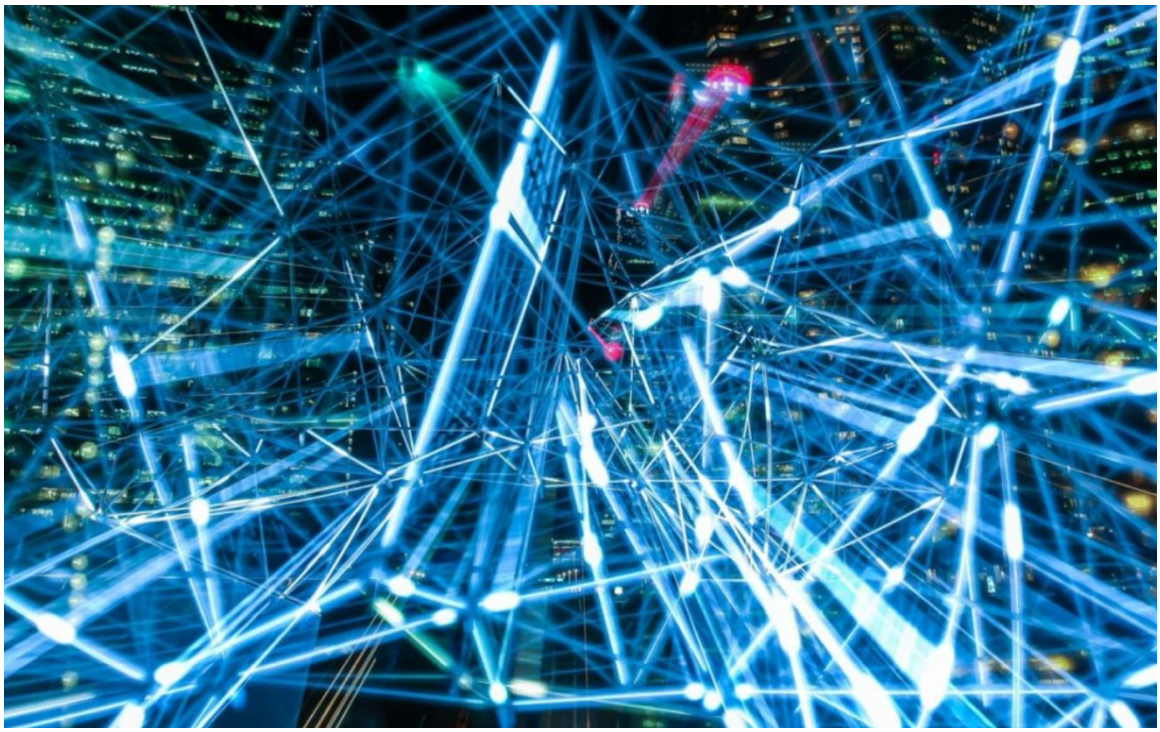
THE CROSS4HEALTH WHITE PAPER

Minimising innovation lag in a COVID-19 world



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1 CROSS4HEALTH IMPACTS

Connections

Open Innovation Spaces, Hackathons, Ideas Contests, Workshops with 708 companies generating 282 ideas

Accelerators

58 companies, customised support, 85% of €5m project budget

Resilience

24 solutions

22 projects secured or pending new funds, 2 projects could not complete testing due to Covid-19

Over the last three years, Cross4Health has supported Innovative SME-led projects that are leveraging technology and know-how from Aerospace, Energy and Creative Industries sectors for the benefit of personalized healthcare. In two acceleration programmes, the project has supported 58 SMEs getting closer to market with their innovative solutions.

As a cluster driven project Cross4Health developed its activities based on the conviction that innovation thrives in specific companies and regions that build an ecosystem with the right conditions, competences and skills.

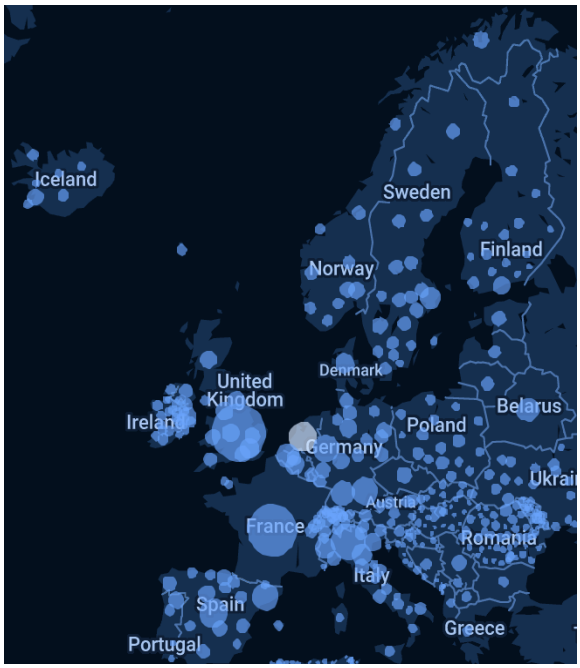
Start-ups and SMEs took part in the project because:

- they were taken seriously by the project and its partners,
- our experts believed in what the SMEs were doing and;
- both the partners and experts believed in the potential of the products/processes/services the SMEs were developing

The two Acceleration Cycles helped our companies build credibility and be taken more seriously by prospective future partners including bigger players, health care providers and investors.

So, with this White Paper we report on crossover collaboration (borders, sectors and markets) in the context of a COVID-19 world, its choke points and how to get through them, meeting people in the 'white space' to generate ideas, taking ideas from mock-up prototype to large-scale demonstration and some of the success stories along the way. We end with a look into the future and a business plan that this consortium has put together to show how we can build on Cross4Health and a previous INNOSUP 1 project (INNOLABS) to generate more opportunities for start-ups and SMEs to be competitive with our support in a COVID-19 world.

2 HEALTH SYSTEM CHALLENGES IN A COVID-19 WORLD



The pandemic's global cost could range from $2 trillion to $4.1 trillion -- 2.3% to 4.8% of the global gross domestic product (GDP), the Asian Development Bank (ADB) said recently[1]. But below these figures are the impact of Covid-19 on people. Deaths from Covid-19 (and from untreated chronic conditions during lockdowns), a Covid-19 tail becoming a chronic condition for some survivors, lock downs leading to job losses and food poverty. Then there are innovative policy responses e.g. furloughs to cover % of lost income and freeze redundancies for a limited period. And in our field a raft of fast-track initiatives seeking quicker Covid-19 solutions than would have been possible before the pandemic. But will these policy innovations be maintained after the pandemic?

The burden on EU health systems has been overwhelming in some countries. Before the pandemic, non-infectious diseases cost the countries of the European Union (i) in excess of EUR €700 billion each year in terms of chronic disease management[2] (ii) with a 2% loss of EU GDP from 4 NCD's[3] alone. This burden has largely been preventable with our choices contributing up to 40% of early deaths and poor health. And then came COVID-19.

The COVID-19 pandemic has revealed that systems were not prepared enough for an outbreak of such size. *The pandemic has hit especially in those systems designed and prepared to fight against non-communicable diseases (NCDs):* outbreaks were not among their main priorities. In fact, WHO stated the necessity to develop new therapeutic technologies to fight antimicrobial resistance and future pandemics and explored the willingness of companies to promote research on them. The reaction from companies revealed that they did not find incentives to invest in this area of therapeutics as revenues did not

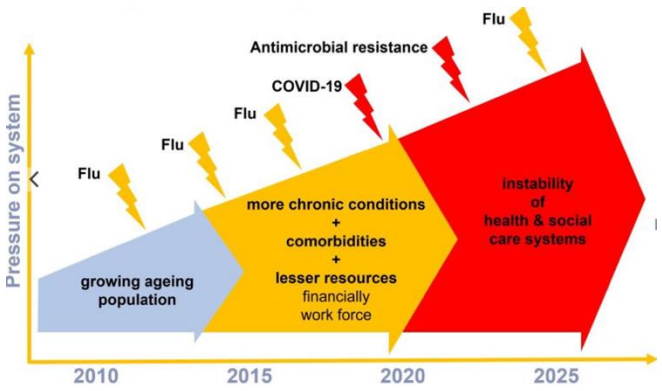


Figure 1: Challenges to health systems. (The challenges include: disruption of systems, workforce burn-out, failing health and social care, poorer outcomes, higher societal burden, negative economic impact) Source – Dr Nick Guldemond, Leiden University Medical Centre

[1] https://www.aa.com.tr/en/economy/covid-19-pandemics-global-cost-may-exceed-4t/1790582
[2] See ProACT - Advancing Proactive Digital Integrated Care: http://www.proact2020.eu See also (i) https://ec.europa.eu/eurostat/statistics-explained/pdfscache/37359.pdf and EuroHealthNet (2019), Financing Health Promoting Services: An introduction, EHN: Brussels, p13
[3] Vandenberghe D, Albrecht J (2019), The financial burden of non-communicable diseases in the European Union: a systematic review, European Journal of Public Health doi:10.1093/eurpub/ckz073

compensate for the required investment and effort. There was no further interest from governments who even reduced or cut the budget of Public Health institutions such as the United States Centre for Disease Control [4,]. The pandemic has also shown many other weaknesses in current systems such as the dependency on materials and technologies coming from Far East countries, the lack of quality of some suppliers, the trend of hospitals to reduce length of stays and a poor culture of safety and hygiene.

In a report published 30 April 2020, researchers at the Center for Infectious Disease Research and Policy (CIDRAP) in the US laid out three scenarios for what the next 18 to 24 months might look like[5]. It is likely that COVID-19 will spike again (maybe not as high) but it raises questions about if the front-line workforce will have recovered enough to be ready for the next spike(s) and what health systems need to do. Health systems will also be dealing with a ripple effect from COVID-19 e.g. chronic lung inflammation and a backlog of untreated physical and cognitive chronic conditions. In preparing for future health emergencies *we need to avoid solutions that overload the resourcing capacity of care providers* and **part of the solution lies in rebalancing the health care value chain.**

In this new COVID-19 world, this will be challenging but necessary. In the current health care value chain, **prevention accounts for only 3% of spend in EU member state health budgets,** while two thirds of health system spend is for treatment and rehabilitation[6]. *This is not optimal for people at risk of a condition or cost-effective for our health systems.* This can be reduced if the value chain is re-designed to give more attention to prevention and prediction with corresponding economic benefit and improvement of citizens health. A recent systematic review found that for every €1 spent on health promotion and disease prevention, €14 was returned to the economy. A recent ECORYS report identified opportunities and challenges for preventive and predictive health (Table 1 below)[7].

	Opportunities	**Challenges for SMEs/innovators**
Consumers/ patients	People are more engaged in improving their own health and are more focused on prevention and staying healthy e.g. through the use of wearables	Improved\new prevention and early diagnosis tools. Sufficient digital health literacy in the population is a prerequisite[8].
Care providers	Prevention (by using machine learning, AI etc.) offers increased opportunities for preventing deterioration of chronic diseases	The role of health care providers needs to change: increased access to data requires systems compatibility and creates the need to work with companies in sharing data. This means an increased focus on service agreements and risk-sharing.
Health insurers	Focus on healthy lifestyles and prevention improves health outcomes and can result in cost savings; offering additional insurance on good service in hospitals or offering rewards including reduced premiums on healthy lifestyles	Problems with mainstreaming digital health solutions are (i) different stakeholders in the services & data value chains and IT vendors lack a shared definition of scale (ii) Care systems tend to finance 'treatments' or 'face-to-face interactions with patients' not 'digital solutions or interactions.

[4] https://www.who.int/health-topics/antimicrobial-resistance
[5] CIDRAP (2020), *Part 1, The Future of the COVID-19 Pandemic: Lessons Learned from Pandemic Influenza*, COVID-19 The CIDRAP Viewpoint, 30 April. https://www.cidrap.umn.edu/sites/default/files/public/downloads/cidrap-covid19-viewpoint-part1_0.pdf
[6] European Commission (2018) State of the Health in the EU, Companion Report.
[7] From ECORYS 2018, The future of the medical technology market
[8] Blueprint - European Commission. 2018. Available from: https://ec.europa.eu/eip/ageing/blueprint_en.

Medtech companies	Medtech companies have strategies focused on preventive care and minimum invasive care. Opportunities for innovative, cost-efficient and holistic people centered approaches as part of the plug-in between integrated care and population health are emerging.	The preventive and predictive end of the care continuum is not yet a formal established business model so financing this population health/ independent living stage before integrated care is an important barrier.
Government	Cost savings through prevention, prediction and early detection e.g. by substituting more expensive and unnecessary care and reducing avoidable hospitalization.	Several ethical and financial issues to be resolved e.g. how can the collective care system remain functioning with escalating cost pressures while dealing with the risks of social inequality as a consequence on a shift towards prevention, prediction and early treatment?

Table 1: Trends in prevention, prediction and early detection[9]

There is an opportunity here for industry to focus on prevention and prediction but only if this is incentivised by governments and health insurers. Prevention, prediction and early diagnosis do not happen in isolation. They are influenced by trends and challenges in digital transformation, robotics, personalised care, remote healthcare, patient ownership of data, value-based healthcare and regulation (MDR, IVDR and GDPR). But they also need attention to reducing innovation lag: the time it takes to get a product and/or service from idea to use by consumers or institutions.

[9] Adapted from ECORYS (2018) The future of the medical technology market

3 INTRODUCING WHITE SPACE

Two ideas have emerged in recent years: (i) innovation often results from meetings between related ideas (creating aha! moments) so regions are best served by hosting a variety of related industries; (ii) innovation often comes from the combination of different knowledge bases[10]. Clusters facilitate this as regional ecosystems of related industries with a broad array of inter-industry interdependencies. These linkages occur in terms of similar location patterns, occupational and technological needs and knowledge spillovers and cross-sector investments. The interest in Clusters stems from the efficiency gains that firms can achieve from the proximity of other similar industries. This helps augment regional innovation, competitiveness and growth[11].

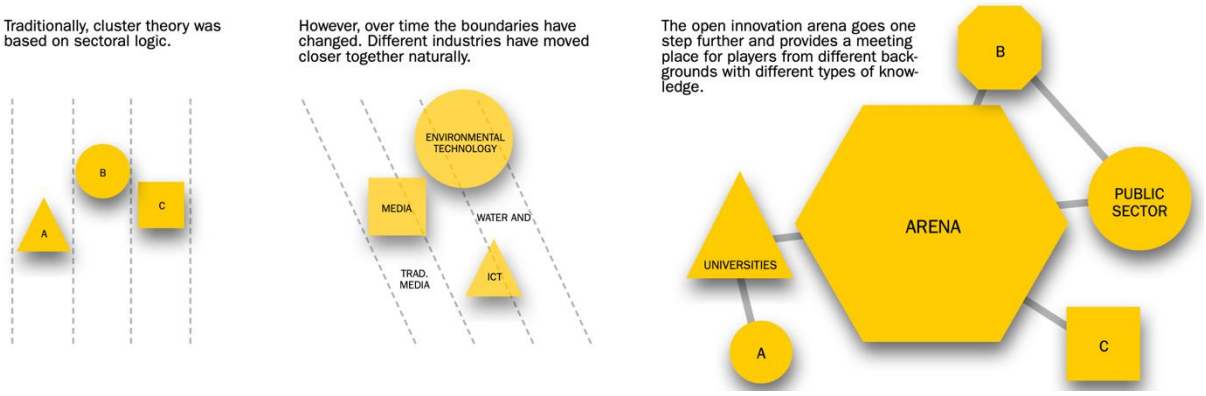


Figure 2: From traditional clusters to the open innovation arena[12]

More specifically, in Cross4Health and what follows it, we have focused on optimising '**white space**'. This term was coined in one of our partner cluster regions Skåne (Sweden) to describe *the development opportunities that arise when 2 or more industries or knowledge areas come together*[13]. They have three Smart Specialisation Strategy priorities: smart cities, smart materials and smart health. But they do not see these as sectoral specific priorities. Rather they depend on crossover solutions. They accepted that products, services and processes are increasingly based on knowledge from different areas of expertise. This concept guided how we worked with stakeholders in our cluster ecosystems to identify challenges for our events and Open Calls. *It is not necessarily about formal connections, but it is more about what happens in between clusters, sectors, hubs and value chains.*

A **synaptic method** was used to identify and find ways to overcome challenges no one has solved or knew they could solve and generating synergies intraregional or transnationally. This knowledge and experience was then applied and capitalized in practice in the Cross4Health approach to crossover collaboration.

[10] Fitjar R D and Timmermans B (2018), Knowledge bases and relatedness: A study of labour mobility in Norwegian regions. In book: New Avenues for Regional Innovation Systems - Theoretical Advances, Empirical Cases and Policy Lessons (pp.149-171), DOI: 10.1007/978-3-319-71661-9_8

[11] EOCIC (2019) *Emerging industries: Driving strength in 10 cross-sectoral industries*, Luxembourg, European Union. p10

[12] Skåne Research and Innovation Council (FIRS) and Sounding Board for Innovation in Skåne (SIS) (2012) Developing new *innovative* and *creative* environments, March, Tryckfolket: Malmo

[13] VINNOVA (2011), White Spaces Innovation in Sweden, VINNOVA report VR 2011: 10. https://www.vinnova.se/contentassets/1b6c8e47cf7b426e8a5312325070883a/vr-11-10.pdf

4 UNLOCKING WHITE SPACE

White Space is an interesting proposition for the health and care sector who face a specific challenge. A consistent issue identified by business owners and health care providers engaged with in C4H, (and previous H2020 and national projects that consortium members have been partners in) is the disconnect between industry, care consumers and care providers. **Health care providers and regional innovation ecosystems tend to operate in a fragmented way**. Essentially, collaboration between care providers and industry does not start early enough. *There is often a lag between what end-users need, what SMEs are creating and need to test/validate and what healthcare providers seem prepared to do.*

An early survey and interviews with cluster partners in the C4H consortium[14], follow-up conversations with Regional Smart Specialisation Strategy (RIS3) contacts in Castilla Y Leon, Nouvelle-Aquitaine, Skåne, Nord-Rhine Westphalia and Norway[15] and companies' assessment of their innovation ecosystems, suggested a number of factors compound this lag. These are summarised in the following table.

Consortium cluster members (n=6)	RIS3 contacts in partner cluster ecosystems (n=5)	Companies in C4H accelerators (n=33)
Understanding crossover opportunities – Health professionals do not find it easy to communicate their medical needs clearly to other sectors. In part, this is because they often can't imagine what crossover opportunities exist, what could be done by utilizing the technologies and know-how available from other sectors.	**The missing end-user voices** – Especially in the health sector, which is over-regulated, the integration of the end-user (citizens, patients, informal carers, health and social care practitioners) in value chains is not easy; relations are most of the time between purchasers and suppliers.	
	Some barriers are imagined – One S3 contact was clear that SMEs and start-ups do not see the sectoral barriers that we imagined, and which are completely institutional. Arguably, we	

[14] Cross4Health (2018), *Baseline survey of crossover value chains in partner regions*, Project deliverable 4.1, 24 May
[15] Lane J (2019), *Re-prioritising S3 to better leverage the benefits of crossover collaboration for health innovation: learning from Cross4Health and other recent projects,* Task 6.3 briefing paper, August

	need to come back to entrepreneurial logics in order to understand an enterprises' needs.	
Different working cultures – In an airplane and a subsea oil platform, teams often change which is not the case in an operating room, so the pressure of the hierarchy seem to be much more present in the Health sector. This might prevent some organizational transfers. Also, in case of a problem in a plane, the life of the pilot is as much endangered as the life of the passengers, which is not the case for a surgeon facing difficulties during a surgery. So, the feeling is completely different, and human factors considerations are not the same. This kind of examples illustrates the difficulties of organizational transfers between sectors.	**Capacity building as an RIS3 priority** – The ability of Medicon Valley (Greater Copenhagen and Skåne) to create growth from new businesses was evaluated as weak (Boston Consulting Group 2012). Growth from the life science sector was mainly driven by few large companies in the region, namely Novo Nordisk and Lundbeck. Growth from medium and in particular small sized companies in the region was marginal. Within the regional innovation ecosystem at that time, cultural and monetary incentives to go the entrepreneurial way were missing.	**Fast tracking innovation** – SMEs tend to think that stakeholders don't work well together to help get crossover products to market and don't think that enough fast track procedures are in place to support project applications
Regulatory differences between sectors – Different industries have different regulatory requirements, for instance require divergent quality management or risk management systems. The most obvious differences are: reliance on the specificity of clinical trials in Health, the concept of risk-benefit balance, and the risks threshold tolerated based on previous studies (not set as in Aeronautics).	**Development dynamics** – care providers work with different business models to those used by SMEs and start-ups. They have different development dynamics and the level of regulatory compliance needed for products that target care providers as a market – rather than individual consumers – is daunting.	**Regulations** – SMEs are also uncertain that current regulations in their region/country make it easier to set up and run a new business based on a crossover collaboration.
Seed funding - SMEs are concerned about time delays in launching a project in a sector they are not familiar with. This is compounded if there is a lack of clear vision about the potential market. This makes them reluctant to commit their own funds when a seed funding is not available. Several promising projects have not started yet because of this lack of time combined with the lack of clear vision of the potential.	**Pump priming support and funding** – A shared experience across partner regions is a lack of support and funding for prototype demonstration in the clinical or home setting. There has been discussion with financial stakeholders including banks to create a 1 stop shop for funding [assess tech and financial viability of each project].	**Private financing** – SMEs are uncertain that private investors understand well the needs of crossover collaborations and believe that: it is difficult to approach them; they don't really offer a range of funding options.
Complex public contract tendering – Procurement in healthcare and in energy and aerospace sectors have completely different procedures. In health care, purchase is driven by complex public contract tendering. EU initiatives (PPI, PCP and EIP Smart Cities and Communities) for leveraging better public procurement have not really changed local procurement practice.		

Table 2: Factors compounding lag time in demand-led crossover innovation

Solutions for reducing innovation lag

Understanding crossover opportunities (C1 R1) - Regular interactions between professionals and experts in cross value chains. Aerospace Valley organized workshops with technology providers from non-health sectors (solution providers) and health professionals who wanted to communicate a medical need they have. Moderated dialogue over an average of three meetings helped a need to be clarified more precisely and match the need with precise solutions available. Health professionals want to engage with other sectors and suggested that matching needs and solutions is a two-way process. Having said this, it is the procurement staff of healthcare providers who act as gatekeepers and need to also be engaged (Nouvelle-Aquitaine).

Norway Health Tech is a partner in Norwegian Pumps and Pipes (NP&P) initiative, which aims at transfer of technology and knowledge from Norwegian Oil and gas sector to Healthcare. NP&P is a platform to bring together professional groups who may not otherwise have the opportunity to interact for the transfer of knowledge and technology knowhow. NHT is in the advisory group and regularly advise and contribute in the activities of NP&P. Cross4Health will further strengthen and promote this initiative at European level (Norway).

Regulatory differences between sectors (C1-3 R4) - All regulatory requirements (that are quite complex for the pharma industry and increasingly so for the medical device industry) must be met within the crossover value chain. Alternatively, new regulatory requirements will be needed to be defined for the emerging industry. The experience of CARMAT shows that Aerospace SMEs working on critical complex systems could "easily" diversify towards Health but would need some regulation support. Regulation does not block transfers from Energy and Aerospace to Health, but slows down them. Regulatory assistance vouchers could facilitate transfer and be attractive to SMEs not ready to pay 10-20k€ for such assistance (Nouvelle-Aquitaine).

There is a potential to transfer knowledge and skills from regulatory services sector in Energy and Aerospace to health technologies sectors. In Norway, several regulatory and quality assurance service companies with origin in Oil and Gas and defense sectors have over the years diversified to health technologies. The availability of such service providers in the open innovation spaces can as well foster the knowledge transfer between the sectors (Norway).

Seed funding (C1 R5) – Dedicated financial supports (associated with a quick and easy process) will help to make crossover projects much more attractive. Practically this means market vouchers, and reduced administrative burden (associated with a quick and easy process) to get Cross4Health support should make crossover projects much more attractive (North Rhine-Westphalia).

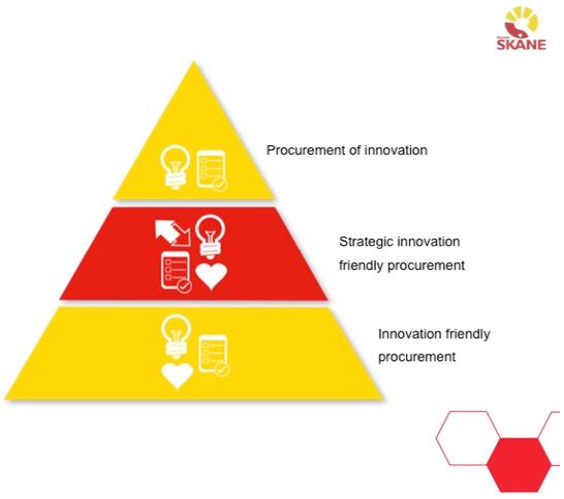
Different working cultures (C1 R3) – Crew Resource Management (interpersonal communication, leadership and decision making in the cockpit), checklists, no-blame of errors to detect and prevent similar faults, use of pedagogic simulation, etc. have been successfully transferred to medical context, based on risk management experience of mainly aeronautics, space, defense and nuclear sectors. Basically, this required some adaptation of these processes to the medical sector, facing similar challenges in risk management but also cultural differences impacting their organisation (Nouvelle-Aquitaine).

Capacity building as a RIS3 priority (C2 R3) – Build on regional strengths and establish short and long term smart specialisation strategies. The Beacons scheme was launched to combine regional strongholds in a novel, innovative way by aligning forces between Sweden and Denmark, between the public and private sector, and through widespread cross-disciplinary collaboration across a range of life

science fields. Using the Drug Delivery Beacon as a pilot, the Medicon Valley Alliance and Invest in Skåne formally launched the Medicon Valley Beacons in November 2011 with funding from the European Union Interreg IV A Programme, which aims to increase the region's competitiveness and attractiveness. In 2013, four additional scientific strongholds were identified as potential Beacons: systems biology, immune regulation, structural biology and independent living. MVA and Invest in Skåne are currently scoping out exactly what to focus on within each stronghold together with experts and stakeholders in Medicon Valley. Each Beacon is characterized by a high degree of cross-disciplinary collaboration between the public and private sector in Denmark and Sweden. The ambition is for the Beacons to have achieved international recognition as world class centers of excellence by 2020 thus underpinning Medicon Valley's status as a leading life science cluster.

A number of initiatives to transfer technology and knowledge have been started after crash of oil price in the international market in 2013 and the crises in the oil and gas industry in Norway. This has led to a national debate on diversification and building the future on existing regional and national strength. Considering the huge societal challenges and need of new and innovative technologies, and disruptive business models to deliver high quality and personalized care in the future, the healthcare sector has been identified with a huge cross over needs. Today, NHT is leading a national initiative Energy2Helath which aim at knowledge, skill, technologies and human resources transfer from Energy to Health sector (Region Skåne).

Complex public contract tendering (C1 R6) – To introduce a new approach to innovation procurement that allow innovation projects to be developed before and during an innovation procurement process. For example, in Region Skåne, they are looking for solutions to clearly prevent fall injuries in the healthcare environment. As a first step a working group is formed with individuals who bring a range of perspectives and expertise to the issue. They formulate a deep shared understanding of the issue to be projected in subsequent dialogue with the market. An open invitation is offered to the market to stimulate new solutions that address the need. There is then competitive tendering with attention to try/test, develop and verify before testing in the healthcare environment before full scale adoption (Region Skåne).

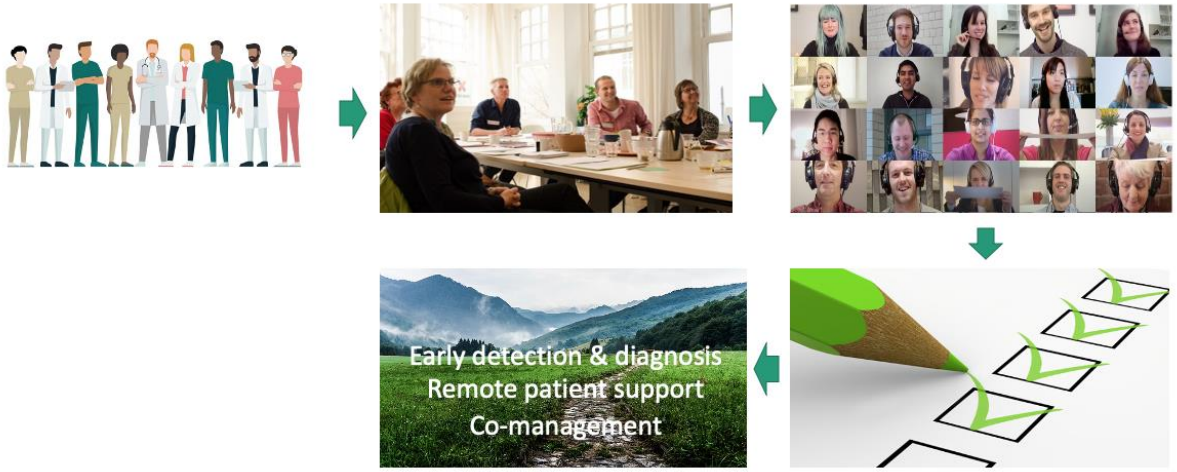


Perhaps as critical, there are 3 levels of innovation procurement in Region Skåne. At the bottom is what is termed 'innovation friendly procurement'. This means being open towards new products and entrepreneurs. The result can be a new product but there is a lower degree of innovation here. At the second level is 'strategic innovation friendly procurement' where procurement seeks a new product in a strategically important area e.g. healthcare or the environment. At the top of the pyramid is 'procurement of innovation'. This happens when there are no solutions available locally and so a new solution is needed to solve a problem/meet a need. The result is a new product or a new way of using an existing product.

5 HOW C4H REDUCES INNOVATION LAG

Before the C4H project, consortium members had dealt with innovation lag in practical ways at systems, intermediary and company levels and in the relationships that make White Space possible (as illustrated in Sections 3 and 4). To minimise the lag time between end-user needs and companies having validated solutions we gave special attention to: people as the challenge owners, companies looking in and out, accelerators that smooth transition from idea to market and large-scale demonstrators of the more mature products/services.

People as the challenge owners



Challenges were identified by means of activities such as workshops and pre-studies that were run "locally" by partners utilizing resources and expertise from their local healthcare system. As a starting point, a partner could make use of previously identified needs or demands that are prioritized in the local healthcare system. Identified needs should have a clear connection to the Grand Societal Challenges in Cross4Health (Ageing Populations, Tackling Chronic Diseases and Efficient Healthcare Solutions). Local/regional experts and end-users are involved in this step. The gathered data is used as important input to the Local nodes. 11 local open innovation space nodes were conducted across the EU with 130 participants. 86 were end-users, 21 were companies from biotech and medical devices sectors and 23 were companies from the aerospace, creativity and energy sectors.

Each partner was responsible for organizing 1-2 local node activities. These are important steps in involving end-users and identifying local needs that are also shared in other EU member states. A set theme or focus for the local nodes helped the need identification process. In order to inspire a deeper understanding of their need areas and to widen their understanding of new technologies, SMEs were invited to be a part of the local nodes.

Each of the partners identified sub-need areas in a second stage where they were filtered through "criteria of selection". Here each need was estimated on its level of impact to create a priority valuation. The estimations were performed by the partner which identified the need sub area. In the criteria of selection step, each partner validated the mapped needs in the *Criteria of selection worksheet*. This step

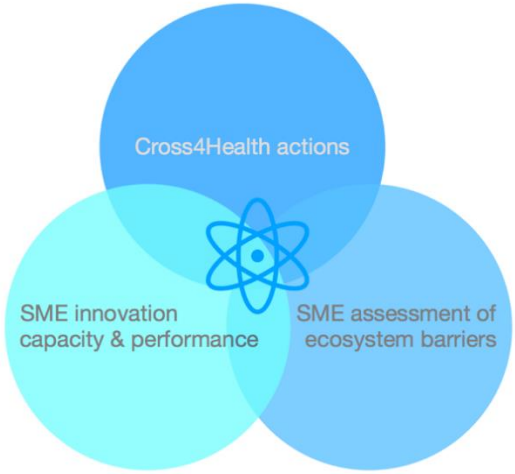
includes ranking the needs by setting score points to each need the partners have identified in four different levels.

An identified and prioritized need sub-area was then discussed and further refined by all the project partners to ensure the validity of the selected need at a European level with a refined need specification included in our Open Calls.

Challenge	Description / example
Early detection and diagnoses	Remote monitoring. Benefits involve enabling patients, within high risk groups, to a higher degree going about their ordinary lives with fewer doctor visits, while at the same time providing security and safety in the acute situation. E.g. EEG measurements for early seizure detection.
	Remote monitoring/self-testing. Risks involve precise enough methods to assure quality, while benefits include fewer doctor visits and improved ability to detect and treat sickness at an earlier stage. E.g. At home self-testing for urine protein indicator detection connected to Uremia, within high-risk groups.
	Remote monitoring. Providing reliable diagnostic measurements in an emergency setting is difficult, since most measurement methods have been developed for a clinical setting. E.g. Hypothermia detection. Research show that e.g. inner ear measurements provide a reliable indicator for core body temperature. A solution for use outside of the clinical setting would substantially improve patient safety in emergency care.

Table 3: One of three challenges in the 2nd Open Call

Baselining innovation practice & performance of SMEs



The potential barriers, indicators and actuators for the SMEs taking part in crossover collaboration for ACEBIM sectors in Europe were assessed by (i) 'looking in' to identify the innovation potential of the SMEs, and (ii) 'looking out' to reveal how these SMEs perceive their innovation ecosystem in the different European countries, especially, how favourable they are for crossover collaboration. The latter has been partially represented in Table 2 above (and with more detail in Section 5), so here the focus is the starting points for companies in the two accelerators in terms of innovation practice and performance.

A better understanding of these capacities, working conditions, both internal and external, as well as the supporting and hindering factors and actuators helped the companies to identify and the consortium to provide needs-led customised support for each company relevant to the product/service they were developing and its maturity.

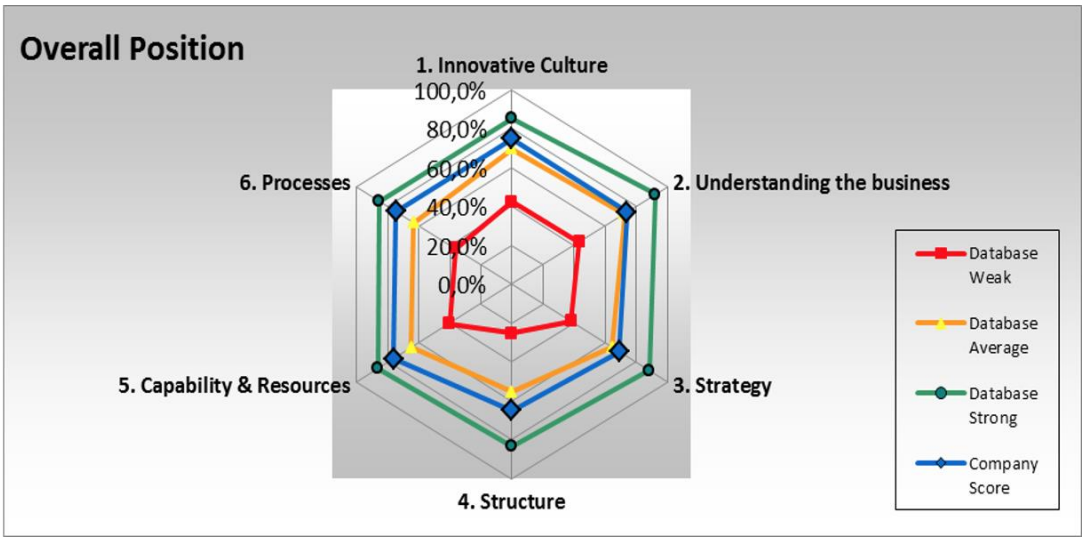


Figure 3: Companies looking in: strengths and weaknesses (n=46)

The outcome of the innovation benchmark indicates an *overall position little below the database strong and close to average* for 54 SMEs who participated in the 1st or 2nd Accelerator (Figure 3).

The three strongest innovation segments for the Cross4Health start-ups and SMEs were: *Capability and resources,* which helps to achieve the companies' goals, to identify gaps and establish appropriate skills; *Processes,* which looks at how the companies carry out the process of innovation; and *Structure,* which shows if the companies are structured in an appropriate way to achieve its strategic goals. The two segments that are a slightly better than average are: *Strategy,* which shows whether the companies have clear views on how they will grow and how they will focus their resources in order to maximise the return, and *Innovative culture,* which is important to implement and sustain a proactive innovative approach to company growth. The segment where the most improvement was needed for the C4H supported companies is: *Understanding the business,* which shows if the companies have a clear understanding on all aspects on the business and how they impact on performance.

Accelerators smoothing transition from idea to market

Through its programme, Cross4health sought to boost crossover collaboration with the additional effect of offering opportunities for new knowledge combinations and innovation. The intent was to shape new products, value chains connecting industries and diversifying specialization patterns with high probability of boosting the economy from local to European and global in scope. In this process cluster partners (i) provided entrepreneurial support to SMEs, (ii) acted as crossover bridge-builders and as catalysts for crossover projects by also (iii) creating favourable open innovation spaces as described in Section 3, to promote value chain innovation using a systemic approach.

Success driver 1: Connections – Cross4Health support for SMEs was guided by utilising 'connection enablers' at regional and European levels. The first step described at the start of this section was open innovation space with 11 nodes offered and utilised to mostly generate the challenges for the two Open Calls. In turn, one European Ideas Contest (Toulouse), 3 F2F Hackathons before COVID-19 (Bochum, Madrid, Kongsberg), a B2B meeting for 2nd AC companies (Malmo) supplemented by on online Medical Devices Regulation workshop, provided the conditions for best ideas to thrive with 708 companies participating. These ideas were then expected to coalesce in teams. 282 ideas were generated for the events and the Open Calls.

Success driver 2: The Accelerators – One of the main challenges that Cross4Health addressed was that SMEs need help to generate, take up and better capitalize on all forms of knowledge, creativity, craftsmanship and innovation. Each company was allocated a Key Account Manager (KAM) to guide them through their Acceleration Cycle.

The provision of needs-led, customised innovation services was preceded by assessing where each SME was in terms of innovation practice and performance. Data was collected from SMEs using a benchmarking tool, the Innovation Health Check adapted from one developed by Enterprise Ireland. It was an important instrument for self-assessment in order to evaluate the SMEs innovation process and that how this process is impacted by company culture, business strategy & structure, the company capability & resources (see Figure 3 above). The identification of the main strengths and weaknesses helped the selection of the best fitting innovation support services for the SMEs.

Besides identifying where the companies needed support, the benefit of this exercise was that it informed a discussion between the company and their KAM on structural issues regarding where the company is at the moment and where it wants or need to grow. It provided a direction for future development, like a "future-roadmap" for newly established companies with fewer employees and without a sophisticated internal structure. The larger, older companies found it useful as a reference for their own direction of travel.

Looking back on their experience with the Accelerators, the C4H project teams identified several challenges and risks that had an effect on their project development during the course of the acceleration and which probably will exist beyond the project as well (see Section 5 for more details). These were *(i) Technological risks* as innovation is a complex process with many obstacles, (ii) *Financial risks* as developing a product costs money, which means financing is crucial, however there are limited number of financial investors, and (iii) *Human resource risks* as developing a product requires experienced staff, which can be particularly hard to recruit in certain cases. All these risks had to be reduced and potential challenges overcome in order to deliver their C4H project plans.

Success driver 3: Resilience – The two Open Calls generated 24 solutions. 22 of the 24 solutions achieved or overachieved against their project objectives. For the 2 that did not, this was due to the impact of COVID-19 emerging to re-prioritise the work of labs in Italy and Spain. One of the most important roles of Cross4Health was that start-ups and SMEs who secured funding and support to further develop their products, gained credibility and an improved business image that aided discussions with bigger companies, potential investors or health care providers about further product development, testing and commercialisation (see Section 5 Table 4 below as a case example of what was possible). Specifically, the acceleration programme complemented SME resources, helping them finalise the technical design,

further development of the product and testing the prototype in real environments. This led to reaching a higher level of market readiness, and helped companies shorten their time-to-market and optimise product development. In several SMEs the resources available also helped them to expand their working team.

Large-Scale Demonstration

The "large" in large-scale demonstrators could mean large in approach, but not necessarily in size: the demonstrator model has a broader way of thinking, testing collaborative solutions involving the smart use of resources, the reallocation of existing funds and the mobilisation of new funds through regional, cross-border and cross-sector partnerships.

To reach the target of boosting the market entry of new solutions, the Cross4Health consortium built a catalogue of demonstration services which are offered to the sub-granted projects during the acceleration periods. The services include access to network of testbeds for a wide range of testing environments; varying from living labs to hospitals or care centres, pre-clinical and clinical sites, IT integration and interoperability and system assessment, usability analysis and engagement with patients, nurses and physicians to validate actual user needs. We reached out and invited healthcare testbeds across Europe, available in each partner region, to list their commercial services as part of the Cross4Health service catalogue. They covered four categories (clinical trials, pre-clinical studies, technical product testing and living labs.

The sub-granted projects enrolled into the acceleration programmes, had access to select services from one of 20 large-scale demonstration service providers. 3 projects in AC1 got access to LSD services using their vouchers. 11 of 23 projects in AC2 got access to LSD services using their vouchers, 2 projects could not get access to lab testing due to Covid-19 demands on the service providers. 9 projects in AC2 did perform demonstration activities involving end-users without using the voucher to finance the activity.

5 SUCCESS STORIES

To put C4H success stories in context, we asked companies in the two acceleration cycles to judge the capacity and capabilities of the innovation ecosystem(s) they work in to support crossover collaboration. This was conducted with a set of 12 crossover innovation indicators identified and piloted with RIS3 contacts early in the project. 37 of 58 companies responded. The overall rating of the 12 indicators is 3,6 in a 1-5 range. This indicates that companies were not completely convinced about support for crossover innovation in their innovation ecosystems. Comparing the assessment by SMEs *across countries*, there were considerable differences.

More surprising, if we look at the responses *within the countries*, quite differing views can also be detected. The perception of the characteristics of the innovation ecosystem seems to vary not only across countries but also SMEs from the same country can judge the same factors very differently being perceived more favourable or less favourable for supporting or promoting crossover innovation.

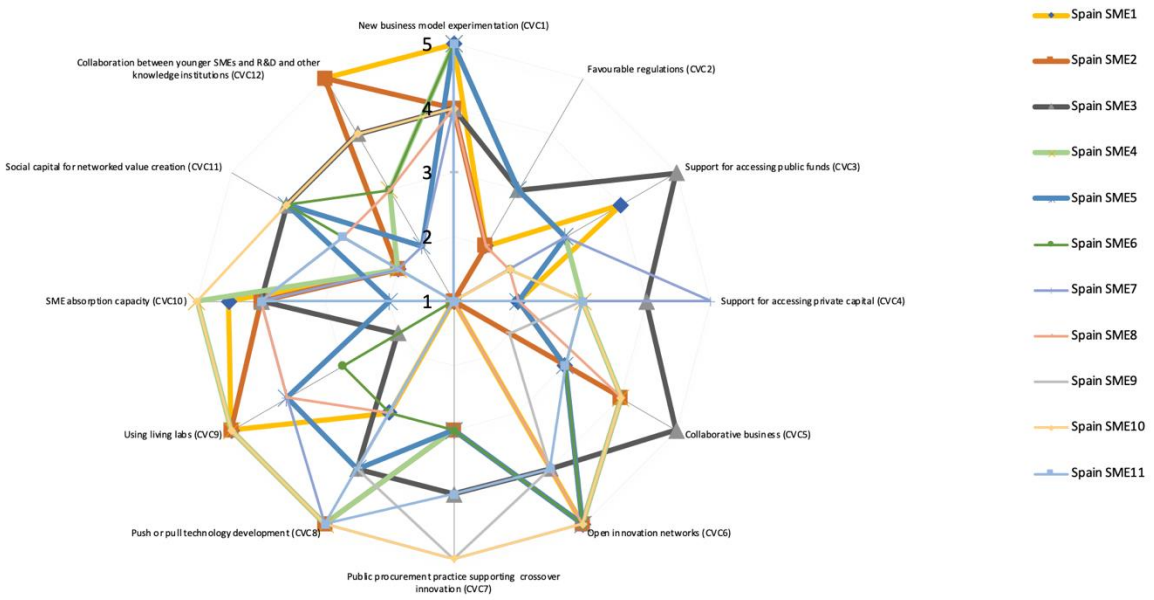


Figure 4: Ratings of crossover value chain indicators by SMEs within the same country – SPAIN (N=11)

The 11 Spanish SMEs were the biggest group in C4H who did the assessment, and had very different views on their innovation ecosystem (Figure 4). They had more or less similar views *only* on 2 fields with quite high average ratings for their country or region (4,3 and 4,7 on the 1 to 5 scale). One is the *New business model experimentations* which indicator highlights that crossover value chains need new business models and a modular approach to technology development to help crossover collaboration to build new paths to value creation. The other one is *Open Innovation Network* which is challenging the traditional internally focused R&D innovation funnel and is a useful way of promoting collaboration across sectors.

EXAMPLES OF SUCCESS TRIGGERS

Product development	• employing a continuous integration process to deploy technical features which leading to near instant feedback from users that also led to a fast development cycle and helped improving the quality of the solution • developing and testing a fully working prototype of a product based on real user needs, which is ready for testing
Understanding the market	• getting support in how to position the product, how to perform market research and develop relevant communication material related to the product • securing several partner deals with relevant software and hardware providers to enhance the benefit of the developed solution for the customers and patients which also enables the company to expand its business model and its total available market
Pivoting the business model	• new ideas related to business models and service systems have become more relevant; the importance of connectivity has become clearer • updating the company management structure for the service commercialization after the end of the acceleration
Meeting regulatory requirements	• adapting the product both technically and logistically to meet the needs of professionals and patients by being fully compliant at technical, regulatory and legal level and allowing privacy and regulation of both identification and health data of patients • feeding the quality assurance plan into the ethics strategy, especially concerning the compliance with the “do no harm” principle and the protection of the patients’ data
Spill-over effects	• the increased credibility that comes from being able to showcase this as a case study to the customers and collaborators will be key in the attempt to reach goals both in terms of growth and in terms of opening new roads for collaborations • benefiting from and promoting in the future each other’s services from the consortium in co-marketing activities by creating a solid foundation for long-term partnership.

Practical steps to facilitate crossover collaboration

Several companies emphasised that they experienced excellent cross-over collaboration within our project with skills and value that has helped accelerate the technical development of their product. However, there were also several challenges mentioned that needed to be overcome:

- cultural differences,
- the different expertise/background among the team members
- the physical separation and less effective collaboration or cost of physical meetings
- not having significant experience in projecting the early development into a potential business application by any of the partners
- lack of information on the potential of emerging industries for the project
- scarce financial resources which are necessary to activate cross-over collaboration.

Several testimonials illustrate how challenges were overcome and opportunities realised:

> *It was a great experience in working with cross-cultural teams. The teams within the companies are also diversified. Overall, we noticed* ***cultural differences e.g. between the Dutch and German way of approaching issues.*** *Both have their own advantages and challenges. A particular challenge was to work from the perspective of IT engineers from GoClinic and Innoviva with German engineers from Poligy, who are working only with physical objects, rather virtual topics.* (Fenomino Asthma Analyser project)

> *iWalku naturally demanded cross-over collaborations between different sectors: healthcare (FisioManual), Information and Communications Technology (ICT) industry (Kinetikos) and space sectors (OeWF). Additionally, it generated cross-border collaboration between Portugal and Austria. The barriers to cross-collaboration is that the iWalkU team had to face were* ***the different expertise/background and the physical separation****. As a very small consortium with partners from different sectors, the iWalkU team knew from the beginning that in order to achieve the proposed objectives, the partners should be seamlessly aligned around the project's goals. Thus, the whole project was designed to minimize potential barriers by being addressed through a waterfall approach. Although the collaboration between all the team members occurred during the entire project, each partner had a more significant collaboration in one specific task. The physical separation between each partner was overcome with an efficient communication process, through email and videoconference. Also,* ***none of the partners had significant experience in projecting the early development into a potential business application****.* ***The webinars offered by the Cross4Health services turned out to be of great value in assessing the business potential of the idea and obtain a proper framing of a potential business idea.*** (iWalku project)

> *Motigravity is in itself a cross-over project: it can be applied to space technology, medicine, gaming, industrial simulation etc….Before C4H we wanted to activate a cooperation with other entities abroad interested to the project, in order to proceed in parallel to its development, increasing the chance of success. We think it was a good opportunity to connect industry with clinicians and people who is close to the rehabilitation market, allowing us to explore new calls to follow developing the product. The barriers we have faced are mainly due to the* ***lack of information on the potential of emerging industries for our project****. This both in our country and abroad. The other barriers are obviously due to* ***the financial resources which are necessary to activate cross-over collaboration****. To avoid a dispersion of resources we decided to focus our*

activity for the moment to Medical and Space sector and to select a limited number of partners abroad (the ones of C4H project) very specialized in their sector and who could be complementary to the nature of Aldebran. (MOTIGRAVITY project)

More about spill-over effects from Cross4Health

There were four types of spill-over effects resulting from Cross4Health: industry spill-overs, knowledge spill-overs, networking spill-overs and financial spill-overs. Each project was able to report achievements in each field as a result of the acceleration programmes. Indeed, the most compelling stories are told by the companies who took part in our accelerators. For example:

Knowledge spill-overs

Up-Code is a SME inside a start-up incubator, consequently its experience and the knowledge learned during the acceleration program can be easily shared in Up-Code context with other start-ups. Others are part of an innovation hub which is also a great opportunity for knowledge sharing: Virtech has become as innovation hub and start-up incubation organisation which has built a large network of partners both nationally and internationally. The role of Cross4Health was of crucial importance. (SNIPE project)

as new technologies and business cases are constantly developed, especially best practices for data sharing and protection, these are also easily transferable between different projects. Compliance with standards makes this progress more efficient for all parties involved. As far as TechApps Healthier is concerned, being part of the EIT Health ecosystem, we are already discussing with start-ups across the EU for possible joint projects which will party build on our new capabilities (HealthierHome project)

Insights we would like to share:

- *Identify & establish key partnerships at an early stage. In particular for health care the innovation cycles are very long & require a lot of groundwork early on to ensure the successful launch of a product or service.*
- *Establish stakeholder interviews and user testing in your innovation iteration processes as an integral part to ensure product-market-fit and user acceptance.*
- *For hardware start-ups, be aware that your manufacturer is like an investor. You need to choose carefully & create an attractive business opportunity for both of you. Having a close work relationship with your manufacturer can save you time in the product development process as well as in quality management.*
- *Establish partnerships along the full value chain with a mix from small to large sized companies, so you can learn from their processes & integrate best practices.*
- *Have a solid business plan in place and make sure that it is flexible enough to integrate new opportunities (e.g. applications for the solution in different verticals) but also deal with unforeseen problems or delays (e.g. availability of components or partners going out of business).* (iBreve and the ePrev project)

Networking and industry spill-overs

Type	Country	cross-border and/or cross-over collaborations
Hospitals		
	ES	Clinical pilots' partner (Public hospital)
	IE	Clinical pilots' partner (Associated university hospitals)
	ES	Clinical pilot partner (Private hospital for women's health)
Insurances		
	ES	living labs, user test & proposal collaboration
Large Companies		
	PT & FR	Patient apps & software as a medical device certification collaboration
	IE & ES	Business model & commercialisation strategy advice for reimbursement model
	AT	Industrial manufacturing of devices in CE & FDA certified manufacturing facilities
Research Institutes		
	DE	AI and machine learning collaboration
	FR	User interviews & user experience testing for the health care sector
	ES	Women's health research project collaboration
	DE	AI based on real-time data from wearable sensors collaboration

Table 4: Networking and industry spill-over from the ePrev project

Thanks to Cross4Health collaboration we have managed to greatly expand our collaborations with other EU partners and resources. This networking was started during Cross4health welcome day in Malmo and we have been in contact with other Consortium service providers apart from our KAM. In fact, ***we analysed also carrying out a trial in Norway with the support of C4H partner NHT before deciding to focus in US market****. Since we are a recently created start up (less than 2 years of formal existence), C4H acceleration has meant for us a large impulse in our product development and market reach.* (PAM Care project)

We have new opportunities to work with other healthcare entities in different customer segments. ***We have proposals to work with Spanish health insurance companies (i.e. Umivale, Mutua Maz), hospitals (i. e. Infanta Leonor Hospitals) and rehabilitation centres (i. e. Vital Clinic, Premium Madrid).*** *Also, we have received proposals to adapt our solution to other pathologies as neurological ones (i. e. Instituto di Ricovero e Cura a Carattere Scientifico (IRCCS) from Fondazione Don Gnocchi (FDG) and the Spanish Reference Centre for Acquired Brain Injury (CEADAC). Also, we have interest from healthcare centres in other countries (i. e. leading health insurance companies from Denmark and Switzerland).* (ReHand project)

Different companies have been interested in the potential of the product and right now we are in conversations with private insurance companies to start using ADAMO as one of their solutions for the physiotherapy patients and further develop the technology. ***From some of our suppliers, like for example Universal Robot, had shown interest in our solution and had customized their products for ADAMO giving us a competitive advance over our potential competitors****. On the other hand, a Clinic presented by the Norwegian market introduction service has shown interest in implementing Adamo within its rehabilitation products, we have laid the foundations for collaboration.* (Adamo project).

Financial spill-overs

Out of the 28 projects 22 teams have managed to make concrete steps to raise additional funding to continue and/or expand product development, targeting either or both private and public sources. These include: international or national funds (e.g. Eurostars, H2020 SME Programme – FTI, Phase 1 & 2, EAIC, ERAPERMED (Greece), EIT Headstart), commercial contracts or private money. Of these 22, 11

projects have already secured further financial resources (between appr. 50.000-2.500.000 EUR/project but the figures were not indicated in each case) or commercial contracts were made. And this has been achieved from a €4m investment by C4H in direct support for participating companies. In comparison, INNOLABS (also led by NHT) generated €28m from a €4m investment.

6 CONTINUING IN A COVID-19 WORLD

Companies who took part in our events, webinars and accelerators valued a non-profit service that is genuinely interested in working together with them. In C4H, we have been building SMEs and clusters capability and attractiveness to participate in future R&D projects or partnerships and receive public funding as well as attracting private capital. By offering direct support and the continuous involvement of stakeholders, Cross4Health has been creating synergies between end-user demand (especially from the heterogeneous silver economy, from patients and care providers) and an emerging crossover industry sector.

Business planning for cluster collaboration

To continue this journey and ensure that the value created is sustained beyond the Cross4Health project period, we are focusing on activities that will strengthen the ecosystem around the clusters, increasing end-user involvement and fostering crossover collaborations. Thanks to Cross4Health, the clusters are building new services that are needed by start-ups, SMEs and other stakeholders in innovation and integrated care ecosystems. These services include supporting SMEs to leverage public and private funding. Norway Health Tech has also built a solid service package towards regulation for healthcare SMEs, especially encompassing the new MDR and IVDR in a "Regulatory Academy". But also, as suggested in Section 1, this needs more investment in upstream solutions focused on end-user driven prevention, prediction and early diagnosis for communicable and non-communicable diseases. This refocus has two challenges: governments and health insurers incentivizing industry to invest in prevention and prediction apps/devices/platforms (see Table 1) and building relationships between stakeholders in the White Space around clusters such as that achieved by Cross4Health.

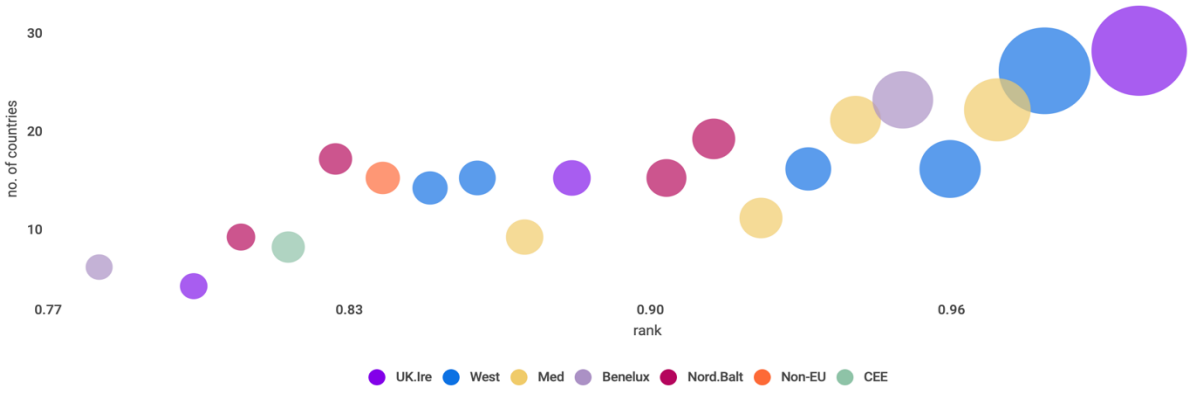


Figure 5: Start-up heat map[16]

Arguably, we should be able to attract VC investments to sustain the supported projects in the Cross4Health Acceleration Programme, and build knowledge amongst investors about investments in

[16] https://www.startupheatmap.eu

prevention, prediction and early diagnosis. However, while many cities (such as Dublin or Barcelona) and regional collaborations (such as Medicon Valley) have vibrant innovation ecosystems, securing private funding is still a problem. Venture capital funding in the EU is significantly lower when compared to US & Chinese hubs.

Figure 5 shows in which EU locations start-up owners in Europe would like to start their company in. The x-axis shows the rank, the y-axis the international connectivity and the size of the bubble the % of owners voting for it.

To attract private investors Cross4Health in combination with INNOLABS consortium members need to maintain a pipeline of investable propositions with a compelling brand that continues to attract start-ups and SMEs. This should be done in collaboration with other accelerators such as EIT Health, Nordic Proof, health catapults for more mature innovations and services (e.g. the pending Norwegian Health Catapult) and platforms supporting early development (to TRL4-5) for prevention and prediction. Norway Health Tech has initiated a matchmaking network for investors and 'investable' companies that works to stimulate and facilitate an increase in private capital into Norway's health industry. With support from Innovation Norway, the Norway Health Tech Investor Network is developing a stand-alone investor's hub and a platform for matching VCs, family offices, business angles, private investors, and corporates with investable companies[17]. Similar activities will be underway in other consortium cluster ecosystems.

To guide such developments, we have agreed nine strategic domains to ensure the sustainability of Cross4Health and INNOLABS. Figure 6 provides an outline of the business plan. For each of these 9 domains we have defined the goals, strategy, actions, results and longer-lasting impacts. The model focuses on activities that will strengthen the ecosystem around the clusters, increase end-user involvement in healthcare innovation and increase cross over collaborations. With this focus, we will continue to support a shift towards a more preventive and user-focused industry.

Figure 6: Overview of C4H post-project business plan

[17] https://www.norwayhealthtech.com/news/a-new-hub-for-creating-financial-room-to-roam-in-the-health-industry/

Annex Actions to bring industry and care providers together

For the previous INNOSUP 1 project (INNOLABS) we concluded its White Paper with a 'Call to Action'. It is worth repeating its main recommendations here. Both Cross4Health and INNOLABS dealt with crossover innovation (sectors and borders). The main difference was that Cross4Health leveraged innovations from outside of the health sector while INNOLABS built new collaborations within the health sector. Accordingly, this 'Call to Action' asks health, industry and trade ministries to work with intermediary authorities to support industry and health care providers in value creation and better services that can result from collaborative solutions between the aerospace, creative industries, energy and ICT, Health, BIOTECH sectors.

The main challenges for further growth and development in Norway and elsewhere are related to demand in the domestic market and using White Space better to identify and meet emerging needs. Dealing with the main obstacles and barriers in the domestic market will strengthen the competitiveness of this ACEBIM collaboration. Lessons learned from Croos4Health and INNOLABS show that start-ups and SMEs value cooperation with and delivering demand-led products and services to the public health and social care sectors that support digital care sustainably.

Attractive domestic markets for this ACEBIM collaboration will provide the basis for increased value creation and boost employment in local health economies. Working together, industry and care systems can contribute to achieving both health and industry policy goals.

Unlocking the collaborative potential between SMEs and health care providers – The starting point for IHBM industry sectors is good but there are still barriers that make it hard for start-ups and SMEs in these sectors to grow.

The most obvious challenge lies with health systems. Health systems are strictly regulated while healthcare providers struggle to manage with static and more heavily monitored budgets. The stakeholders (SME owners, clinicians, clusters) we have talked with believe that healthcare providers and their funders are at a tipping point: maintain the status quo where there are few incentives to optimise adoption of new solutions or see the challenges as opportunities to change the attitudes of management/decision-makers. Transitioning requires an attractive 'hook': new solutions that enable more affordable service delivery with improved performance - better patient and population outcomes. As it is, the politics of administration blocks innovation uptake. Organisations commission and adopt the wrong things so how to resolve this?

Practically speaking, a number of actions are needed to overcome such challenges. In Norway a case for action by relevant government ministries has been made to help make Norway an ideal environment for health start-ups to develop[18]. This has been adapted to provide the following reference guide for partner clusters although some might be more advanced in bringing industry and health care providers together.

1. Incentivise and resource cooperation - Establish a stronger culture for contact and dialogue between business & industry and the public health & social care sectors responsible for integrated care

[18] https://www.regjeringen.no/contentassets/41435798a618491e902935a590967502/en-gb/pdfs/stm201820190018000engpdfs.pdf

Emphasise the expectations of cooperation with the business sector in the assignment document (or similar) for the regional health authorities and in funding allocations to the underlying agencies providing integrated care

Submit a new national health strategy in which primary and secondary care integration, technology and competence are key elements

Continue to develop the funding system for hospitals in order to better support coherent digitally enhanced person-centred care pathways, use of new technology and innovation in service design

Utilise existing intersectoral fora as an arena of interaction for cooperation with the business sector

Assess how to develop innovation activities at local municipality level for integrated care services

Ensure that state and private funders develop their advisory services to municipalities and industry in order to stimulate innovation when building community care facilities including social housing

Facilitate management development in innovation and business development, and ensure its inclusion in current or planned executive management development programmes for providers of integrated care

2. Good business conditions - Work to ensure good business conditions in general, and for research and innovation in particular

Study the potential for utilising any spare capacity in existing laboratories and infrastructure for testing and piloting at universities, university colleges and hospitals by making it available to business and industry and assessing possible incentives to that end

Map the potential for increasing interaction with the IHBM sectors in relevant parts of integrated care ecosystems at ecosystem, organisational and patient/informal carer levels

Put in place effective and coherent translational research pathways for key integrated care pathways to inform effective regional and cross-border value chains

Assess if national ministries for trade should take on a coordinating role in joint international marketing of individual industries and research environments

Continue work on increasing participation in EU programmes and take steps to enable local companies to participate in innovative procurements in other European countries

Perform a comprehensive review of the policy instruments in place for the business sector

Continue prioritising on business-relevant research and innovation, the high level of support to policy instruments with the highest degree of innovation and efficiency, and continue the focus on broad, nationwide schemes.

3. Attractive partnerships - Make the public health and social care sectors an attractive partner for business and industry specially in the context of person-centred integrated care

Right-skill basic researchers and clinical researchers to better translate ideas into viable innovation products for testing and eventual commercialisation in partnership with industry – and especially local SMEs

Submit an action plan for clinical non-pharmaceutical medical device trials in 2020

Establish 'one stop shop' for clinical trials (but distinguishing between pharmaceutical and non-pharmaceutical trials), by linking relevant national agencies more closely to business and industry through a partnership model

Study how a combination of different research and innovation policy instruments can contribute to a more coherent process towards the implementation of new technology and new solutions for integrated care services

Introduce indicators for measuring adoption of digital solutions to enhance service delivery and related data management by integrated care providers and consider implementation in a results-based funding system of research

Establish or enhance platform(s) for health data analysis to simplify access to health data for retrospective and prospective research and analysis purposes, while strengthening protection of privacy. Including enabling more active use of health data in the process of developing pharmaceuticals and medical technology

Ensure that Tech Transfer and Innovation Offices in national agencies and sub-national intermediaries (such as clusters and universities) have the ability to provide good regulatory advice to business and industry and the health service.

4. Culture of entrepreneurship - Facilitate more commercialisation of medical and health-related research and of ideas generated within the health and care sector.

Power-up public sector innovation capacity to support a culture of entrepreneurship that looks to better utilise resources and people skills in generating, adopting and diffusing digital health solutions and tools

Map how entrepreneurship is taught and whether it needs to be strengthened in the education of health and social care professionals

Consider incentives for commercialisation of research results in the public health and care sectors, and particularly consider implications for re-working hospitals as knowledge centres supporting closer to home care

Map whether better guidance is needed on intellectual property rights in the health industry or parts thereof

Provide financial support for SMEs and public health care providers to work together in preparing 'proof of need' and 'proof of concept' for new innovation products,

Prepare an action plan for female entrepreneurs, to be completed in 2020

5. Smart Procurement - Smarter procurement by integrated care providers

Treat investments in digital solutions (platforms, eHealth, mHealth, sensors, wearables, medical devices) as shared investment by integrated care providers to help make efficiencies of data sharing and associated models and tools, more accessible for under-resourced care ecosystems providing support for marginalized urban and dispersed rural communities.

Facilitate increased use of innovative public procurements for integrated care at national and sub-national levels

Support the chances of promising innovations being adopted with explicit attention to managing change at organisational and workforce levels in public health and social care providers.

Improve the ability of health care supply chain staff to make procurement decisions that are better informed by critical appraisal of HTAs and market intelligence regarding the purpose, efficacy and quality of new digital products (platforms, wearables, sensors etc

Increase capacity for Agile Health Technology Assessment at sub-national levels including mini-HTAs to overcome the common problems with classic HTA which relies on publications and large datasets. A particular focus should be on producing accessible briefings of emerging technologies with comparative cost and impact analysis with currently used technology

Regional health systems should define their own "economic footprint" as a basis for baselining current spending patterns for goods and services (what stays in the region and what goes out of the region) and then routinely monitor the contribution of their procurement activity to sustainable regional development.