DIMECC

ANNUAL REPORT 2017

CONTENT

NTRODUCTION

This annual report summarizes 2017, the 10th operational year of DIMECC Ltd. or it's predecessors. 2017 was the first full operational year after the merger of Digile Ltd. into FIMECC Ltd. (both of the companies established in 2008). With the merger, Finnish Technology Industries started a campaign to create 100 000 new jobs. In this campaign, the role of DIMECC was to create and lead a wide industry-led R&D&I portfolio that has both long-term visionary research programs and fast-moving commercial innovation services. At MPD2017, this campaign ended in the form of SF Tec Ltd. winning the new MPIDEA competition. In statistics, 2017 was the year of a huge new employment in mechanical engineering, marine, and ICT industries.

DIMECC – Digital, Internet, Materials and Engineering Co-Creation – Ltd. is a non-profit company, and the form of our annual report primarily supports the documentation of the most important activities. Economic analysis is not in focus because the objectives of DIMECC Ltd. are in long-term change of company-university cooperation, knowledge creation, and innovation activities' impact rather than in financial perspective.

For more information about DIMECC, see www.dimecc.com.

DIMECC IN NUMBERS 2017

- 30M€ Program Portfolio
- 1M€ PoDoCo scholarships by private foundations
- 300+ Customers
- 2 000+ Persons involved in DIMECC activities
- 780 Participants at Manufacturing Performance Days (MPD2017)
- 2 Innovation competitions launched (MPIDEA @ MPD2017, Pike Tank @ SLUSH)
- 10 Employees
- 10 Program managers
- 2 Doctoral schools (Breakthrough Materials & CEESIMP)
- 3 Demo days, 24 Demobooster customers
- 2 DIMECC offices (Helsinki, Tampere)

IMECC ECOSYSTEMS – GLIMPSE OF THE EUROPEAN FUTURE THAT WE WANT

On 3rd of July, we published our report LAB – FAB – APP to direct the Future of European research and innovation (R&I) landscape in the form of ninth framework program (FP9). The report was given by a High-level group (HLG) chaired by the former trade commissionaire Pascal Lamy and nominated by the current R&I commissionaire Carlos Moedas. The primary target of our HLG was to maximize the impact of European R&I programs.

In LAB – FAB – APP, we give eleven recommendations to Europe. They all are based on the idea to invest in the European Future that we want. It is about what we Europeans want for Europe, and then implementing it. Extremely simple. We have the scientific evidence on how different scientific and research mechanisms impact our society and structures, and we know what we want from the R&I funding as outcomes: Jobs and growth.

One of our eleven recommendations is to increase the volume and share of mission-driven research. Another recommendation is to activate and mobilise individuals and citizens to take part in R&I activities. Hence, companies, businesses, European Commission, and taxpayers will be asked to define the missions that we fund in Europe, and to help in executing them.

Why did we end up with such recommendations? On one hand, there seems to be enough political capital and fact-based willingness in European Commission to try something new compared to what has been funded since the beginning of the framework programs' history. On the other hand, we have both statistical and qualitative evidence based on the empirical field work in forerunning countries, with novel R&I models, and under unconventional leadership, that classical call-based research-oriented proposal writing & project execution may not produce the highest impact. In contrast, these all may be needed, but they may boost the jobs and growth more when applied in novel combinations with private-sector leadership, non-hierarchical participation, and heterogeneously open ecosystems.

One of the most forerunning, novel, and unconventional R&I set-ups in Europe is DIMECC, our multi-organisationally owned non-profit company. We, meaning the more than 2 000 dedicated and creative people from companies and research institutes, have led the digital transformation and co-creation activities of manufacturing industries, including manufacturing of software and digital technologies, in Finland since 2008. The time-to-market and innovation probability of the players in our platform has improved dramatically. We do not talk about incrementality, we talk about 20-fold pay back for R&I investments, like our 2017 customer survey show-cased, and speed-up of the R&I work by hundreds of percents, like the case of software testing in our N4S program. The best outcomes and highest impacts are available in this annual report. Our trademarked services, e.g. PoDoCo and Manufacturing Performance Days, grew significantly.

With our partnering companies and the Finnish Funding Agency for Innovation, we have launched "One Sea" and "Connected Industry" as missions deriving from private companies' foresight and strategies: There will be autonomous ships in traffic before 2025. There will be operations centre for smart connected industrial systems before 2028. In both cases, global new businesses can be led from one single location without human fingerprints on physical activities and processes. We do not talk about R&I, we talk about new business creation. We talk about P4.0, that means opening the industry-driven Public Private Partnerships to "People" in the context of digitalisation of manufacturing industries

(Industrie 4.0). It is a totally new approach to any kind of research – P4.0 is impact-driven.

The Finnish minister for Transport and Communications, Mrs. Anne Berner, has supported the autonomous mission strongly, especially with strong marketing efforts that are needed to bring official governmental status to private-sector led missions and executors. Minister Berner is committed to work for changing the international rules and regulations, which forms an integral part of a true Public Private People Partnerhip. This autonomous thinking will, naturally, be extended from marine part of the logistics chain to cover the parts inside factories or among any operating fleet or assembled base of manufactured goods.

Private companies have connected their research, development, innovation, and new business creation efforts to One Sea and to Connected Industry. They take the joint missions forward by using DIMECC innovation platform for their own efforts. By show-casing their results and experiments to others, learning through our platform is faster than any other learning method could provide. Universities and public research institutes will get mission-related funding to technology, human behaviour, and business concept related R&I programmes, and their competence and knowledge can be integrated to the execution of the missions. Finally, individual citizens, start-ups, inventors and everyone interested will have open forums to speed up the learning of not only individuals and businesses but the society in total. This mutually open learning is boosted through joint infrastructures like the globally first ever totally open test site for autonomous marine technologies, Jaakonmeri, that we opened in 2017 close to the West coast of Finland.

One Sea and Connected Industry – DIMECC Ecosystems – integrate all systemically. The models, tools, instruments and methods are there already. Fastest learning method is co-creation, and the speed of learning defines the winners in the market. Speed is the new intelligence. About ten years ago, the Finnish government and public sector asked us to make growth in our industry sector possible in 5-10 years' time frame. Looking at the statistics – the positive turn in the Finnish economy started in 2015 – we made it! Target – implementation – keep it simple. Let's just create the European Future that we want!

I would like to thank DIMECC's customers, program participants, investors, shareholders, stakeholders, service suppliers, and our personnel for the impactful year 2017!

Harri Kulmala, CEO

IMECC OPERATIONAL MODEL

DIMECC thematic areas

Digitalization is not just about embracing new technology. Instead, it is a comprehensive approach referring to the changes associated with the application of advanced technological solutions at all levels of organization and in all aspects of business. Technological innovations lead to technology disruptions. Companies need to adopt new technologies by utilizing new solutions in products and services and by integrating traditional assets to address new challenges and pursue new opportunities. The business process need to build new capabilities and formulate new business models to exploit full potential of emerging technologies, to create intelligent and sophisticated customer understanding and to harness customer value. Digitalization also drives systemic changes throughout the industry affecting society overall. Thus, to unlock the potential of digitalization comprehensive systemic approach are needed. DIMECC's vision is to be the leading co-creation platform for digital transformations. The vision is achieved through mission driven co-creation activities in four main domains:

1. Manufacturing,
2. ICT,
3. Maritime, and
4. Materials.

Under these four domains DIMECC drives systemic change by addressing following thematic areas:

1 **Enabling Technologies:** World-class enabling technologies and utilization of these technologies in business creating competitive advantage and differentiation in the market.

2 **Technology Cross-utilization:** Global leadership in technology cross-utilization and technology integration by combining latest R&D&I results and by turning these to insightful market offerings.

3 **Business:** Capabilities to exploit the full potential of emerging technologies in business, to create intelligent and sophisticated customer understanding and to harness customer value.

Research programs and projects have been an important part of DIMECC's operation and continue to be. To achieve the targets other co-creation instruments are needed as well: co-creation services and network actions focusing on facilitated foresight activities, ideation, innovation commercialization, rapid prototyping and crowdsourcing are integrated as an essential part of our operations. The purpose of these activities is to accelerate the research work of the programs and support the research work execution even after the programs finish. These activities include, for example: Demobooster (rapid commercialization), PoDoCo (strategic renewal & technology transfer), Innovation Camp (idea crowdsourcing), industry-driven doctoral schools, and effective utilization of partnership networks.

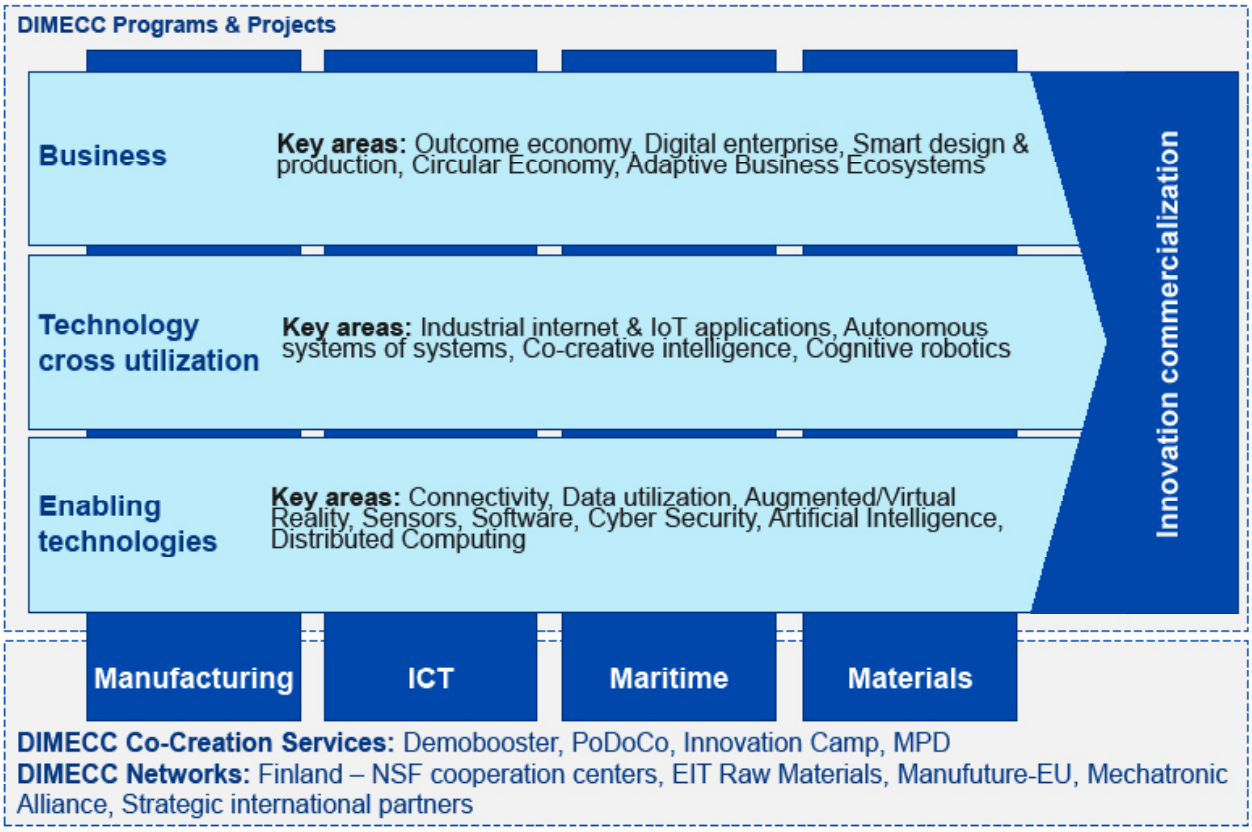


Figure 1: DIMECC main domains and thematic areas.

DIMECC innovation funnel

DIMECC's role in the innovation landscape is to effectively resolve the challenging high-risk research questions with significant business potential through mission driven co-creation. DIMECC accelerates R&D&I activities through three types of services:

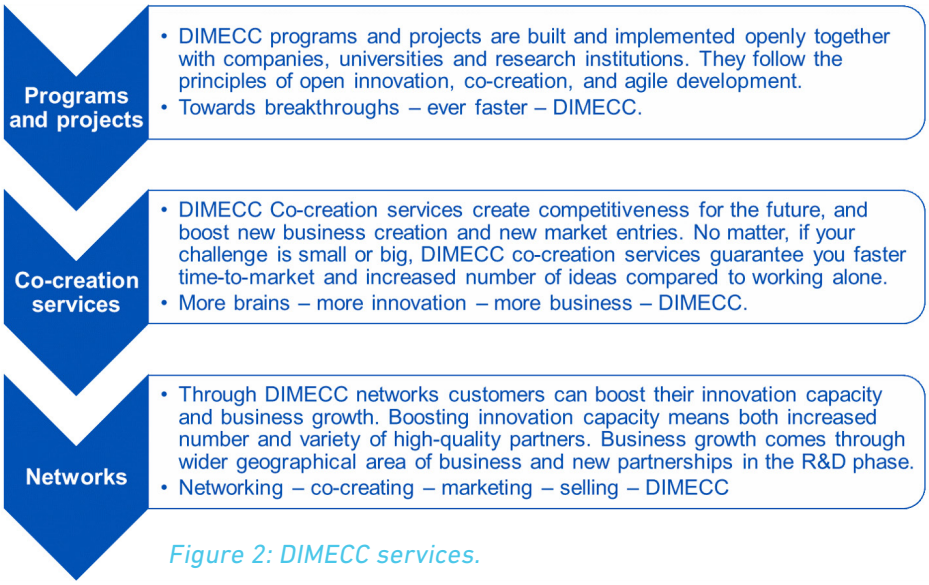


Figure 2: DIMECC services.

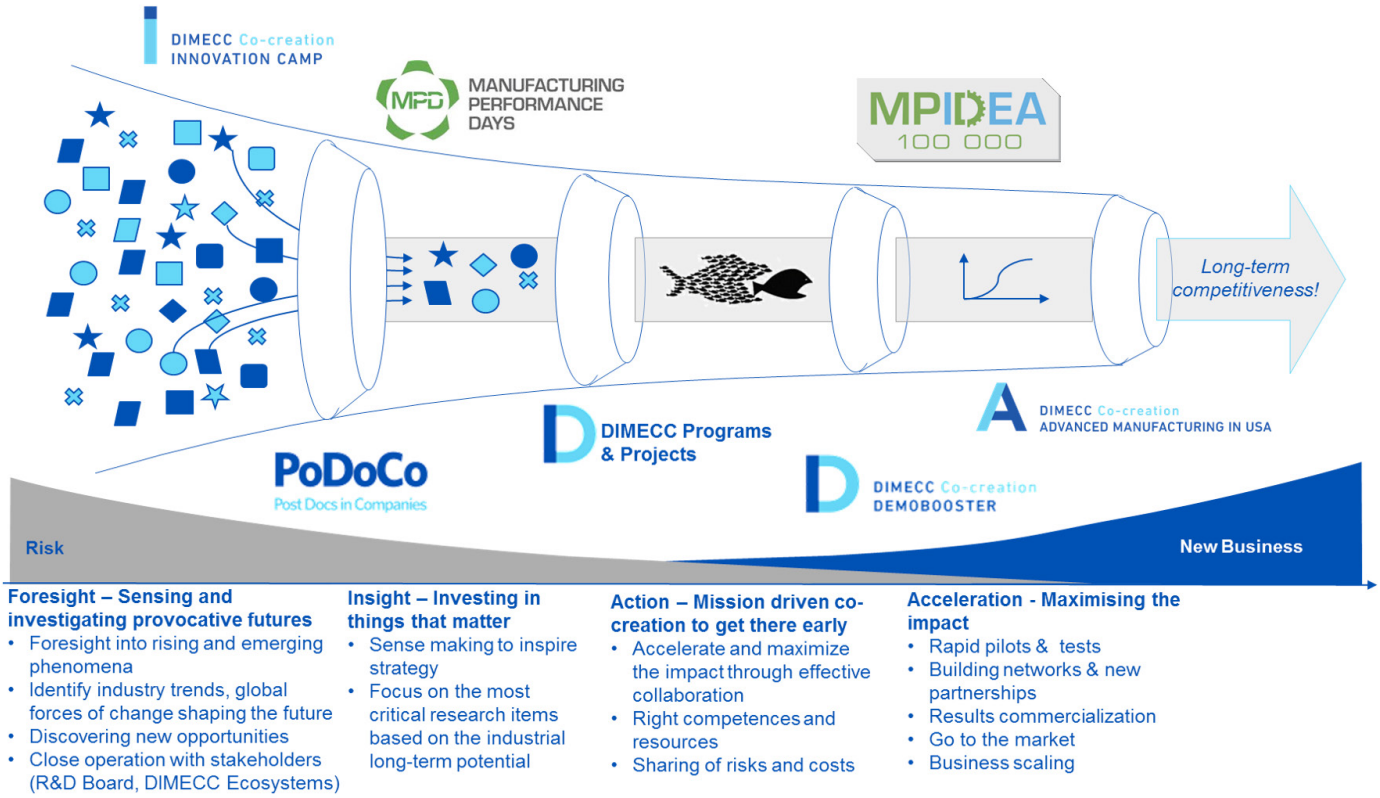


Figure 3: The relationship of DIMECC Innovation Funnel and DIMECC services.

1 **DIMECC Programs and projects** – Accelerate your R&D&I

2 **DIMECC Co-creation services -** Speed up your sales and R&D&I

3 **DIMECC Networks -** Open up new avenues for business

DIMECC's process can be described as an "innovation funnel". DIMECC innovation funnel is accelerated through DIMECC services (i.e. programs & projects, co-creation services and networks).

In the first phase industry trends and global forces of change that are the shaping the future of industry are identified and elaborated. The aim is to discover new opportunities of future. The shareholders define the focus of DIMECC activities and foresight activities are carried in close collaboration with DIMECC shareholders. This is organized through an R&D board that is used for foresight activities to produce and interpret the foresight data. Also, DIMECC ecosystems are in important role in producing foresight to selected industry domains.

In the second phase shared understanding of future business opportunities are formed and R&D&I needs required to realize future opportunities are identified. The aim of the second phase is to define the most relevant strategic research areas. Concrete strategic research areas are defined by thematic steering groups formed by experts. Relevant strategic research areas need to fulfil the following criteria: 1) Significant long-term business potential; 2) High scientific ambition; 3) Enough joint industrial interest. Based on the defined strategic research areas future R&D&I programs and projects, and other joint development actions, such as training

and competence development programs, and commercialization activities, are initiated.

The third phase focuses on company driven development activities that turn the new opportunities into business that ensure the competitive advantage of Finnish industry. DIMECC mission driven PPP-programs and projects are an effective way to accelerate strategic research in which risks and investments can be shared while the benefits of the results are maximized within the consortium partners. The programs enable large companies and SMEs to co-operate with the leading national and international universities and research teams. The work developed in DIMECC´s programs and projects are often transversal with respect to the different thematic areas. The development and growth of individual companies is a key motive for the companies to join DIMECC, but DIMECC's aim are systemic digital change which goes beyond the success of individual companies.

DIMECC maximizes the impact through DIMECC co-creation services and DIMECC networks, which focus on accelerating the development actions of individual organizations and in which the research results are developed in the direction of the commercial phase. All the activities drive towards result commercialization, enabling the long-term competitiveness of the industry.

Overall DIMECC emphasizes the development of the ecosystem through which individual companies can develop their business in collaborative manner. The systemic R&D&I programs and projects focus mainly on precompetitive research, while many co-creation services are close to market. Since all R&D&I programs and projects within DIMECC are industry-driven, the results are strategically important for the companies and interest to go to market with them is in-built into the DIMECC system.

DIMECC key operation responsibilities

DIMECC's organization and operating model are based on lean operations through which network-based co-creation activities can be effectively steered and managed. This operating model requires strong commitment from shareholders and other stakeholders, which is ensured on a strategic level through typical limited company processes – steering and governance by a Board of Directors. The core content is steered by shareholder experts in the R&D council, and committed customers in the Management Boards of DIMECC's ecosystems. Both the BoD and R&D council are used as communication channels.

The operating infrastructure of DIMECC (employees, offices, etc.) is paid through service fees.

DIMECC Activities

DIMECC Programs and Projects

This chapter introduces shortly the program and activity portfolio and research volumes of DIMECC in 2017. All on-going research programs, projects and other activities can be joined later, if the existing consortium accepts the new applicant and the new applicant accepts the existing consortium agreement.

The focus of on-going programs in 2017 was in finalizing, reporting, and showing and disseminating the results of ending programs, and in initiating the creation of DIMECC's new Strategic Research Agenda based on strong vertical focus. The renewal effort took place through One Sea and Connected Industry ecosystems.

Following figures represent companies' (Figure 5) and research institutes' (Figure 6) DIMECC participation in all programs in 2017. The budget division of DIMECC program portfolio in 2017 is presented in Figure 7. Tekes' funding in DIMECC's programs was ca. 47 per cent on average.

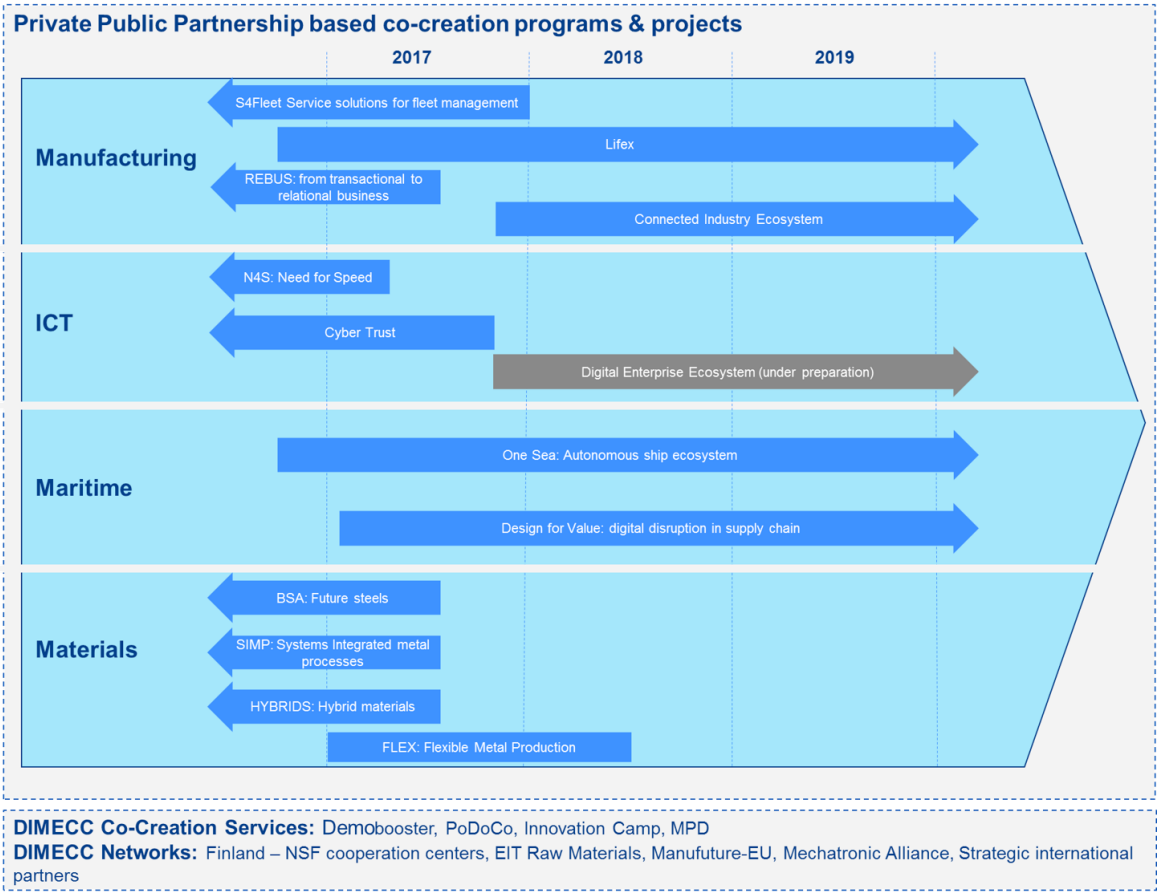


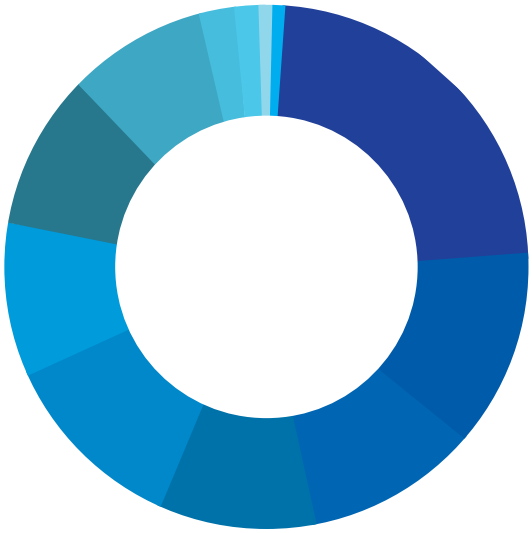
Figure 4: DIMECC program portfolio 2017

SSAB	12,9
F-Secure Oyj	11,1
Ericsson	6,8
Rolls-Royce Oy	6,7
Valmet Oyj	6,5
Nokia Oyj	5,9
Outokumpu Oyj	5,5
Outotec Oyj	5,4
Bittium Wireless Oy	5,0
Cargotec Oyj	4,6
Others	57,3

Figure 5: Companies' total investments in DIMECC portfolio (M€) in 2017.

Aalto University	16,2
VTT	15,3
Tampere University of Technology	14,5
University of Oulu	12,7
Åbo Akademi	8,2
University of Helsinki	3,7
Lappeenranta University of Tech.	3,5
University of Vaasa	3,1
University of Turku	2,9
University of Jyväskylä	2,7
Other	4,7

Figure 6: Research institutes' total program budgets in DIMECC portfolio (M€) in 2017.



N4S	52,3
BSA	25,2
SIMP	24,2
Cyber Trust	23,0
REBUS	22,9
HYBRIDS	20,4
D4V	19,6
S4Fleet	18,9
FLEX	4,4
LifeX	2,7
Connected Industry	0,9
One Sea	0,8

Figure 7: Total budget division of on-going DIMECC portfolio (M€) in 2017.

Current DIMECC portfolio

DIMECC Program BSA

DIMECC BSA - Breakthrough steels and applications - builds on the existing strengths to secure the leading position of the Finnish metals and engineering industry. The program answers to major global challenges and end-user needs by taking metals research and design to a new level.

Essential elements:

- DIMECC Breakthrough Materials Doctoral school
- Extensive collaboration both nationally (joint knowledge platform with Hybrid Materials program) and internationally

Impact:

- Renewed and successful Finnish metals and engineering industry based on innovative and sustainable solutions
- Applications of the program results will benefit various fields of industry
- New business opportunities will be opened in new areas
- An extensive international steel competence network will be created

Vision: Finnish metals and engineering companies are key players in global cleantech markets by 2030

The program has proceeded according to the plan. Within the program originally more than 100 researchers are forming an international network concentrating on essential parts of the steel and engineering industry value chain. The BSA program is linked and will be run in close cooperation with another DIMECC materials program HYBRIDS (Hybrid Materials). The BSA and HYBRIDS program form also a platform for the DIMECC's Doctoral School with 34 doctoral projects. Now there is a risk that this network will break out which impact significantly Finnish metal based industry's competitiveness and possibilities to gain EU funding for the area.

DIMECC's BSA and HYBRIDS programs are major efforts in application oriented materials R&D in Finland, they have been built based on the needs from different industry sectors and have close links with the R&D programs in those as well as the fundamental research activities by Academy of Finland (e.g. Programmable Materials). The results can be directly used by the participating material producers in the development of new higher value added steels. The participating equipment and machine manufacturers have access to new steel solutions and can test and apply them fast in their prototypes and products. The results also strengthen the increasingly important service business by providing in addition to improved equipment performance also longer lifetime.

Schedule: 2014-2017
Volume: 25,2M€

CONNECTED INDUSTRY

DIMECC Program
CYBERTRUST

Connected Industry is an innovative ecosystem connecting leading Finnish equipment manufacturers and providers of digital solutions to drive and to realize the immense opportunities of the emerging new era of Connected Industry.

We're drawn to the physical: to seeing, feeling experiencing and touching things. Sensing the fruits of our labors. The manufacturing industry is the final mile of the long process of digitalization. It is where data is turned into physical reality.

Turning data into practical tools and devices completes the circle. It fulfills the transformation of the manufacturing industry into the Connected Industry. And opens the flood gates for the seamless utilization of better, more effective, zero-defect, customized products. Transforming how companies serve customers and fulfill human needs.

The vision of Connected Industry Ecosystem is to match demand with an effortless flow of perfectly customized supply. The effect of accelerating technology development and data availability is unprecedent. Focus has been realigned from manufacturing to needs of individuals. Bringing humans as customers, suppliers, and workers in the core of digitalization.

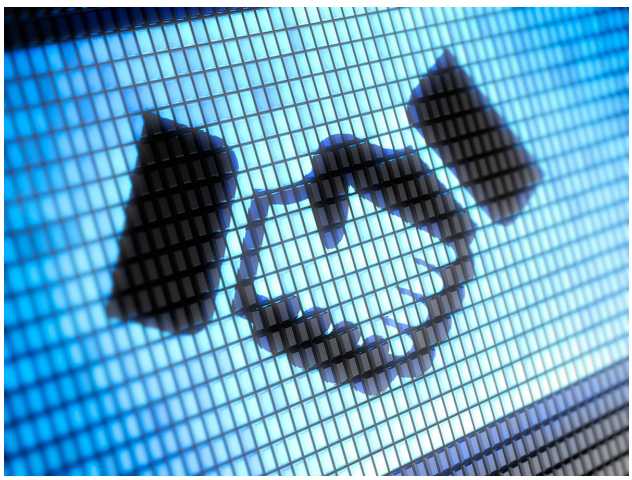
Finland is a market long known for its prowess in design and manufacturing. Pride in engineering combined with an exceptional willingness to transparently share knowledge and experience in order to develop cumulative expertise has proven a capable competitive edge for a small country. Our intuitive and distinctive aptitude for collaboration and co-creation distinguishes and defines us.

Connected Industry, through the vast array of benefits it has brought about, has taken the driver's seat. And we, as leaders in our prospective fields, are here to make sure the advance has only just begun.

People are more and more dependent on networks, electricity and data processing while our infrastructure is becoming more dependent on unpredictable risks. **DIMECC Cyber Trust** Program creates a foundation for Finnish research and industry to address the needs emerging in the cyber security domain. The main research objective pf the DIMECC Cyber Trust program is to improve the privacy, trust and decision making in digital infrastructure by monitoring, analysing, virtualizing, and visualizing traffic, objects and events. The program utilizes the strong expertise, extensive knowledge and solid cooperation model in public-private sectors. The consortia consists of 19 companies, and 8 research institutes and universities.

In DIMECC Cyber Trust Program, the cyber security is approached with the following themes: secure services, securing platforms and networks, and Advanced threats and Security Assurance.

Schedule: 2015-2017
Volume: 22,9 M€



DIMECC Program D4VALUE

DIMECC D4Value program will enable the best possible use of digital disruption for business growth. The D4Value program has a strong industry demand which has been emphasized by the rapid development in different supply chain parts (factories, ports, ships, etc.). The program focuses on door-to-door supply chain which is under digital disruptions and is rapidly changing towards an ecosystem of fully autonomous system-of-systems. Although changes are ongoing in many fronts of the supply chain, the overall value network has not been disrupted yet.

The program focuses on two application areas: autonomous maritime and manufacturing use cases in digitalization. In autonomous shipping, D4Value program has a critical role as it is the first ecosystem level approach in the area.

In the program business concepts are driving the research in 3 areas: business models and ecosystem design; technology solutions and platforms; regulatory, societal and people aspects in creating new ecosystems. DIMECC D4Value program is collaborative research effort with consortia of 11 companies and 9 universities. Website http://d4value.dimecc.com/ provides additional information about the program.

Schedule: 2016-2019
Volume: 19M€

DIMECC Program FLEX

Metals production is facing major economic and environmental challenges. The main requirements for competitiveness in the future are the capability for a flexible response to changing demands and the ability to produce metals at high cost efficiency. In addition, the planned reduction of CO2 emissions requires drastic changes to the current process practices. These demands cannot be met with the existing operation paradigms, but requires implementation of new flexible approaches.

The vision of the project is a paradigm shift from stiff and reactive production to flexible and proactive operating mode, while moving the Finnish metal industry towards circular economy with zero waste plant concept and CO2 lean metal production. The shift necessitates digitalized and interlinked information flows at various levels of the production chain.

The program is divided to three work packages; Proactive Metal Production, Adaptive Refining Metallurgy and Intelligent Rolling. One of the major goals of the **FLEX** program is to develop zero waste plants in accordance with circular economy and increasing the internal recycling rate of byproduct fines by 20%. Another major goal is to digitalize metals production processes in order to increase process efficiency by 5%.

Program company partners: SSAB Europe Oy, Outokumpu Stainless Oy, Outotec Finland Oy, Casim Consulting Oy, Luxmet Oy, SFTec Oy and Sapotech Oy. Research institutes in the program: University of Oulu and Aalto University

Schedule: 2017-2018
Volume: 3,5 M€

DIMECC Program HYBRIDS

HYBRIDS -Hybrid materials - builds a unique multidisciplinary knowledge platform that will strengthen the manufacturing industry

The program solves fundamental challenges in the R&D and application of multi-materials to create advanced property combinations that conventional materials do not possess.

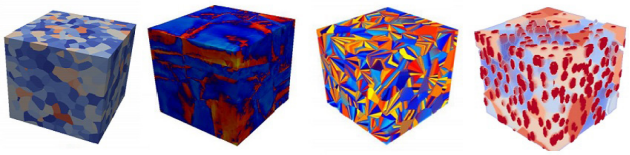
Essential elements:

- DIMECC Breakthrough Materials Doctoral school
- Extensive collaboration both nationally (joint knowledge platform with Breakthrough Steels and Applications program) and internationally

Impact:

- New value-added hybrid material solutions meeting high customer demands (multifunctional, durable, cost efficient and sustainable), creating a competitive advantage
- Digitalisation of manufacturing and material development will decrease the time to market
- A strong manufacturing industry ecosystem and new industrial networks (in contrast to knowledge silos)

Vision: Growth and improved competitiveness by value added, hard to copy solutions



DIMECC HYBRIDS program is managed in close cooperation with the DIMECC BSA (Breakthrough Steels and Applications) program and is the other main contributor for the DIMECC breakthrough materials doctoral school. The program is a key tool to renew the Finnish industry and secure its future competitiveness through knowledge-intensive materials. As a result, a unique multidisciplinary technology platform and a world-class competence network was planned to be created. This would have provided Finnish companies a competitive advantage to apply HYBRID materials effectively in future application which require special material characteristics.

Schedule: 2014-2017
Volume: 18,2 M€

DIMECC Program LIFEX

LIFEX program focuses on advancing digitalization and Industrial Internet in Finnish industry. To develop and produce competitive new product related services, companies need deep knowledge throughout the whole product lifecycle. The knowledge is gathered and shared during design, operation and recycling phases with help of Industrial Internet.

LIFEX program currently consist of two joint projects of companies and research organizations. DYNAVIS project develops and tests next generation Product Lifecycle Data Management practices where virtual and augmented product information is efficiently created and used for different business needs.

IVM project focuses on new innovative vibration management solutions. Based on earlier successful marine applications a novel damping and design concept is applied to several new industry applications.

Schedule: 2016 ->
Volume: 2,7 M€

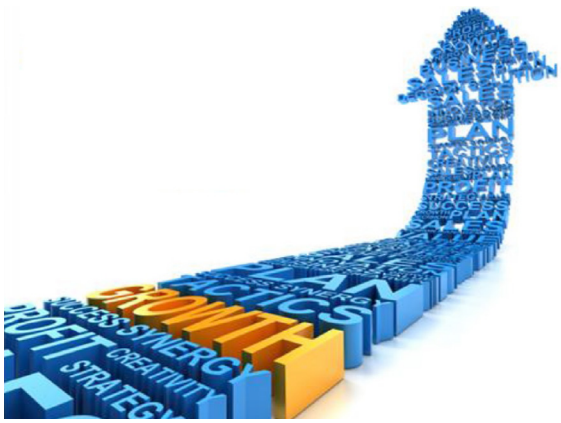
DIMECC Program NEED FOR SPEED

DIMECC Need for Speed (N4S) will create the foundation for the Finnish software intensive businesses in the new digital economy. DIMECC N4S adopts a real-time experimental business model, and provides capability for instant value delivery based upon deep customer insight. The program is executed by the forefront Finnish software companies. The consortia consists of 13 large industrial organisations, 16 SMEs and 11 research institutes and universities.

The internet is the first truly global platform for the digital economy and will create significant new business, economic, and social opportunities. Digital resources are constantly available on-line, and for all to use. Increasingly, products and services are not developed by a single company but rather by a network of collaborating companies. This network of companies contribute to the ecosystem through different elements from both established and newly developed products, forming new, even more compelling offerings.

The long-term plan of DIMECC N4S is to serve other companies where software plays a dominant role in engineering—for instance, those associated with the automation industry—by making the program's results, tools, and processes widely available.

Schedule: 2014-2017
Volume: 52,3 M€



DIMECC Program ONE SEA

One Sea is a high-profile project with a primary aim to lead the way towards an operating autonomous maritime ecosystem by 2025. The Finnish collaboration gathers together leading marine experts and is a strategic combination of top research, state-of-the-art information technology and business. The project began in 2016, and the aim is to create an environment suitable for autonomous ships by 2025.

Digitalization of the marine environment
Ship owners and operators should consider when to take advantage of the lower capital and operating expenditure – with the better efficiency, reliability, safety and sustainability – that digitalization has brought into other areas of business and industry.

Marine industry suppliers and shipyards are actively looking for opportunities to be the first to offer ship owners the latest competitive edge of digitalization. The companies and organizations collaborating in the project are forerunners in their respective fields and the knowledge they share sets them apart from other likeminded projects. The ecosystem ensures a well-researched, tested and highly capable autonomous shipping network.

The co-creation ecosystem will also set the course for new industrial standards. With the leadership, participation and steering from the One Sea Autonomous Maritime Ecosystem, the new standards will correspond with the targets of minimizing accidents, decreasing the environmental footprint of marine traffic, and advancing possibilities for new commercial ventures.

DIMECC Program REBUS

DIMECC REBUS - Relational business practices - program aims at making scientific breakthroughs in the area of networks and business ecosystems. The program challenges the participating firms to take major leaps in developing these practices as well as fundamentally change their underlying mindsets of managerial behaviour. The particular focus is on those relational business practices that are needed to act as a member in as well as to take advantage of various networks. Big organisational innovations are rather paradigmatic changes in managerial thinking and organisational behavior than small-scale breakthrough innovations with high speed of diffusion. As results of the new research-based practices the REBUS program aims to create a collection of verified relational business practices that are proven in practice and shown to be advantageous in terms of innovation, growth and efficiency for networked firms.

The industrial sectors within the REBUS program are in particular within transportation and energy systems. These two sectors are globally the most investment-intense areas in the coming years and are at the core of the interest of Finnish present and future industry.

The REBUS program is built on a common theoretical framework, within which the four separate projects focus on different network contexts as they implement the actual research and development tasks. The program consists of four projects and one cross-sectional common research task addressing relational business practices.

The four sub-projects are:

- Project business networks
- Logistics networks
- R&D networks
- Value networks

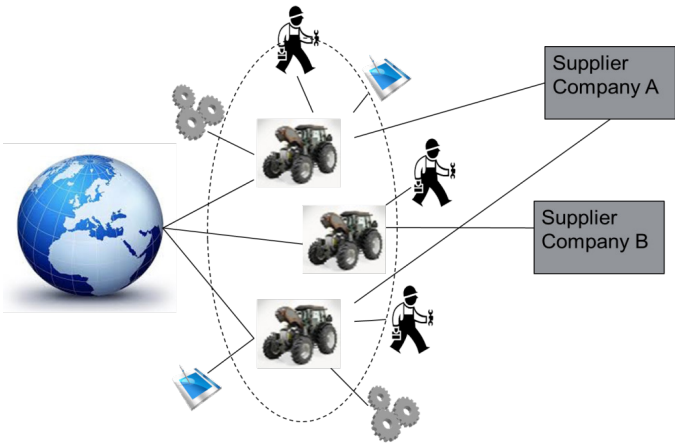
All 22 participating firms have strongly connected the REBUS program with their main growth and development strategies and 7 Finnish research institutions are committed to explore relational business practices with them. The REBUS program is also highly international and there are collaboration activities with 18 international universities.

Schedule: 2014-2017
Volume: 22,6 M€

DIMECC Program S4FLEET

The digitalization of industry is enabling entirely new levels of real-time management of industrial devices, processes, and global fleets of equipment and people. Digitalization has potential to improve resource productivity, process efficiency, flexibility, and large-scale coordination. Digitalization enables new forms of networked cooperation and business models for much greater value creation.

DIMECC S4Fleet - Service solutions for fleet management - program combines the strategic, operations, and technology perspectives to explore and capture the emerging business opportunities of the digitalizing industry. The three focus areas of the program are strategic intelligence in fleet management, operational excellence and dynamic service delivery systems for distributed fleet, and technological solutions for fleet analysis. The program combines resources and skills from 23 industrial and IT companies and six research institutes into a fast-pace three-year research program. Program implementation emphasizes



strong collaboration between participating companies by arranging practice benchmarking opportunities and special interest groups programs, in addition to the program level seminars and other collaboration opportunities. The program also emphasises new scientific results creation and dissemination by arranging a yearly doctoral school and engaging leading scholars to evaluate and advice the research teams.

Several studies have found the services building on digitalisation critical to the future competitiveness of the Finnish industry. The purpose and goal of the S4Fleet research program is to explore and capture new innovative, globally scalable, and differentiating service business growth opportunities. The approach to use global fleets as platforms for new business creation is effective way to scale-up new life-cycle service offering. S4Fleet is the Finnish version of the German Smart Service Welt initiative.

DIMECC S4Fleet and DIMECC S-STEP together form the Finnish company-driven Industrial Internet R&D entity, which is designed to be implemented together, with a small timely gap, since there is no new service business without the technologies, but with the technology only, there is no commercial success.

Schedule: 2015-2017
Volume: 18,9 M€

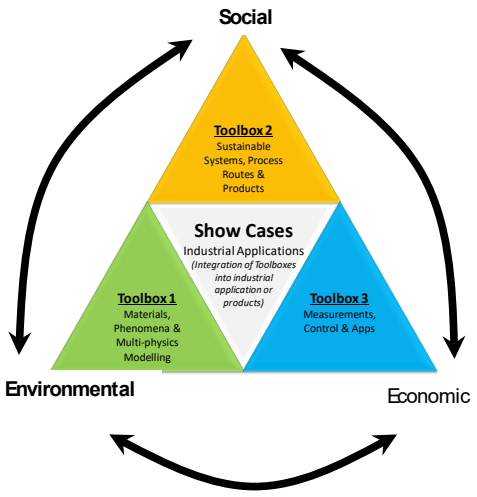
DIMECC Program SIMP

Resource efficiency is high on the EU political agenda and plays more and more critical part also in society. Digitalisation of processes, process chains, systems and linking them in a real-time process control systemic is arguably a key component for tackling this global challenge. The objective of the program is to further improve the already low environmental footprint of the 7.8 billion € export "Metals and metal products" Finnish industrial sector and to significantly increase its global competitiveness. The program focus on 3 key Finnish industry sectors i.e. copper, steel and stainless steel.

SIMP - System integrated metal production - program will provide the basis to further innovate the production systems to higher resource efficiency and render the world class export metal products even more sustainable and CleanTech based. World Class CleanTech systems will therefore be an important product of this program. This is an enormously challenging task to take, but it is also self-evident that if these objectives are achieved, not only will the Finnish metallurgical industry improve its resource footprint but it will provide techniques and technology that places it in a leading global position with regard to enabling increased resource efficient metal production. During 2015 a new industry driven doctoral school with 25 researchers was launched within the program.

Additional funding for the area was successfully applied from the EIT raw materials KIC in which DIMECC is an associated partner. SIMP program works basically as a platform for the raw material KIC' partners in their KAVA activities and DIMECC is looking for new ways how to offer this kind of platform also in the future.

Schedule: 2014-2017
Volume: 24,0 M€



DIMECC Co-creation services

The co-creation activities consist of reducing the time-to-market, accelerating companies R&D&I, supporting technology transfer and bringing together companies and research organizations into ecosystems facilitating the large-scale systemic transformation of industries.

DIMECC Demobooster

Demobooster is an innovation service for rapid commercialization. It provides a collaboration platform for companies hunting for killer applications through strategic partnerships: an innovation highway from ideas to products.

Demobooster in a nutshell

- The market place where demand and supply of software demos efficiently meet
- Provides immediate feedback on the functionality and applicability of the demo
- Speeds up product development process through "success or fail fast" principle

The mission of Demobooster is to demonstrate new ideas in practice. The outcome is not a "slide show presentation" but a concrete solution!

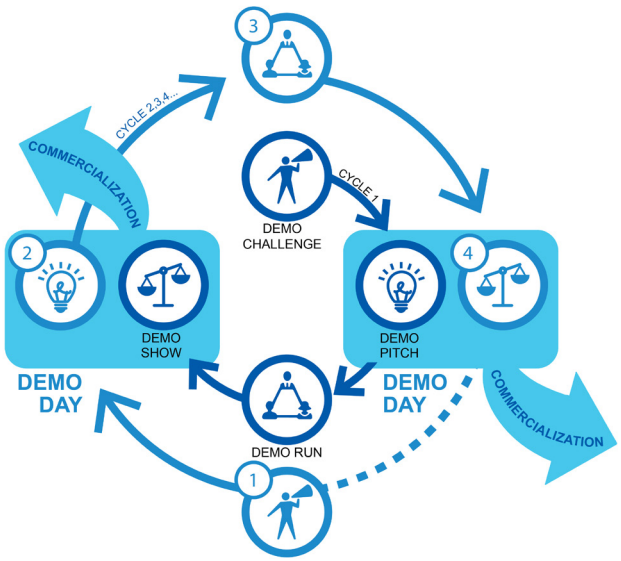


Figure 8: DIMECC Demobooster service cycle.

Demobooster in numbers after 2017:

9	Demodays
51	Companies
36	Challenges
92	Solutions
22	Demos

Demobooster creates a specialists' network for the development and marketing new ideas between Appliers (engineering industry) and Producers (software enterprises and expert organizations). After 2017, we've had 9 successful Demodays with 36 different challenges presented by the Applier companies. The Producers have pitched 92 innovative solutions to the problems, 22 of which (with a few additional ones currently under development) resulting in a concrete demo. In total, there have been participants from 51 different companies. Demobooster is a registered trademark of DIMECC.

www.demobooster.com

PoDoCo

PoDoCo is a matchmaking program supporting long term competitiveness and strategic renewal of Finnish companies and employment of young doctors in the private sector.

The duration of PoDoCo project is 1-2 years and it consist of two phases: research period and targeted research period. PoDoCo program is funded by PoDoCo foundation pool and companies participating in the program. PoDoCo foundation pool offers research grants of 6-12 months for the research period. Grants awarded by PoDoCo foundation pool are intended for academic research investigating new innovative ideas to boost the strategic renewal of Finnish industry. After the research period the company hires the Post doc to deepen the research results and to create company specific insight. The result is a

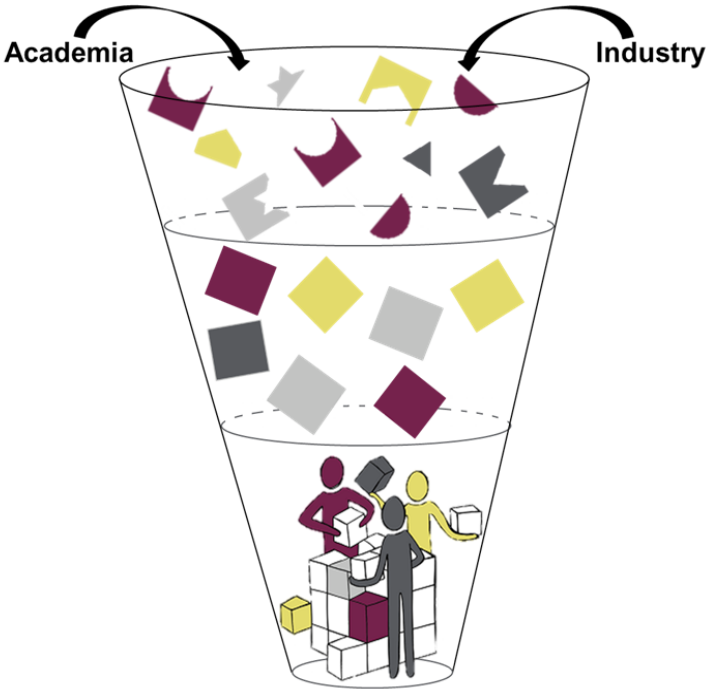


Figure 9: PoDoCo matchmaking.

win-win situation where academic research is supporting the long term competitiveness and strategic renewal of Finnish companies and young doctors get industrial experience.

Post Docs in Companies, PoDoCo program, is a joint initiative of Finnish universities, industry and foundations. Nine foundations allocated altogether almost 1 000 000 euros to the program during year 2017. The program's foundations are Finnish Cultural Foundation, Jenny and Antti Wihuri Foundation, Maa- ja Vesitekniikantuki ry, Svenska Kulturfonden, Finnish Foundation for Technology Promotion, Maj and Tor Nessling Foundation, The Foundation for Economic Education, KAUTE Foundation and Technology Industries of Finland Centennial Foundation. DIMECC operates the PoDoCo program and facilitates the novel matches and meeting between companies and postdocs. PoDoCo is a registered trademark of DIMECC.

After 2017 PoDoCo program has funded 64 collaborative projects between companies and postdocs. First projects ended during 2017 and first postdocs were employed to private sector through PoDoCo program. In total over 500 postdocs and 200 companies have participated in the program activities.

www.podoco.fi

Advanced Manufacturing in USA

During 2017 DIMECC coordinated execution of the "Advanced Manufacturing in USA" (AMGP) internationalization and export growth program funded by Finland's Ministry of Economic Affairs and Employment. The target group were those Finnish companies that have innovative tools and solutions for the American manufacturing industry. The growth program was helping them to establish or expand their operations in the North American market. Focus segments were metal processing, production technology, information technology, and automobile industry.

As part of the program, the participants received

Figure 10: AMGP stand at FABTECH, Chicago, USA.

tailored support for planning their go-to-market and marketing activities, from product and market definition to identification of initial customer leads and writing marketing messages. The program also had a booth at the FABTECH exhibition (Chicago, IL, November 6-9, 2017). During the exhibition, program participants were able to meet with their target market and collect hands-on experience about the local practicalities and realities.

For DIMECC this program provided an opportunity to link with relevant industry networks and innovation platforms in the United States. For example, in the Chicago area we now have contacts to two innovation platforms: DMDII (Digital Manufacturing and Design Innovation Institute) and City Digital (smart cities infrastructure) – both relevant partners for DIMECC's programs and ecosystems.

The planned duration of the AMGP program was two years (i.e. years 2017 and 2018), but as the number of participants was significantly lower than expected, DIMECC decided to close the program after the first year.

Manufacturing Performance Days event as a renewal platform

Manufacturing Performance Days is an international top level B2B summit which is organized every second year in Tampere, Finland. MPD is an executive and visionary event for manufacturing industries, researchers, and technology & service providers worldwide. This highly appreciated event brings together internationally recognised experts and academia to discuss and represent industrial best practices and operational excellence, novel business concepts as well as scientific and technological breakthroughs in the field. Company visits, meetings, and networking nourishes potential for R&D&I collaboration over the boarders and grows opportunities for new business contacts.

In 2017, the 6th MPD reached all-time-high record both in the number of participants (ca. 780) and in the number of organising partners (65). The new innovation competition, MPIDEA, was launched in 2017. MPD is a registered trademark of DIMECC.

www.mpdays.com

MPD MANUFACTURING PERFORMANCE DAYS

Manufuture 2017

DIMECC has been co-organiser of the international MANUFUTURE 2017 Conference which was organised on 24-25 October, 2017 in Tallinn, Estonia. The MANUFUTURE conferences have been organised since 2003 in EU Presidency countries so that this conference was the 11th MANUFUTURE conference. The head theme of the MANUFUTURE 2017 conference was 'Moving up the Value Chain' and the themes of the three parallel tracks were 'Digital Manufacturing', 'Sustainability and Circular Economy' and 'Collaborative Technological Innovation'. The Conference served as a forum for 600 participants representing stakeholders and decision makers from industry, universities, research institutions and government, and discussing the future of manufacturing industry and prioritizing the ways forward in technological and business development towards the year 2030.

www.manufuture2017.eu

MANUFUTURE 2017, TALLINN

DIMECC Networks

DIMECC supports its shareholders and program participants in increasing their international research collaboration through international networks and strategic cooperation partners. DIMECC is closely embedded in a larger ecosystem. It is part of the EIT Raw Materials KIC, and the Industry–University Cooperative Research Centers Programme of the US National Science Foundation (NSF). DIMECC is also part of EFFRA (European Factories of the Future Research Association), and ensures that there will be topics of interest for digitalizing manufacturing industries in the EFFRA roadmap. The network also participates in the public private partnership SPIRE (Sustainable Process Industry through Resource and Energy Efficiency). In 2017, DIMECC´s CEO was a member of Commissionaire Moedas' the high level group on maximizing the impact of European research and innovation programs.

EIT Raw Materials KIC

EIT Raw Materials was designated as an EIT Knowledge and Innovation Community (KIC) by the EIT Governing Board on 09 December 2014. The KIC will address challenges in the field of raw materials, such as sustainable exploration, extraction, processing, recycling and substitution. KIC includes over 120 companies, universities, and research institutes all over Europe. DIMECC is an associated partner of EIT Raw Materials. From Finland other KIC participants are Outotec, Metso, Spinverse, Aalto University, Oulu University, Lappeenranta University of Technology, VTT, and GTK. EIT Raw Materials' has co-locations in Espoo, Luleå Sweden, Leuven Belgium, Wroclaw Poland, Metz France, and Rome Italy, and the headquarters in Berlin Germany.

NSF

DIMECC together with partners have created new opportunities of international cooperation for Finnish researchers and companies. US National Science Foundation's (NSF) I/UCRC (Industry/University Cooperative Research Centers Program) provides a unique possibility for co-creation between research and industry. The National Science Foundation (NSF) is an independent federal agency created by the US Congress in 1950 "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense…". NSF is vital because it supports basic research and people to create knowledge that transforms the future.

Starting from 2015 Finland has participated (as the fifth country outside USA) in the Program in the field of Big Data in the CVDI-center (Center for Visual and Decision Informatics). CVDI conducts research on data science, big data, analytics, including visual analytics, augmented intelligence, and decision informatics. Finnish Site of CVDI center was created within DIMECC Data to Intelligence program. Currently 11 industry members participate in the work of the center. Tampere University of Technology is working as the Finnish Site for the center and all Finnish Universities may participate in the center through TUT.

The United States of America and Finland have also agreed on a significant cyber security partnership based on DIMECC's Cyber Trust program. In 2017 site of Security and Software Engineering Research Center (S2ERC) was opened at University of Oulu. The center is conducting applied and basic research on software security, system security, and software engineering problems in order to enable technology gains in member organizations. Currently 24 industry partners are involved in the work of the center. Similarly to CVDI center

other Finnish universities may participate in the center as well.

DIGINNO

Digital Innovation Network's (DIGINNO's) objective is to advance the digital economy and to speed up the process of moving towards the single digital market in the Baltic Sea Region (BSR). The project aims to increase the capacity of policymakers, industry associations and industrial SMEs to enable faster and more efficient uptake of digital solutions both in public and private sector. The focus specifically is on promoting uptake of ICT in the business sector, developing innovative and interoperable digital public services and facilitating Digital Single Market related policy discussions on the Baltic Sea Region level.

Partners: 15 full partners and 9 associated partners from nine BSR countries (incl. Norway)

Finnish partners: DIMECC as full partner and Ministry of Finance and Technology Industries of Finland as associated partners

Schedule: 01 October 2017 – 30 September 2020
Volume: 3,5 MEUR

www.diginnobsr.eu

DIGINNO Digital Innovation Network
Interreg Baltic Sea Region
EUROPEAN UNION EUROPEAN REGIONAL DEVELOPMENT FUND

DIMECC Strategic Partnerships

DIMECC supports its shareholders and program participants in increasing their international research collaboration, especially together with strategic cooperation partners:

DIMECC was member in co-operation networks in 2017 as follows:

Artemis Industry Association
EIT Raw Materials KIC
IIC Industrial Internet Consortium (U.S.)
FIIF Finnish Industrial Internet Forum
ECSEL Joint Undertaking
ManuFuture European Technology Platform
EFFRA (European Factories of the Future Research Association)
A.Spire (Sustainable Process Industry through Resource and Energy efficiency)
The Industry Innovation Center for Future Network, China (IICFNC)

In these networks, DIMECC's goal is to ensure that these networks' research priorities are of interest for DIMECC's shareholders. DIMECC also seeks to be a major node in European Digital Industry Hub landscape. DIMECC organises excursions to various foreign innovation locations and organisations regularly. All DIMECC programs include systematic and continuous researcher exchange.

SHAREHOLDERS 2017

SHAREHOLDER	N. OF SHARES
Aalto-korkeakoulusäätiö	150
ABB Oy	120
Andritz Oy	50
Bittium Technologies Oy	120
Boliden Kokkola Oy	50
Cargotec Oyj	120
Centria Ammattikorkeakoulu Oy	12
CSC-Tieteen tietotekniikan keskus Oy	12
Cybercom Finland Oy	12
Digita Oy	52
Elisa Oyj	120
Oy L M Ericsson Ab	120
EXFO Oy	12
Fastems Oy Ab	50
FIMA Forum for Intelligent Machines ry	50
Finn-Power Oy	50
F-Secure Oyj	12
Haaga-Helia Oy Ab	12
Helsingin yliopiston rahastot	24
Innovaatio Oy Uusi Tehdas	64
Inno-W Oy	12
Itä-Suomen Yliopisto	12
Juridiska Personen Åbo Akademi	40
Jyväskylän Turbiini Oy	12
Jyväskylän yliopisto	52
Kaakkois-Suomen ammattikorkeakoulu	12
KONE Oyj	120
Konecranes Oyj	120
Kumera Oy	50
Lapin Ammattikorkeakoulu Oy	40
Lapin Yliopisto	24
Lappeenrannan teknillinen yliopisto	64
Laurea Ammattikorkeakoulu Oy	52
Medialiitto	12
Metropolia Ammattikorkeakoulu Oy	52
Metso Oyj	120
Meyer Turku Oy	120
Murata Electronics Oy	24
Nokia Oyj	120
Nokia Solutions and Networks Oy	84
Oulun yliopisto	64
Outokumpu Oyj	120
Outotec Oyj	50
Prizztech Oy	12
Rautaruukki Oyj	120
Raute Oyj	50
Reaktor Innovations Oy	12
Rolls-Royce Oy Ab	50
SalWe Oy	9
Sanoma Oyj	120
SSH Communications Security Oyj	12
Stiftelsen Arcada	9
Stiftelsen Svenska Handelshögskolan	40
Stonesoft Oy	12
Suunto Oy	12
Tampereen Ammattikorkeakoulu Oy	40
Tampereen yliopisto	12
Technopolis Oyj	60
Teknologian tutkimuskeskus VTT Oy	210
Teleste Oyj	12
TeliaSonera Finland Oyj	120
Tieto Finland Oy	120
Turun Ammattikorkeakoulu	52
Turun yliopisto	64
TTY-säätiö	64
Vaasan yliopisto	40
Wapice Oy	50
Wärtsilä Finland Oy	120
Åbo Akademi	24
Älykkään liikenteen verkosto - ITS Finland ry	12

69 shareholders

23 research institutes

46 companies

BOARD OF DIRECTORS

Board of directors was elected in the annual general meeting in April 26th, 2017. The board had eight meetings in 2017.

In 2017, the remuneration paid to board members was 150€/meeting (200€ for the chairman). PricewaterhouseCoopers Oy, and Mr. Jouko Malinen as the auditor in charge, continued as the auditor of the company.

Members

Ilari Kallio (chair)
Lauri Oksanen (vice chair)
Petri Kalliokoski
Tapani Kiiski
Sauli Eloranta
Samu Salmelin

Deputies

Martti Mäntylä
Timo Kotilainen
Tomas Hedenborg
Joonas Lyytinen
Kari Knuutila

MANAGEMENT

Dr. Harri Kulmala
Chief Executive Officer

External positions in 2017:

- Member of H2020 evaluation and renewal high-level group, EC
- Member of The Finnish Academy of Technical Sciences
- Member of The Royal Society of Arts
- Member of high level group, EU ManuFuture technology platform
- Associate professor (docent), LUT
- Member of innovation council, Finnish Technology Industries
- Member of advisory board, Tampere University of Technology
- Chairman, EU-US Frontiers of Engineering

Dr. Ülo Parts
EVP Operations

External positions in 2017:

- Member of Future internet forum coordination group for H2020
- National contact point of next generation internet (NGI) forum

Essi Huttu (M.Sc.Eng)
VP Co-creation

External positions in 2017:

- Member of Factory2Fit external advisory board

PERSONNEL

Marika Moilanen (BBA)
Manager, marketing and communications (until 10/2017 - maternity leave)

Dr. Matti Hämäläinen
Manager, international relationships (until 11/17)

Dr. Jaakko Talvitie
Innovation Scout (In memoriam † 10.03.2017)

Risto Lehtinen (B.Sc.Eng.)
Program manager

Kari Aunola (B.Sc.Econ.)
Financial manager

Anu Tengvall (M.Sc.Hum.)
Controller (until 2/2017)

Prof. Reijo Tuokko
Manager, international relationships (part-time)

Päivi Haikkola (M.Sc. Nav. Arch, M.Sc. Econ.)
Ecosystem Lead

Jukka Merenluoto (M.Sc. Tech., MBA)
Ecosystem Lead

Dr. Arto Peltomaa
Program Manager

Doris Pryjma (M.Sc. Eng.)
Manager, marketing and communications (maternity leave substitute for Marika Moilanen from 9/2017)

PROGRAM MANAGERS

Outsourced program management at the end of 2017:

Cyber Trust:
Markku Korkiakoski,
Bittium

S4Fleet:
Dr. Pekka Töytäri,
Efekto

SIMP and FLEX:
Ingmar Baarman,
Tammet

DIMECC FELLOW

DIMECC Fellow is a public recognition to a person, who represents the official set of DIMECC values in force at the time of nomination and forwards these with his/her behaviour. In 2017, the title was rewarded to the following people:

#6
R&D director
Janne Järvinen,
F-Secure

#7
Director, Sales and
Business Development
Markku Korkiakoski,
Bittium

#8
EVP Sauli Eloranta,
Rolls-Royce

Previously the title has been awarded to the following people

#1 Prof. Pentti Karjalainen, University of Oulu
#2 Director Ilkka Niemelä, The Federation of Finnish Technology Industries
#3 CTO Matti Sommarberg, Cargotec Oyj
#4 Arto Ranta-Eskola, R&D director, SSAB
#5 Ismo Vessonen, senior research scientist, VTT

RESULTS – A SELECTION OF NEW DIMECC RESULTS AND OUTCOMES

This chapter introduces new 2017 results and outcomes from DIMECC activities. The names of the authors refer to people behind the specific result at hand, not the whole program. All the results introduced here are strongly related to the industry digitalisation and eco-efficiency work carried out by DIMECC.

DIMECC Prize winner - Cyber Trust Program Paved the Way for The Finland-USA Cyber Partnership

DIMECC's Cyber Trust Program was awarded as the producer of the most important result of the year at DIMECC 10th Annual Seminar. Based on the Cyber Trust program, the United States of America and Finland agreed on establishing a significant cyber partnership in the form of a National Science Foundation Center. The research collaboration concerning cyber trust offers considerable cooperation possibilities to Finland and at the same time displays Finnish excellence in the matter.

Establishment of the Security and Software Engineering Research Site of Oulu was one aim of the Cyber Trust program. The site is planned to be a part of Software Engineering Research Centre (S2ERC, https://www.serc.net) that is one of the National Science Foundation Industry/ University Cooperative Research Centers (I/ UCRC) operating since 2010 in US. S2ERC consists of 13 participating universities and over twenty industrial and government affiliates in US. Security and Software Engineering Research Site of Oulu consists of three Finnish universities (University of Oulu, Tampere University of Technology, and University of Turku) and 5 industrial affiliates. Research in Finland is partly funded by Business Finland.

Industry members will obtain access to a wider and deeper array of research projects, gain a greater ability to tap into technical expertise of new faculty, access potentially new funding sources through direct interactions with DIMECC, and have an opportunity to collaborate with international industry members and students. The addition of an international Oulu site within Finland will allow researchers, faculty, and students within Georgetown University and Virginia Tech access to a broader base of knowledge and will enhance the intellectual property that results through S2ERC research.

Figure 11: Markku Korkiakoski (right), receiving the prize from DIMECC CEO Harri Kulmala (left).

"It is great that our hard work in the Cyber Trust program is rewarded in two ways. For us, of course, the creation of a cyber partnership between the USA and Finland due to a successful research program is very important. In addition, the appreciation of the Finnish influential industry in the form of this award is also heart-warming", says Program Director **Markku Korkiakoski**.

Treasure Chest: Tools and Guides for Real-Time Software Business

DIMECC's Need for Speed (N4S) program adopted a real-time experimental business model and provided capability for instant value delivery based upon deep customer insight. N4S shortened significantly the cycle time of program participants. The product development of certain participants speeded up even 100-250% without loss of quality. Thanks to the program, the total sum of yearly savings of six big DIMECC shareholders (Nokia, Tieto, Elisa Appelsin, F-Secure, and Bittium) rose to 40.7M€.

Because DIMECC is an open ecosystem, all companies operating in Finland are able to reach similar results by utilizing the results and learnings from N4S. The program has collected these results in systematic manner on an open website. The site offers instructions and guidelines for software intensive companies, how to start new business. **N4S Treasure Chest** includes 171 "gold nuggets" that are guides, research results and tools, that help quickly launch products, get more out of customer relations, and make fast product tests before entering the market. The treasure chest holds practical instructions how companies can continuously recognize new market opportunities and how to benefit from them. The Treasure Chest guides how company can in practice change into being more agile and less bureaucratic.

N4S Treasure Chest identifies and collects useful artifacts from N4S consortium. The Finnish software intensive industry has renewed their existing business and organizational ways of working towards a value-driven and adaptive real-time business paradigm. The industry is utilizing the new technical infrastructure such as data visualization and feedback from product delivery. These new capabilities as well as various sources of data and information help for gaining and applying the deep customer insight. The important question is how data science can support service and software development for real-time business. New Goal Driven Hunting Culture – mercury business approach expands beyond existing business. This has been created and adopted by the N4S consortia with several successful examples of adjacency towards the new markets and business areas. The N4S partners are entering the satellite hardware market and at the same time breaking into global software service market.

N4S Treasure Chest makes vast amount of results available for all interested parties in a way, which has not been done ever before in the collaborative research program.

How to forecast people flow - PoDoCo program brings business and academic research closer

In PoDoCo project Juho Kokkala together with KONE applied mathematical methods to forecast people flow in buildings. The project was closely linked to KONE's vision to deliver the best people flow experience. *"I am privileged applying the mathematics for developing KONE's leading customer experience further"* states Juho who is now continuing the work as permanent basis in KONE.

How to forecast people flow? The answer to this question will help KONE to develop its customer experience even further. And this is the question which D.Sc. (Tech.) **Juho Kokkala** has been researching in KONE for the last 18 months, the first six months period thanks to a PoDoCo project.

Building on vision

KONE's vision is to deliver the best people flow experience. This calls for a throughout understanding of traffic in and between buildings. KONE aims to make people's journeys safe, convenient and reliable.

In tall buildings, elevator group control systems select which elevator to dispatch to each request, aiming to minimize waiting times. The performance of these systems may be improved by forecasting future traffic based on historical statistics. During his PoDoCo project Juho started

Figure 12: In PoDoCo program Juho applied mathematical models for developing KONE's leading customer experience.

to develop Bayesian filtering based methods for short-term traffic forecasting.

Data based modeling

Juho's research was conducted using data obtained from simulating the traffic of an office building in Finland. The simulated traffic counts were aggregated into incoming, outgoing, and inter-floor traffic components and 5-minute intervals.

"During the PoDoCo period, I developed a proof-of-concept forecasting model for the simplified problem of forecasting single traffic components. With the data we had, the main conclusion was that the idea has potential, but more data and research will be required", describes Juho.

Work continues as permanent basis

As one very concrete outcome of the project, Juho was hired permanently to KONE's people flow planning team. The team is working on optimizing people flow in buildings.

Juho has continued to work with mathematical modeling of traffic inside a building.

"The PoDoCo grant definitely influenced the direction of my career. Without the program, I would possibly have tried to continue in academia at least for a while. But now, I can contribute to business with the research knowledge I have acquired", Juho sums up.

Lifecycle Efficient Material Solutions for Power Production

World with a zero-emission target and the pressure to maintain fuel flexibility, also an increased use of economical, low-quality fuels with high efficiency, has resulted in a severe corrosion challenge for fireside surfaces in boilers and other high-temperature process piping. New changing process conditions also have an effect on microstructural alloy stability during long-term performance in processes at high service temperatures. Certification from material suppliers or simplified laboratory testing is not sufficient proof to qualify a material whose unexpected failure may cause major economic

losses or personal accidents. Long-term testing in commercially operating units constitutes the backbone of materials qualification for these challenging applications.

During the project, a separated pressure loop was successfully installed in the Äänevoima power plant to enable long-term testing of materials in real operational conditions. The designed and built steam loop in the Äänekoski FB boiler, for long-term material testing by Foster Wheeler Energy and Metsä Group, is a unique testing facility in Finland offering opportunity for testing materials at different service environments with different fuel mixtures and changing operational loads.

"The material testing in actual operating conditions in the steam loop is important, as in laboratory experiments it is not possible to simulate all process parameters affecting oxidation and/or corrosion. The ability to define the temperature limits that steam side oxidation sets in real conditions for the boiler materials will enable us to design and fabricate more reliably supercritical boilers", explains **Jouni Mahanen**, R&D Engineer of Amec Foster Wheeler Energia Oy.

Figure 13: Äänekoski factory. Photo from https://databank.metsagroup.com/l/2zWHdvDxRzXV.

Based on the results obtained an alternative solution for manufacturing components subjected to extreme conditions was developed, and the expected benefits of the manufactured overlay welds, and especially Al-alloyed austenitic stainless steel, are clear: increased lifetime, and operational reliability bringing longer operational periods without maintenance breaks and reductions in operational costs. The novelty value of the project includes the material performance information from combined laboratory and real service environments, utilizing corrosion probe measurements and long-term field testing. This is to facilitate the introduction of more efficient carbon-neutral combustion processes in real industry.

Project Management Intelligence – Mastering the Delivery of Life Cycle Solutions

The delivery of life-cycle solutions as projects is not a new concept. However, there is a lack of understanding of how business intelligence (BI) can be used to facilitate the successful delivery of projects to customers. Building upon current research, empirical data was collected from technology companies, and utilized to develop a BI-driven project delivery life-cycle. The objective behind the project was to further understand the role and dynamics of BI in the delivery of projects, outline the step-by-step project delivery process, and identify the key BI tools used in technology companies to facilitate the delivery of a solution to the customer.

To achieve the project goals, an extensive review

of the literature was made, and numerous interviews were conducted with the technology company representatives in the sales, project management, and service departments. It was discovered that the several different BI tools support and contribute to the successful project delivery process (e.g. a product customization system, a sales configurator, a service support configurator, a project life-cycle and tasks manager, a project portfolio management system, a customer relationship management (CRM) system). The project demonstrated the various multiple benefits that each of the BI tools brings to companies. However, the process of integrating BI into the project life-cycle and using it on a daily basis is challenging and requires increased attention to such areas as: a user-friendly BI interface, data codification, inadequate IT, a lack of motivation to use BI, integration with other BI systems, time needed to learn to use BI, training, and quality of data in BI.

Drawing on data collected during the project, the project contributed to the development of the Fleet Management BI tool in Prima Power, which is remote access and support software combining the functions of a service cases repository, O&M reporting tool, and real-time monitoring and controlling system. Fleet Management is a BI tool used primarily in the post-project phase by sales managers, project managers, and service managers, and it has built-in descriptive and predictive data-driven analytics, extracting valuable insights from the equipment online, connected to the cloud.

"Fleet Management helps Prima Power to analyze machine-generated data, speed up troubleshooting and minimize the need for on-site maintenance", tells **Esko Petäjä**, R&D Manager, Prima Power. Fleet Management contains information on real-time and historical equipment condition and performance, service maintenance cases, field service logs, triggers, and alarms. It also provides an online overview of the product portfolio and supports service managers in improving machine availability and enhancing machine performance.,

The impact of the project is significant. The new solutions developed for Fleet Management increased competitiveness of the Prima Power's products on international level. The achievements also enhanced the position of Finnish factory as a leader in innovation on the group level. This resulted in incresased trust from group management level meaning more projects and more internal funding for Finnish site. The promising results also supported Prima Power's participation in international innovation activites. The solutions developed in the project have been further developed for example in CECIMO (the European Association for the Machine Tool Industries) digitalization activities.

Collaborative R&D projects support the development of start-ups and SMEs – Case Luxmet

LUXMET is a start-up company offering advanced control systems for high temperature metallurgical processes. During the DIMECC SIMP program Luxmet executed three sub-contractor projects from Outokumpu Stainless Oy and SSAB Europe. The focus for Luxmet Oy was the development of a measurement system for an electric arc furnace.

An electric arc furnace is a process in which raw steel can be produced from recycled steel scrap. Steel scrap is molten with electricity, which is consumed in high amounts. Even though electric arc furnaces have been around for many years, accurate measurement of scrap melting

Figure 14: Luxmet. Photo by Jernkontoret, Photographer: Stig-Göran Nilsson

is a challenge. When scrap melts, the energy of the arc is lost to the sides, which means that energy efficiency gets lower and refractory wear increases. Currently, scrap melting is measured from the cooling water temperature difference on the mantel, but the problem is that this is too slow, since it measures energy already lost.

The approach of Luxmet Oy is to measure the light emitted from the furnace sides, which indicates if the protective slag layer is molten. The approach is internationally novel; no previous measurements of light have been recorded from industrial AC furnaces. Measuring light enables the use of optical fibers, which in turn enables the delicate measurement equipment to be placed away from the hazardous environment of the furnace. Even though light could be measured remotely, getting the fibers intact in the electric arc furnace roof was a tough challenge. Continuous improvement of equipment design made it possible, by the end of the project, to achieve a system requiring very little maintenance.

The system developed for measuring scrap melting was tested in online control in Outokumpu Stainless electric arc furnace. The results are very promising. "With the help of Luxmet's ArcSpec system, the process time can be reduced by 7%. The ArcSpec system also reduces energy losses by 200 000 euros annually" Niko Hyttinen, Researcher at Outokumpu Stainless Oy explains the results of the new system.

The DIMECC SIMP program was also crucial in the development of this new technology. The project was very important to Luxmet Oy, since it showed that the system works in online control. *"The DIMECC SIMP program has played a major role in enabling Luxmet to test and further develop its technologies in new applications, together with industrial partners in the metal industry"*, tells **Mikko Jokinen**, managing director of Luxmet Oy.

Luxmet Oy will continue commercialization of the new technologies and products developed during the DIMECC SIMP program.

STAKEHOLDER RELATIONSHIPS

Support and assistance from following non-shareholder organisations supported in DIMECC strategy and operations:

Beijing Academy of Science and Technology
CECIMO
China-Finland Strategic ICT Alliance
Chinese Academy of Sciences – Qingdao Academy of Intelligent Industries (CAS-QAII)
Clic Innovation Ltd.
Confederation of Finnish Industries EK
EFFRA
Finnish Marine Industries
Finnish Ministry of Employment and the Economy
Flanders Make
It'sOWL Clustermanagement GmbH
Linz Centre for Competence in Mechatronics (LCM)
Metallinjalostajat ry
Ohjelmistoyrittäjät ry
Orgalime
Politecnico di Milano
Production2030, Sweden
RWTH Aachen
Upper Austrian Research GmbH
SalWe Ltd.
SYMME
Tekes
Finnish Technology Industries
ZPark

Following suppliers were used for services:

Fondia Oy - Legal services
Gaia Consulting Oy - Demobooster
Hopiasepat Oy - Impact analysis & communications
Inno-W Oy - Web pages & research portal
Koodiviidakko Oy - Communication platforms
Kuudes kerros Oy - Corporate image & branding
Meom Oy - Web pages
Triuvare Oy - IT infrastructure
Talenom Oy - Accounting
Management Events Studio - Manufacturing Performance Days

COMMUNICATIONS

The primary communications between DIMECC and public media were through website www.dimecc.com. Several DIMECC personnel interviews, articles and technology policy comments were published in Finland.

DIMECC was active through following communications:

- DIMECC High Tech section at www.dimecc.com revealed the most impactful research results
- DIMECC In-Brief information package was updated
- DIMECC Newsletter was published in digital form
- Co-creation service leaflets were branded and printed
- MPD2017 communications were published.
- Nine new DIMECC publication series reports were published.
- DIMECC was active in social media channels in Twitter and LinkedIn.
- One Sea and Demobooster websites were renewed

KEY FINANCIAL INFORMATION

The financial year 2017 of DIMECC ended December 31st. Due to the special role of DIMECC as a non-profit company, the key financial information is presented in short form and without traditional business performance measures.

Income	
Net sales	782 591,22
DIMECC program management fees	935 534,56
Other income	622 074,63
Total income	**2 340 200,41**
Expenses	
Materials and services	-589 687,04
Staff costs	-1 002 484,18
Program management cost	-284 115,81
Other expenses from operations	-727 109,63
Total expenses	**-2 603 396,66**
Operating loss	**-263 196,25**
Financial income	5 695,16
Loss for the year	**-257 501,09**

Assets	
Stocks, shares, and fixed assets	818 065,48
Long-term investments	10 593,00
Short-term receivables	407 880,76
Cash and bank balances	2 140 112,20
Total assets	**3 376 651,44**
Liabilities and shareholders' equity	
Restricted equity	1 146 500,00
Non-restricted equity	2 302 113,91
Net losses from previous years	-110 715,36
Net loss for the year	-257 501,09
Liabilities	296 253,98
Total liabilities and shareholders' equity	**3 376 651,44**

DIMECC

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