standortagentur Tirol  | Examples: Cluster Initiatives in<br>Styria like Automotive-Cluster,<br>Green Tech Cluster, Silicon Alps<br>Cluster   | Examples: in Styria BioNanoNet and Austrian Center of Industrial Biotechnology   | Examples: in Vienna Austrian<br>Aeronautics Industries Group,<br>Austrian Traffic Telematics<br>Cluster, in Upper Austria Verein<br>Netzwerk Logistik  |
| Coverage Austrian Clusters: 50 %  | Coverage: 20 %   | Coverage: 10 %   | Coverage: 20 %   |
| <ul> <li>Main Elements:</li> <li>Public-private financing model with public basic funding</li> <li>Cluster Activities deeply integrated in service portfolio of Regional Development Agency and RIS-3 strategies</li> </ul> | Main Elements: - Private shareholders (often large companies) and public (blocking) minority with private & public financing - Clusters act quite independent from Regional Development Agencies, highly committed to sectoral or corporate agenda | <ul> <li>Main Elements:</li> <li>Associations, legal entities or departments of (non) university or research centers</li> <li>Public financing through research projects</li> <li>Research driven</li> <li>Act quite independent from Regional Development Agencies</li> </ul> | <ul> <li>Main Elements:</li> <li>Often Associations founded<br/>by companies or private<br/>persons from the same<br/>sector or technologies</li> <li>Private financing and public<br/>financing through projects</li> <li>Highly committed to sectoral<br/>or corporate agenda</li> </ul> |



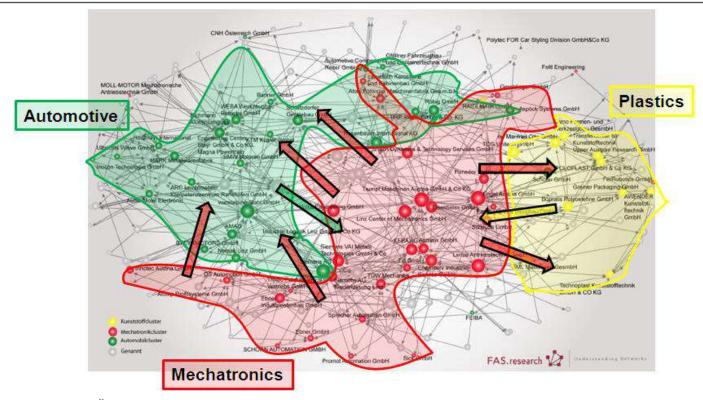
# Clusters and their impact on innovation capabilities – fiction or fact?



- The increasing individualization of customer requirements and concentration on core competencies indicate an increasing need for cooperation - no company today can meet all of the requirements itself - value creation can therefore increasingly only be realized in cooperation groups and network structures
- The complexity for innovation is increasing. The necessary resources for innovation (technology, human ressources, capacities, IPR,...) can no longer be provided by one company alone but through cooperation with other specialized actors along or across the value chain
- Small and medium-sized enterprises (SMEs) are the backbone of the (Upper) Austrian economy. Through cooperation, SMEs are in a better position to set up the resources necessary for innovation

# Bringing together the right companies and people might have a transformative impact on certain sectors...





# ...and by concluding "structural holes" within networks they might become more resilient to external impacts

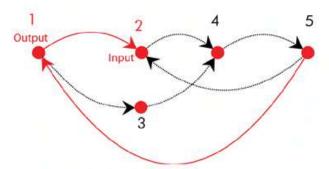


Cold versus Hot Value Chains



#### Cold Value Chains

- Strictly hierarchical
- No Feedback loops with other actors
- Little potential for innovation
- Failure of one actor causes the chain to break
- Often found in Value Chains with dominant actors (e.g. OEM in Automotive industry)



#### Hot Value Chain

- More Feedback Loops between the actors of the value chain
- The more loops there are, the more innovative the value chain is
- Resilient to the failure of individual actors
- Often found in Value Chains with dispersed ressources or competencies like Mechanical Engineering, ICT, etc.

# Current examples of cross-company cooperation: Digital Transformation



#### Cluster cooperation project UNIBOX

- Digital 24/7 shopping concept on a self-service basis
- Use of fallow or vacant space and integration of a sustainable energy concept for cooling & heating
- Contactless access (app) and payment system

## Cluster Initiatives SME Accelerator & ROBinWOOD

- compact digitization course for carpenters with online / face-toface seminars
- Demonstration of the possible uses of robotics in woodworking;
   Cooperation with the Art University Linz and the Ars Electronica Center (AEC)











- New, digital solutions in grocery shopping
- Diversification of sales channels
- Autonomous energy supply
- Supply for the rural / rural area
  - Support of the domestic furniture industry in the digital transformation
- Identification of new digital technologies
- Joint projects to reduce fears / barriers

# **Current examples of cross-sectoral cooperation: Sustainable Industry & Production - Circular Economy**



Lead project "Circumat" for the circular economy model region Upper Austria

- High-quality plastic products made from post-consumer recyclates
- Pioneering product: "OELI"

  1 made from 100% recycled material



#### Cooperation project "rePETitio"

 Objective: Proof that PET waste beyond PET bottles can be processed into new strapping, PET food cups and PET hollow bodies, in compliance with all product-specific approval regulations



#### Cooperation project "bin\_up.AT"

 Goal: Manufacture of garbage cans from 100% post-consumer plastic waste. Development of a seal of approval for regional circular economy and quick tests for recyclers to identify undesirable / dangerous substances (REACH).



JYU

<sup>&</sup>lt;sup>1</sup>Used cooking oil collecting bucket

# Current examples of cross-sectoral cooperation: Sustainable Industry & Production - Circular Economy



Lead project "Circumat" for the circular economy model region Upper

Cooperation project "rePETitio"

• Objective: Proof that PET waste

Cooperation project "bin\_up.AT"

- Goal: Manufacture of garbage cans
- Interdisciplinary cooperation between several clusters (plastics, clean tech, mechatronics, etc.)
- Present plastic as part of the solution
- Create best practice examples for circular solutions / processes
- Visualization of Upper Austria's overall solution competence
- Arouse enthusiasm for the material and break down prejudices







<sup>1</sup>Used cooking oil collecting bucket





# Upper Austrian Clusters and their integration into Regional Innovation Strategy for Smart Specialization



#### Strategic Programme 2000+



- 1998 2003
- 3 Areas of Strategies
- Programme Volume € 300 Mio. (€ 81 Mio. from Upper Austria)
- Approx. 25% of the budget for clusterrelated activities

#### Strategic Programme Innovative UA 2010



- 2005 2010
- 5 Areas of Strategies
- Programme Volume € 600 Mio. (€ 200 Mio. from Upper Austria)
- Approx. 15% of the budget for network oriented activities

#### Strategic Programme Innovative UA 2010+



- 2010 2013
- 5 Areas of Strategies
- Programme Volume
   € 450 Mio. (€ 150
   Mio. from Upper
   Austria)

#### Strategic Programme Innovative UA 2020

### OBERÖSTERREICH ODERÖSTERREICH

- 2014 2020
- 4 Areas of Strategies
- 5 Fields of Action (Industrial production processes, energy, health / aging society, food / nutrition, mobility / logistics)
- Programme Volume € 1,35 Mrd. (€ 450 Mio. from Upper Austria)

#### Strategic Programme Upper Vision 2030



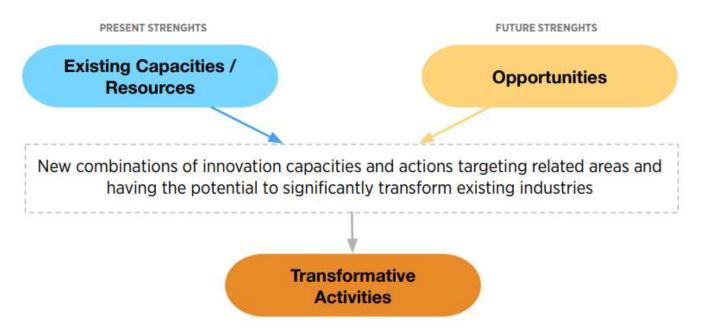


- 2021 2030
- 4 Areas of Strategies
  - 5 Fields of Action
    (Digital
    Transformation,
    Efficient and
    Sustainable Industry,
    Systems and
    Technologies for
    People, Connected
    and Efficient Mobility

# Smart Specialication Strategies (RIS<sup>3</sup>): Use limited regional ressources effectively to sustain competitive



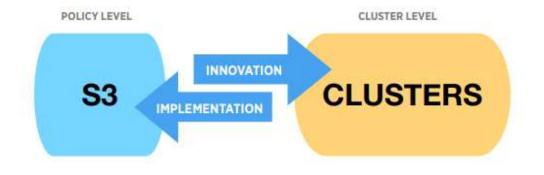




# Clusters embrace relevant actors of the innovation process & provide information about needs and trends...







#### Main Benefits of the Interplay

#### S3 triggers

Transformation processes Entrepreneurship Innovation

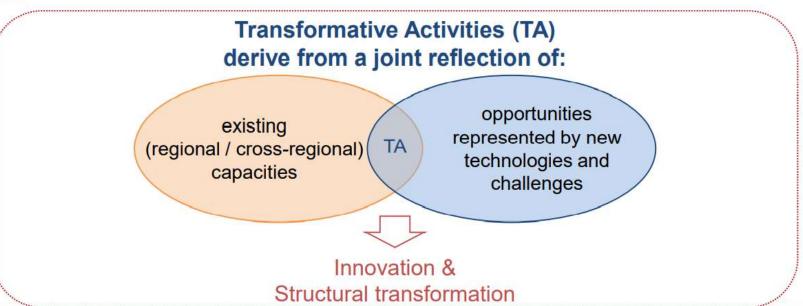
#### **Clusters represent**

Local concentrations of capacities Entrepreneurial resources Mid-grained level of aggregation Cross-sectoral connectivity Actors of the quadruple helix

# ...which could be used to identify and develop transformative activities and cross cooperation



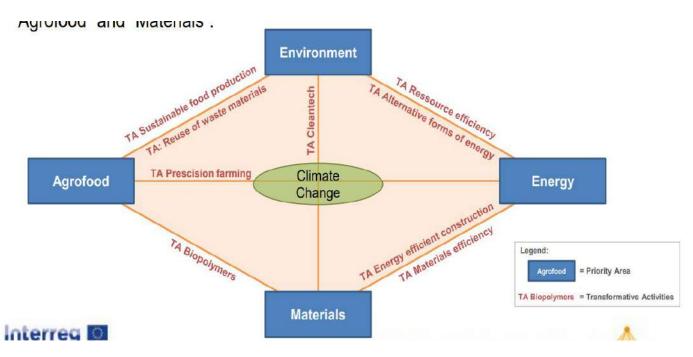




### **Example: Entrepreneurial Discovery Workshop I**



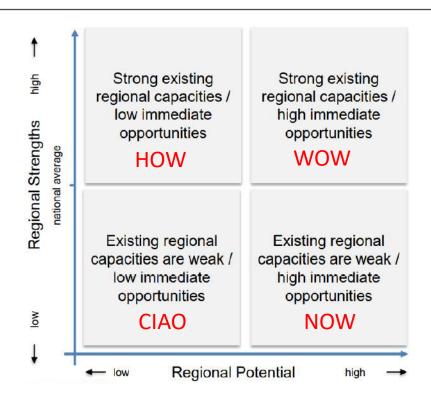




## **Example: Entrepreneurial Discovery Workshop II**





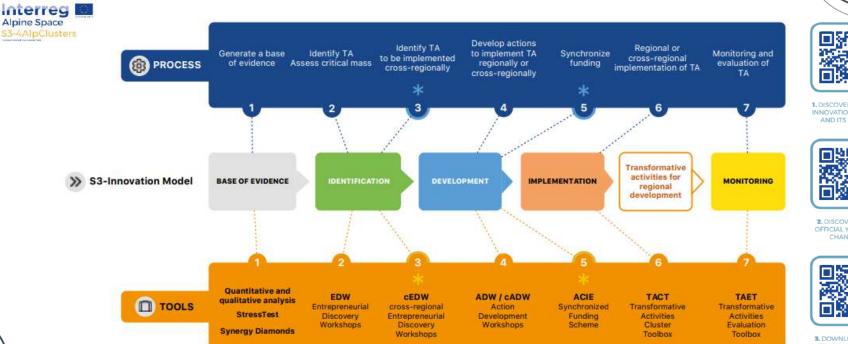


### **Useful Guiding Questions**

- What is the innovation potential of this challenge / solution?
- Can the implementation be realised on a short term perspective or a long term perspective?
- How much resources are necessary for the implementation?
- What capacities are needed for the implementation? Are they already present in the region or are they yet to build?
- How urgent is the implementation?

### The S3-Innovation Model and its action lines







1. DISCOVER THE S3-INNOVATION MODEL AND ITS TOOLS!



2. DISCOVER OUR OFFICIAL YOUTUBE CHANNEL

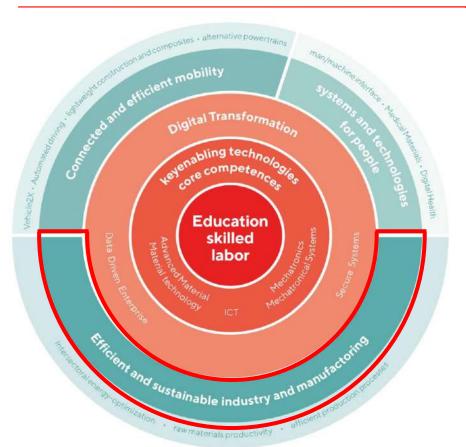


3. DOWNLOAD THE TRAINING TOOLS

(1) S3- 4AlpClusters - YouTube

### **Operational Framework**





"Strengthen regional strengths, dare to try something new" - the strategic orientation focuses on existing regional strengths and competencies and attempts to develop them steadily.

Strengthening of existing and support for new exporting companies; increasing number of "start-ups", more research & technology-oriented companies.

**Economic sustainability of the industrial and research location.** 

Creation and preservation of sustainable jobs through early recognition and identification of disruptive developments, customer needs and fields of application and the development of new business models





# Putting "Upper Vision 2030" - Upper Austrian Industry is Decarbonized...





- Showcase region for renewable energy New Energy for Industry (NEFI)
- Decarbonization & use of up to 100% renewable energy in production











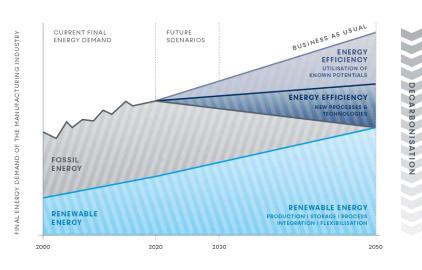






- Around 40 MEUR of funding from BMK / KLIEN trigger investments of> 100 MEUR in sub-projects
- Status quo: 17 ongoing projects with around 100 partners from all over Austria, funding volume 21.2 MEUR; next Call for Projects until September 31, 2021





### ...into Practice







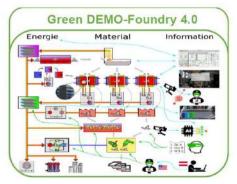
### Green foundry of the future

- In the envloTcast project, the "green foundry of the future" is being developed, in which fossil fuels are completely replaced
- For this purpose, a demo factory is being built at the Ranshofen Light Metal Competence Center (LKR), in which a new energy concept for aluminum die casting will be demonstrated.
- Funding agency: FFG / Energy Model Region NEFI
- Project volume: € 1.8 million
- Duration 03/2021 02/2024





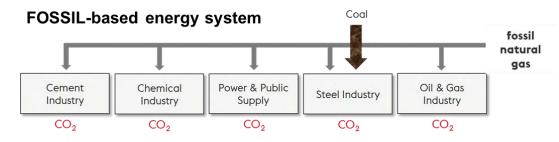


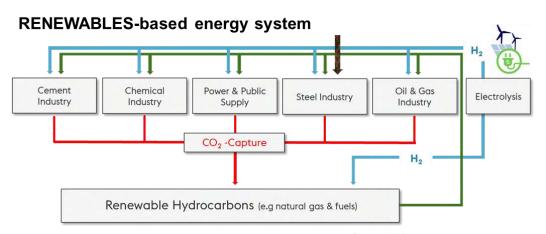




### **HCMA Hydrogen & Carbon Management LAB Austria**







- The transformation of the energy system in Austria with 100% renewable electricity in 2030 and CO2 neutrality in 2040 requires cooperation between the energy-intensive industrial sectors.
- Since a switch to 100% renewable primary energy is a long-term process, the recycling of CO2 and renewable hydrocarbons must also be taken into account in the transformation.
- A 100% renewable energy system can only function with a decoupling of generation and demand and the inclusion of highly efficient storage technologies based on hydrogen, CH4 or longerchain hydrocarbons.
- Through the demand-oriented coupling of energyintensive industrial sectors and the electrification of processes (hydrogen), a quantitative reduction in greenhouse gas emissions from industrial processes is possible.

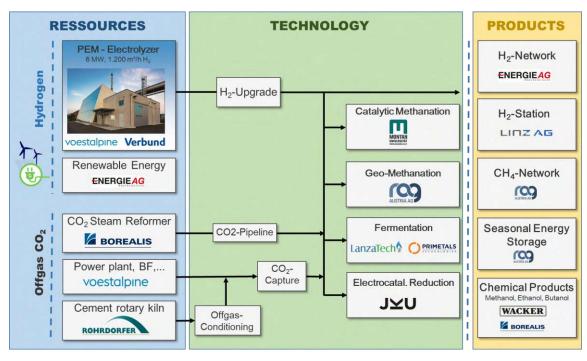






### **HCMA Hydrogen & Carbon Management LAB Austria**





The basis is the existing **PEM** electrolysis on the voestalpine site with 1,200 m3 / h of hydrogen.

- Project includes CO2 capture at voestalpine and Borealis, different variants of converting H2 / CO2 into hydrocarbons, use e.g. in public transport and storage at RAG Austria.
- The Upper Austria location has a unique selling point due to the concentration of the energyintensive industrial sectors.
- Holistic view of the energy situation from generation to consumption including storage.
- Project volume (CAPEX / OPEX) from € 80 to 100 million depending on module size and variants.

**Research Partners:** 









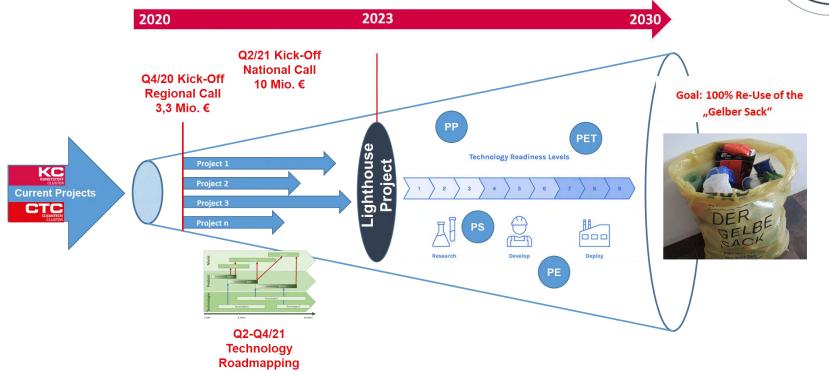






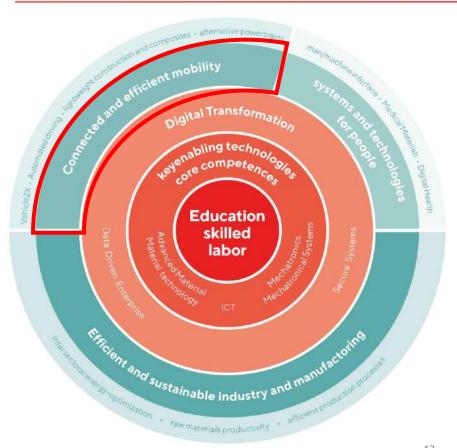
# Putting "Upper Vision 2030" - Upper Austria as Model Region for Sustainable Plastics Solutions





### **Operational Framework**





"Strengthen regional strengths, dare to try something new" - the strategic orientation focuses on existing regional strengths and competencies and attempts to develop them steadily.

Strengthening of existing and support for new exporting companies; increasing number of "start-ups", more research & technology-oriented companies.

**Economic sustainability of the industrial and research location.** 

Creation and preservation of sustainable jobs through early recognition and identification of disruptive developments, customer needs and fields of application and the development of new business models







# Putting "Upper Vision 2030" - Upper Austria is a leading Region for Connected & Automated Driving...

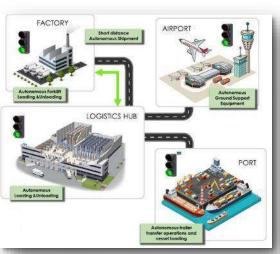


Test region Austria-North for autonomous driving Ecosystem for research, development & application (DIGITRANS)

- Focus on digitization & logistics aspects
- Project duration: 2018-2023; 5 years; > 40 Lol partners;
   Project budget: EUR 7.5 million







# AWARD - All Weather Autonomous Real logistics operations and Demonstrations

- Horizon2020 project with a total volume of 20 MEUR (2,84 MEUR for Upper Austria), Jan. 2021 – Dec. 2023
- Objective: Development and operation of safe autonomous transport systems (ATS) in a wide range of real logistical use cases in a large number of different scenarios.



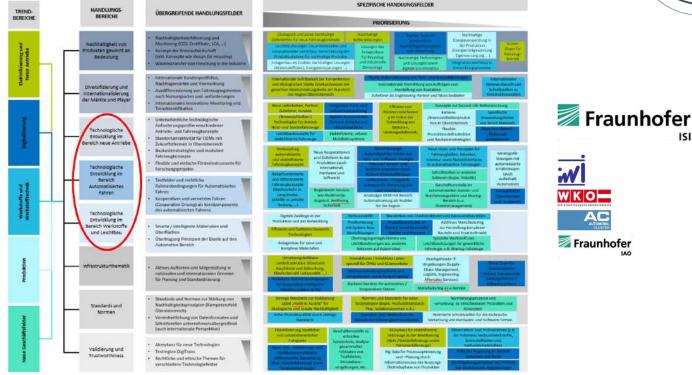
# ...as well as Zero Emission Powertrains PTTH - Powertrain Technology Transfer Hub...

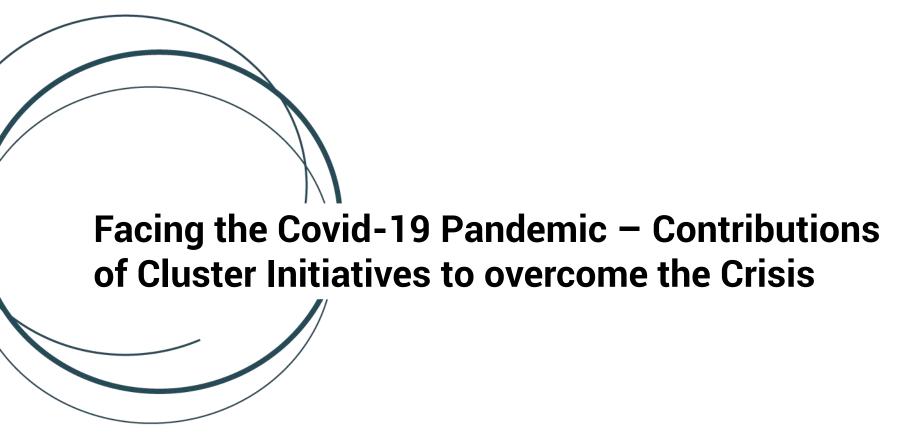


Acceleration of technology and know-how transfer in order to manage the fundamental change in the direction of "zero emission" powertrains: from "virtual vehicle design" testing-validation-qualification to the "Prototyping LAB" System Test, Launch & Operations material technology TRL 8 System/Subsystem **PTTH** TRL 7 **Prototyping LAB** Technology Development power electronics F-machines Research to Prove energy storage Numerical Simulation Techniques

# ...as one Element derived from the Automotive Study – Working Programme for the years to come!







### **Re-shoring / relocation of value chains**



#### COVID-19 pandemic shows

- the production of important, critical products and supplies has been outsourced in part or in full to other economic areas outside of Europe in recent years
- has happened in the course of advancing globalization and on the basis of understandable economic decisions
- in global economic crises, however, this means that value chains cannot or only partially be maintained, which causes damage to the Austrian economy

Strategy 1: Bring back productions to Europe (especially from Asia) -"Bring back to Europe"



Strategy 2: Strategically oriented, sustainable business settlements to close gaps in value chains



### More resilient global value chains



The outbreak of the corona pandemic had significant effects on global value chains (GVCs)

- Deliveries of advance work from abroad could no longer be guaranteed due to production stops and border closings
- If there are no regional substitutes for these preliminary products, the concerned companies risk enormous production losses

Strategy 1: Real-time monitoring of GVCs (Supply Chain Visibility) including alternative concepts for regional suppliers and necessary certifications



Strategy 2: Alternative regional supplier strategy and provision of necessary certifications (!!)



# Resilience strategies for key industries and new regional value chains



Austria is a highly export oriented country. A high proportion of added value in Austria is closely integrated into global value chains (GVCs) - if GVCs colapse — Austrian economy fails

Strategy 1: Reduce dependency of US or Asian (technology) suppliers seek for European alternatives



Strategy 2: Circular economy concepts for greater material and resource independence



Strategy 3: Support SME competencies and capacities to become relevant for GVC's



# Value Chain Supporting Technologies and new organizational mechanisms



In the current crisis in particular, the importance and potential of new technologies (monitoring, development, implementation) that support value chains and the need for new organizational mechanisms for supply chains are evident

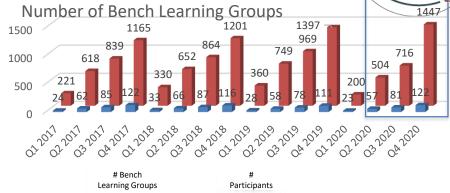
Strategy 1: Observation of emerging technologies and technologies with particular relevance for value chains like artificial intelligence, blockchain, 3D printing, big data, etc.

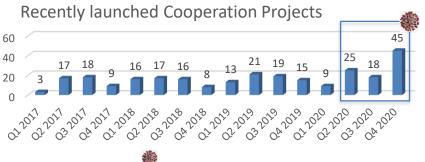
Strategy 2: Observation of new organizational mechanisms like agile product development, holacracy, new work etc.

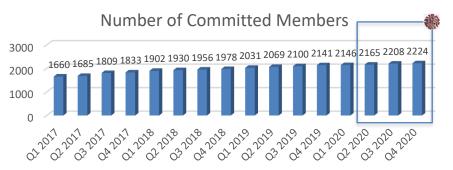


# Facing the Covid-19 Pandemic the Clusters and their Business Portfolio digitized almost over night...









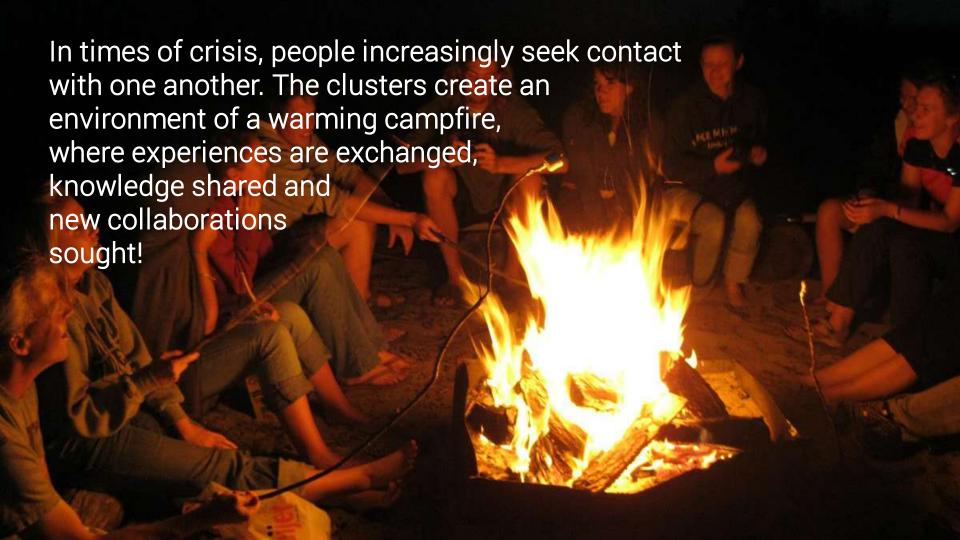
Biz-up mainly digital from 16.3.-31.05.2020; mainly physical/hybrid 01.06. – 18.09.2020; mainly digital since 19.09

business

# Rethinking the offered service portfolio – Speed over perfectionism



- Weekly, digital advisory board meetings to assess the situation and share experiences
- Establishment of communication channels to public authorities, ministries and interest groups for unbureaucratic discussion of emerging challenges
- Exchange of experience on the subject of virus-safe production together with clean room, ventilation and hygiene experts
- Digitization of the service portfolio "click and meet the OEM" instead of physical supplier innovation days
- Development of training concepts for digital sales
- Collection of possible producers for critical medical devices to fight the Corona crisis
- Focus on facilitating and development of joint projects between companies, universities and research facilities
- Etc.



### Contact and Information



### DI (FH) Christian Altmann, MBA

Authorized Signatory, Head of Department Cluster & Cooperation

+43-664-8186561

christian.altmann@biz-up.at

www.biz-up.at

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innovation is our business.

## **Key Topic - Digital Transformation**





### Digit Region Upper Austria





- Focus
  - Industry 4.0
  - Connected mobility
  - Digital medical technology
- Technology- and Innovationnetwork in Upper Austria

- Excellent education facilities
- Excellent research institutions
- www.digitalregion.at



Home Digital Region Upper Austria

### Digital Region Upper Austria

Contact

#### Upper Austria offers everything a company needs

As a leading export, technology and industry region at the heart of Europe, Upper Austria offers everything companies need to be competitive: first class infrastructure, qualified specialists, a closely networked and innovative environment and the highest quality of life. A spirit of innovation and dynamic optimism are what make the people in this region different. With its universities, technical colleges and the Hagenberg

software park, Upper Austria provides the skills to make it a hotspot for IT companies from all over the world. With excellent national and international networks, they form the digital region of Upper Austria. This is characterised by a dynamic development: above-average growth of value creation, employment and investments in information and communications technologies.



Digital Region Upper Austria

Digitalisation Campaign

Key Areas

EN Q

Home Digitalisation Campaign

### Digitalisation Campaign

Contact

#### by the province of Upper Austria

The digitalisation campaign is the Upper Austrian programme for the digital future of Upper Austria. The implementation is coordinated by Business Upper Austria - the Upper Austrian Business Agency. Digitalisation is firmly anchored as an issue that affects

all fronts in the strategic and economic research programme Innovative Upper Austria 2020. It concerns every fields of action and makes a significant contribution to achieving the objectives of the strategic programme.





"Digitalisation is a major innovation factor for our economy. It presents all our industries with huge challenges, while at the same time opening up new opportunities for economic development - large and small alike. Attractive framework conditions for people and companies ensure that Upper Austria remains the most dynamic economic region in Austria. Our region has strong digital competencies and resources. Innovative companies, open-minded and dedicated specialists who are keen to stay ahead and make Upper Austria one of the leading digital regions in Europe. With our comprehensive digitalisation campaign we want to make sure that no opportunities are missed in using the

digital transformation to make us even stronger as a business location."

Thomas Stelzer Governor of Upper Austria Markus Achleitner State Minister for Economy

### Digitalisation Campaign - Goals

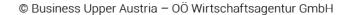


- Upper Austria has a top-quality IT infrastructure
- Upper Austria is becoming a model region for the data-driven economy
- Upper Austria is perceived as an attractive digital region, nationally and internationally, and attracts a large number of digital talents
- Upper Austria is good basis for a creative start-up scene
- Upper Austria has a high level of expertise in information security
- The economy is stimulated by the broad awareness of the economic importance of digitization

### Digitalisation Campaign - Overview



- 20 Measures to make Upper Austria's economy fit for the digital future.
- 22.035 million Euro budget for the entire flagship digitisation initiative.
- The overall **coordination** of the 20 projects (excluding broadband) will be handled by **Business Upper Austria**.
- The **projects of Business Upper Austria** within the framework of the flagship initiative Digitisation (budget and content) follow a **three-year plan** with a total budget of EUR 1.5 million.

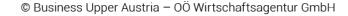


### Digitalisation Campaign - Success Stories



- 22 approved Applications for the innovation assistant program
- 11 Cluster cooperation projects in the field of digitisation and industry 4.0
  - 40 companies as project partners
  - Project volume: € 2,256,687 (funding applied for: € 600,821 )
- 152 Submission to the tender Consultant focus on digitisation.
- 14 approved projects for Call Digitisation (5.68 Mio€ volume)
- 31 workshops/lectures of the coordination office on the topic of digitisation with approx. 750 participants
- 24 project submissions from the biz-up for the LID funding year 2018

Project Examples see <a href="https://www.digitalregion.at/en">www.digitalregion.at/en</a>







### **Digital Skills Qualification Alliance**

The chance for digital competence



innovation is our business.



Digital Region Upper Austria

Digitalisation Campaign

Key Areas

EN Q

Home > Digital Region Upper Austria > Digital Skills Qualification A...

### Digital Skills Qualification Alliance

### Overcoming the challenges of digital change together

The Digital Skills Qualification Alliance is a network of Upper Austrian companies that deal with the challenges of digitalisation together. The Digital Skills Qualification Alliance supports manufacturing and production-related companies in individual planning and joint implementation of in-company courses. The courses are supported by AMS OÖ and the commerce department of Upper Austria.

The Qualification Alliance was founded on 26 September 2017 and registration is still possible at any time.

Currently (as of January 2021), more than 117 companies are actively participating in in the alliance. The first qualification network in Austria for the promotion of digital skills is cross-industry, comprises 50% SMEs and the member companies are spread over the whole province, so it is also possible to organise the training course content according to regional focal points.

### Join now for the full benefit

- · Access tailor-made subsidised training
- · Get support from a consulting team to determine your training needs and create a personnel development concept for your company
- · Attend expert lectures and networking events free of charge
- · Exchange experience with other companies

Join free of charge - open to other companies at any time. Would you like to join the Digital Skills & IT Security Qualification Alliance? Then please contact us now.

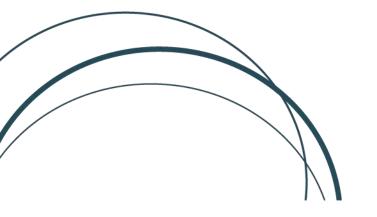


Christian Mayer

Manager

Send E-Mail Mobile: +43 664 8186555 Phone: +43 732 79810-5052

Contact





### **Digital Check – Maturity Model Industry 4.0**



innovation is our business.

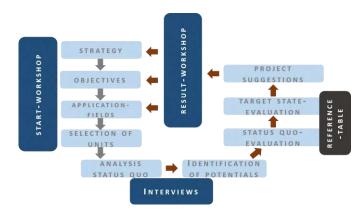
### Maturity Model

### Maturity Model process





The digital change offers a wealth of opportunities to increase your productivity and develop new business models



The maturity model Industry 4.0 provides the answers:

- Structured valuations regarding the Industry 4.0 maturity
- Identification of Industry 4.0 potentials
- Concrete implementation recommendations for industry 4.0 measures
- Industry 4.0 benchmark within the industry or within the application fields.







### Maturity Model

References































19 October 2021 - 22 October 2021 Linz, Austria

B2B-Meetings at International Forum Mechatronics 2021

lome l

How it works

FAQs Location

Contact

### B2B-Meetings (on-site and virtual)

Technical progress requires new concepts to master industrial and strategic challenges - Symbiotic mechatronics as a new paradigm

The B2B-Meetings are an important part of the conference "International Forum Mechatronics". The scheduled face-to-face meetings offer an ideal opportunity to identify potential cooperation partners and to establish interesting business contacts. Every participant selects his conversation partners individually and has 20 minutes to exchange about projects and products.

Participation in the B2B-Meetings is free of charge.

Besides the participation on-site, virtual participation (video conferencing via this website) is also possible!

### Please be aware:

- In the B2B-sessions on 19 and 22 October only virtual meetings are taking place!
- In the B2B-session on 20 October only on-site meetings are taking place!

Register for the B2B-Meetings here.

### Register now

Open until 17 October 202

### LOCATION

Altenbergerstraße 69 4040 Linz, Austria

### ORGANISED BY













### **Automotive-Cluster**

the future-mobility-ecosystem



















Menti survey <a href="https://www.menti.com/6pqfkiwdq5">https://www.menti.com/6pqfkiwdq5</a>





Goto

## www.menti.com



Enter the code

53 68 26 1



Or use QR code

30.09.2021

### We live in a VUCA world



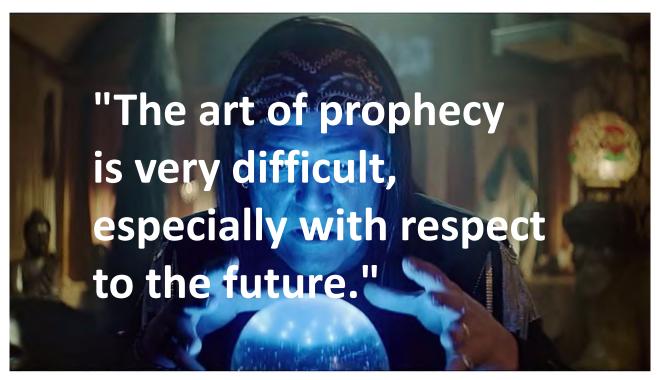




### Mark Twain is said to have stated that:



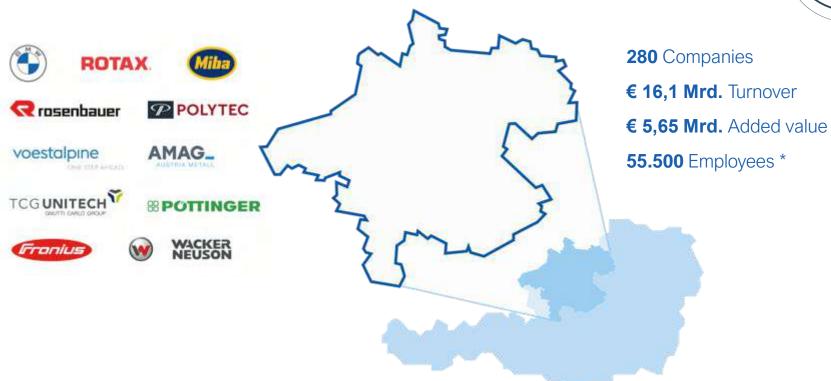




# Upper Austria Mobility ecosystem : Facts & Figures







# Automotive Austria: R&D, internationalization





- Export share
  - 88% of all parts produced in Austria are exported
- R&D
  - about 3,8% of Austria's GDP are spent on research and development
  - strong automotive cluster organizations
    - Automotive Cluster Upper Austria
    - AC Styria



### **Our Partners**









### Strategic Focus







## Efficient & Sustainable Processes

continous improvement of critical processes in automotive-business



### **Connected Mobility**

Digital transformation CASE (connected, autonomous, shared, electrified) Car2X, Smart Cities



### **Efficient Mobility**

affordable & sustainable lightweighting alternative propulsion systems



### Internationalization

Access to new markets
Access to new customers

### Automotive-Cluster at a glance





- ~ 280 partners
- > 20 bil. € sales
- > 80.000 employees

### USPs

- Finding new customers and new markets
- Automotive-specific training
- Single entry point for funding and/or collaboration procejts
- · Best practice sharing
- Visibility in Austrias biggest mobility eco system

# AC-Team AC-Team AC-Team AC-Team AC-Team

More than 300 site visits every year

### colaboration

6 projects > 100 companies

>30 Mio. funding volume

15 industry leaders in the advisory board

### Strategic pillars

- Efficient & Sustainable Processes
- Efficient Mobility
- Connected Mobility
- Internationalisation

Network with > 50 OEMs & Tier1 and international expertise in Asien, USMCA Raum, Near Middle East Region

- > 53 Automotive-Trainings
- > 500 participants



# https://www.automotiveit.eu/sonderausgaben/marktpositionierung-der-globalen-automobilhersteller.html

### Global automotive market





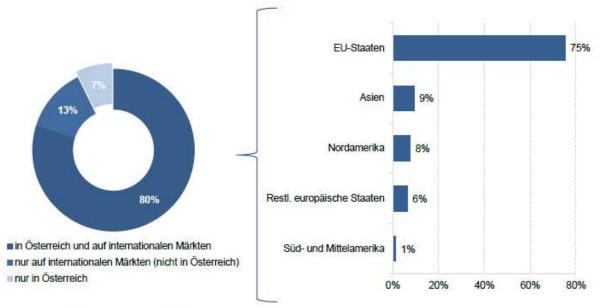




### Export share of Upper Austrian mobility industry







- Most important are the EU member states, especially Germany
- 90% of Upper Austrian suppliers have German customers
- Strong connection with German automotive industry and their quick recovery especally in China might be a ressiliance aspect

Anm.:

links: n=55; rechts: n=39 (Filterfrage); Keine Angaben bereinigt. Frage (links): Wo bieten Sie Ihre automotiven Leistungen an?; Frage (rechts): Wie verteilen sich Ihre Exportaktivitäten im Automotiven Bereich anteilsmäßig auf folgende Absatzmärkte?

IWI (2020)

# Upper Austria Automotive-Study "efficient and sustainable mobility"





- Determine challenges for the mobility industry and recomendations for policy makers
- In-Depth SWOT analysys
- Identification of new market opportunities for the mobility industry and actions for repositioning of Upper Austria

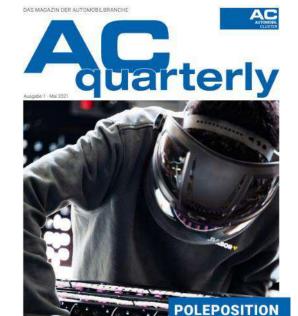
### Outcomes:

- Attention of management and adaptation of processes for current and future trends and requirements, including sustainability, differentiation and internationalization.
- Technological conversion to BEVs and other alternative drive systems, diversification
  especially in special vehicle segment (such as commercial and agricultural vehicles),
  components and test procedures for networked and autonomous vehicles, as well as
  the necessary production platforms.
- Active shaping of the market environment through participation in standardization processes, international customer management, education and training as well as knowledge transfer between business, research and politics.

# Are we prepared?







- LCA optimized battery packs
- High-strenght steel for affordable, sustainable and smart
- Efficient joining technologies
- Emssion free foundries
- International studies in the automotive industry
- Worldwide networking with OEMs
- Regulatory Sandboxes AD without safety drivers
- Proving Ground for AD-Use Cases
  - automated freight transport on the road



















### Frontrunners in special and comercial vehicles









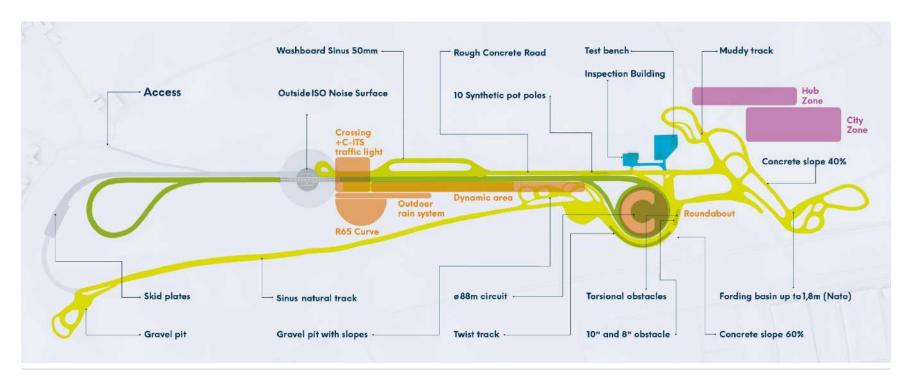


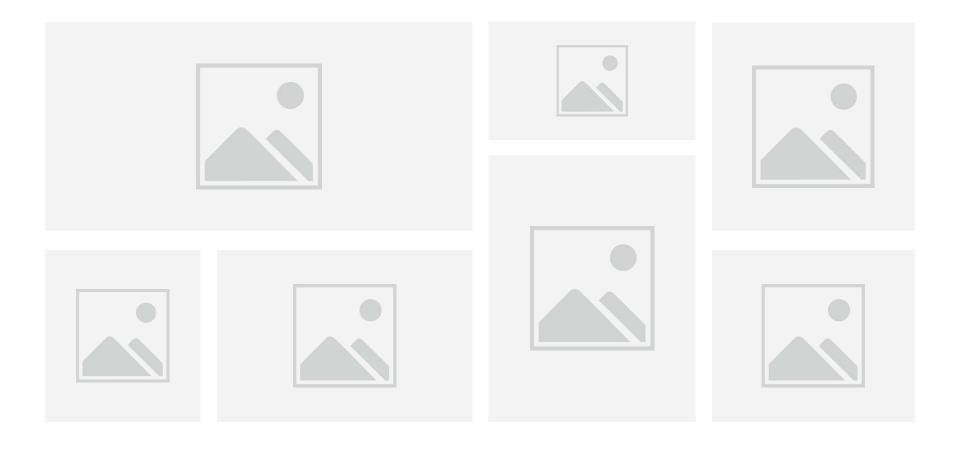
# fields of competence

Digitrans provides know-how and test infrastructure and supports testing, validation, research and implementation of autonomous commercial vehicles and their different applications.



### **Proving Ground expansion 2021 / 2022**



































### **Proving Ground Facts**

**Test Area** 

40 ha 2.2 km 7 Km

**Asphalt Track** 

Offroad Terrain

ODD Elements



Seminar "Industry Clusters and Resilience"

September 28th, 2021

info@biz-up.at, www.biz-up.at

Business Upper Austria – OÖ Wirtschaftsagentur GmbH Hafenstraße 47-51, A-4020 Linz, Tel.: +43 732 79810



Nora Mack, MSc MBA BSc

Cluster Manager Medical Technology Cluster Business Upper Austria – OÖ Wirtschaftsagentur GmbH

Mobile: +43-664-8186572 E-Mail: nora.mack@biz-up.at

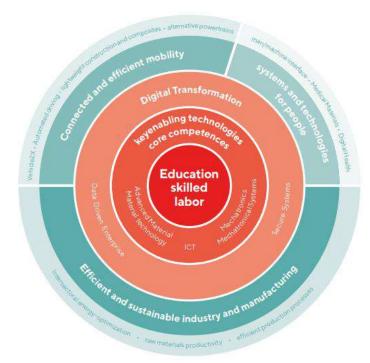
www.biz-up.at www.medizintechnik-cluster.at

# RESILIENCE #upperVISION2030





- #upperVISION2030 strategy for business and research policy in Upper Austria
- Securing both long-term orientation and sufficient flexibility
- Clear concept designed to meet the great challenges of our time
- Focus on smart specialisation and the rapid transfer of research results into business applications in order to place Upper Austria at the forefront of technological developments
- "Systems and technologies for people" form one of the four focal points of the Upper Austrian economic and research strategy #upperVISION2030.
- The goal is to use the latest digital technologies, artificial intelligence and supporting systems in a meaningful way in all areas of life, especially also in the health sector.



Source: https://www.uppervision.at/

### #upperVISION2030: Systems and Technologies for people





### Objectives

- Position Upper Austria as an international competence region for applications at the human/machine interface, especially in the fields of automation and robotics
- Transfer key Upper Austrian technologies and core competences from production to medical technology, especially in the areas of digital health and medical materials



### What systems and technologies for people in Upper Austria mean for us:

- We focus our activities on the human/machine interface and create networked, semi-autonomous as well as autonomous systems that enable people to remain actively involved in familiar surroundings for longer.
- We increasingly think in terms of interdisciplinary and holistic approaches in order to benefit from existing competencies and technologies.

Source: https://www.uppervision.at/

### #upperVISION2030: Systems and Technologies for people





Upper Austrian Future Forum 2021 (OÖ Zukunftsforum 2021)
March 23<sup>rd</sup>, 2021
Humans at the centre of artificial intelligence.

>> MTC / MC Session: Al for Human Support Innovative systems to support people





"AI must adapt to humans.



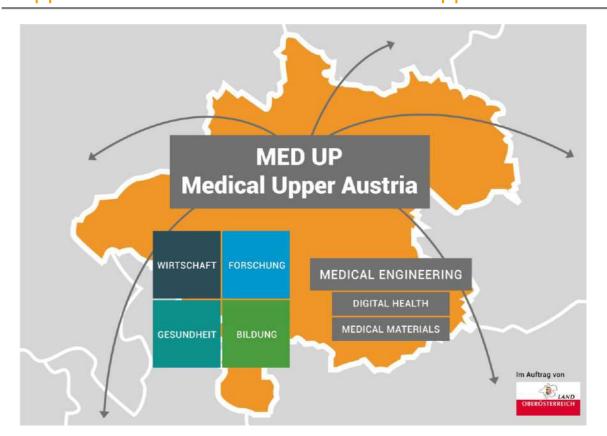


### RESILIENCE

### #upperVISION2030: MED UP - Medical Upper Austria







Source/ continuative information:

https://www.medizintechnik-cluster.at/mtc-schwerpunkte/medtechcircle/archiv-medtechcircle/

https://www.medizintechnik-cluster.at/news-presse/detail/news/64-mio-euro-fuer-den-ooe-medizintechnik-standort/

https://www.medizintechnikcluster.at/fileadmin/user\_upload/Cluster/MTC/ Downloads/MTC-connect-01-2018-web\_.pdf

# source: EY | EY Studie Life Science Oekosysteme und Bilanzen Pharma 2018, S.

# RESILIENCE MedTech-location Upper Austria | areas of expertise

Deutschland

Germany

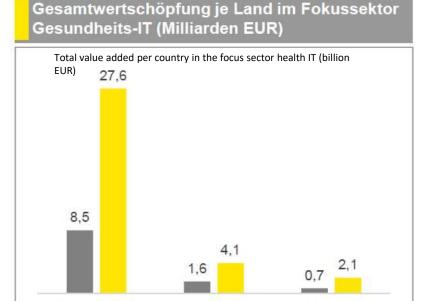




### DIGITAL HEALTH

2030: The development of value creation.

Health IT: Significant growth.



Schweiz Switzerland

**2015** 2030

Österreich

Austria

The health IT sector in Austria will triple from €0.7 billion to €2.1 billion.

# RESILIENCE Innovation through cooperation.







source: https://medusa.health/de

### Medical EDUcation in Surgical Aneurysm Clipping "MEDUSA"

A hybrid neurosurgical training and planning platform will combine the real and virtual worlds to create versatile and realistic training opportunities. Surgeons can thus haptically feel the artificially created patient and see internal, otherwise invisible anatomical structures in the form of virtually generated holograms.

The mixed reality application created by the "Medusa" project is intended to be used in the training of young surgeons on the one hand, and on the other hand for the concrete preparation of complex operations by incorporating real patient data.

In the medium term, an internationally leading simulation and cooperation centre is to emerge from this flagship medical technology project tendered by the province of Upper Austria. The associated pull effect will benefit the economy and research institutions in Upper Austria. MEDUSA led to a strategic networking of 7 research institutions and 6 companies, thus demonstrating the know-how available in Upper Austria.

research project with the participation of 13 Upper Austrian institutions and companies funded by the Upper Austrian government under the Strategic Economic and Research Programme "Innovative Upper Austria 2020":

alpha medical concepts e.U, cortEXplore GmbH, eulerian-solutions e.U, EVO-tech GmbH, FH OÖ Forschungs- und Entwicklungs-GmbH,
Johannes Kepler-Universität-Institute of Polymer Product Engineering, Johannes Kepler-Universität - Institut für Polymerwissenschaften,
Kepleruniversitätsklinikum Linz - Universitätsklinik für Neurochirurgie, LIFEtool gemeinnützige GmbH, Netural GmbH, RISC Software GmbH, R'n'B Consulting GmbH, Profactor GmbH

# RESILIENCE Innovation through cooperation.







Credits: Robert Hartmann/Netural

### Project\_partners:











### **VR4 Mind & Motion**

Virtual reality-assisted physical and mental training for people with dementia

The aim of the "VR4 Mind & Motion" project is to develop a VR-supported training system for people with dementia, which is to be used primarily in care facilities but also in the home environment.

The basic idea is to allow people with dementia to experience, for example, a **forest** environment or meadow landscape by means of 360° degree video recordings and to combine this with physical activity on an ergometer.

The focus of the training is to evoke **positive feelings** in those affected. The aim is to relax them and at the same time motivate them to engage in **physical activity on the ergometer**.

VR4 Mind & Motion is intended to expand **conventional therapy approaches** and contribute to the **support of caregivers and relatives**.

# Source: https://www.symptoma.at

# RESILIENCE Covid-19 pandemic: STIMULATION for innovation





### Symptoma is your digital health assistant.

It helps you understand what might be wrong when you feel unwell. Simply enter your symptoms and answer questions to find possible diagnoses.

- 14 years of scientific research by doctors and data scientists to help patients get the right diagnosis and treatment.
- Millions of users and searches per month makes Symptoma the most widely used symptom checker in the world by both doctors and patients.
- Diagnostic accuracy validated in internal, external and peer-reviewed scientific publications comparison of 107 solutions worldwide and Symptoma clearly in 1st place.
- Awarded Austrian of the Year/ Right diagnosis at the right time.



### RESILIENCE

### Covid-19 pandemic: STIMULATION for innovation





### COMPACT, SIMPLE AND FAST - GENSPEED XPOC FAST TESTS

The GENSPEED COVID-19 test portfolio µELISA on site in laboratory quality

- With 3 rapid tests based on the GENSPEED μELISA platform, GENSPEED offers a product portfolio with great added value for the entire society.
- The GENSPEED COVID-19 IgG xPOC antibody test is already available on the market
- Within 15 minutes, the GENSPEED COVID-19 IgG xPOC test delivers laboratory-quality results, as was also impressively shown in a study by the medical faculty of the Johannes Kepler University Linz with a sensitivity of 100% compared to six laboratory ELISA methods Journal of Clinical Virology.
- A second rapid test indicating acute infection with SARS-CoV 2 and Influenza A & B will be launched soon.



We offer the GENSPEED technology platform with its universal applicability as an OEM solution for test manufacturers who want to enter new markets or meet the increasing demands for rapid tests in the future.

Our GENSPEED product portfolio ranges from a COVID19 test portfolio, direct detection of periodontitis pathogens in the dental practice (dental tests) to the rapid detection of dangerous hospital germs.

source: https://www.genspeed-biotech.com

# RESILIENCE MedTech-location Upper Austria | Notified Body







- It all started with the idea of unique and sustainable patient safety in the new EU medical device regulatory environment.
- At QMD Services, we proudly aspire to become the first Austrian Conformity Assessment Body according to Regulation (EU) 2017/745 (MDR) and 2017/746 (IVDR). In addition to providing recognized certification to the Austrian medical device industries, QMD strives for a European reach.
- The Mission of QMD Services is to establish a leading independent Conformity Assessment Body for medical devices to advance patient safety and care, as well as optimized patient outcomes, by complying to the MDR/IVDR and by adhering to key principles and standards of medical device vigilance, post market surveillance and device risk management.
- Headquarters in Vienna and Operations Office in Linz/ Upper Austria.

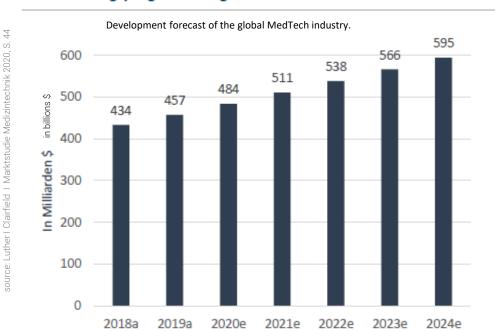
# RESILIENCE MedTech-location Upper Austria | diversification





MEDTECH-NEWCOMERS (corporates switching to MedTech, start-ups)

### Entwicklungsprognose der globalen MedTech-Industrie



Quote:
Companies from the
automotive supply industry with
highly specialized
manufacturing capabilities are
entering the medtech market.

### MedTech-Newcomer: RO-RA Health Technologies





### Aviation and medical technology from a single source

RO-RA Health Technologies is another division of RO-RA Aviation Systems GmbH - a successful supplier to the aviation industry. In an interview, Managing Director Helmut Wiesenberger describes why medical technology is an industry of the future and what synergies there are with the other division.

### What do you see as the biggest challenges for the division?

Market growth is certainly a given in medical technology. We see the digital implementation of personalised medicine in combination with modern manufacturing processes as the big challenge that we are happy to face. For us as a company, the challenge certainly lies in developing a value proposition in the product portfolio. I assume that we will need two to three years for a sustainable market entry - we already know this staying power from aviation.

### How important is the medical technology cluster network for you?

The MTC has provided us with expert advice and support in the development of medical technology. This advice has given us a good insight into a market that is new to us. The next step is to get to know the MTC network better and to conceptualize meaningful and scalable R&D projects together with the university institutes.



Helmut Wiesenberger, Managing Director bei RO-Ra Health Technologies © Fotografie Schwamberger



For further information pls visit: www.ro.ra.com

# RESILIENCE MedTech-location Upper Austria | MedTech-Incubator







Raphael Friedl, CEO tech2b, councilor Markus Achleitner and Nora Mack, Cluster Manager MedTech.

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### MedTech-Incubator

close cooperation of Medical Technology Cluster (MTC) and tech2b giving guidance for the founding of an enterprise in the field of MedTech

- >> support with the execution of the innovative idea
- >> counselling with regard to the regulatory strategy as well as business model
- >> assistance in applying for additional funding
- Pilot phase (10/2018 06/2021) successfully completed
  - > 13 start-ups accompanied
- starting July 1<sup>st</sup>, 2021: a fixed component of the services offered to MedTech-Start Ups located in Upper Austria
- distribution of roles:
  - tech2b as the expert for incubation
  - MTC as the expert for technical and industry knowledge (regulatory affairs)

### MedTech-Incubator: ForgTin®

MEDICAL TECHNOLOGY CLUSTER upper austria

Revolutionary medical product against tinnitus passes first test - current study by the University of Regensburg shows extremely high effectiveness.

Pansatori GmbH, a start-up from Braunau am Inn in Upper Austria and proud participant of the MedTech-Incubator programme, announces the first results of a study conducted by the Department of Psychiatry and Psychotherapy at the University of Regensburg on the medical device ForgTin®.

ForgTin® is a **CE-certified medical device** that is worn behind the ear like a pair of glasses. The 3D-printed stainless steel and soft-touch silicone temple is worn permanently during the day and works by **stimulating four key pressure points.** This pressure stimulation sets in motion a "forgetting process" that reduces the neuronal "constant fire" in the brain and thus leads to **forgetting of the chronic tinnitus**.

The current study of the University of Regensburg showed the following excellent results. Already after 6 weeks of wearing the ForgTin®, the following parameters were reduced statistically significantly in the test persons.

After 12 weeks of wearing ForgTin®, a strong reduction of the subjectively perceived tinnitus volume occurred in 60% of the test persons.

For further information pls visit: www.forgtin.com



Klaus Grübl, Founder & CEO



### MedTech-Incubator: blockhealth GmbH





blockhealth GmbH, **proud alumni of the MedTech-Incubator programme** uses new, innovative technologies to bring about a paradigm shift in the communication of health-related information worldwide.

The self-determined, secure management of one's own health data, its targeted, clear summary for selected experts from the health sector and the use of all information to optimize one's own lifestyle will contribute worldwide to increasing subjective well-being, relieving local health systems while increasing their efficiency and ultimately creating living environments that can be followed by sustainable, positive change.

### App Vivellio - digital health manager

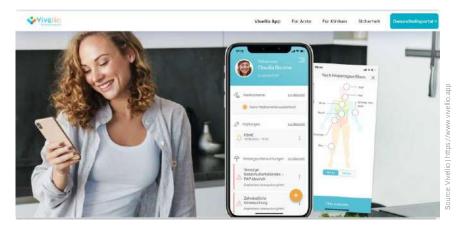
- Manage your findings yourself
- Medication plan
- Digital vaccination certificate

### Solution for doctors

- All relevant data at a glance
- > Simple, seamless communication
- Safety and quality

### Solution for clinics

- Direct communication with your patients
- > Seamless transfer of health data
- > Support of therapy success through increased adherence
- > Safe therapy and follow-up care
- Personalised services



For further information pls visit: <a href="https://www.blockhealth.ai/">https://www.blockhealth.ai/</a>

# RESILIENCE #upperVISION2030: The Digital Patient Journey







The digital future of healthcare Hospital 4.0





Together against data thieves

IT security as a challenge for manufacturers and users

**Digital Patient Journey - Matchmaking** 

### Digital Health Call / #upperVISION2030 Digital Patient Journey



Dr. Jama Nateqi, Founder and CEO Symptoma GmbH, councilor Markus Achleitner and Dr. Henrietta Egerth, Managing Director Forschungsförderungsgesellschaft FFG. © Land OÖ/Tina Gerstmair

"From a medical and economic point of view, the **digitalisation of healthcare** is a great opportunity. On the one hand, the care of patients can be further optimised and on the other hand, there are great opportunities in the future market of medical technology, especially for Upper Austria as a business location.

With our new funding call 'Digital Health - The Digital Patient Journey', companies and research institutions in Upper Austria will receive a funding turbo of almost 5 million euros for the development of future projects.

This is another milestone on Upper Austria's way to becoming a hotspot in medical technology," emphasises Markus Achleitner, Provincial Councillor for Economic Affairs and Research.













Business Upper Austria is the Upper Austrian government's location agency. We are an innovation driver and the first contact partner for companies in Austria and abroad to whom we offer customised solutions for their investment and innovation projects. We help steer economic and research policy. innovation is our business

Business Upper Austria's activities are largely funded by Land Upper Austria.

### Nora Mack, MSc MBA BSc

Cluster Manager Medical Technology Cluster Business Upper Austria – OÖ Wirtschaftsagentur GmbH

Mobile: +43-664-8186572 E-Mail: nora.mack@biz-up.at

www.biz-up.at

www.medizintechnik-cluster.at







**Q&A** session

















