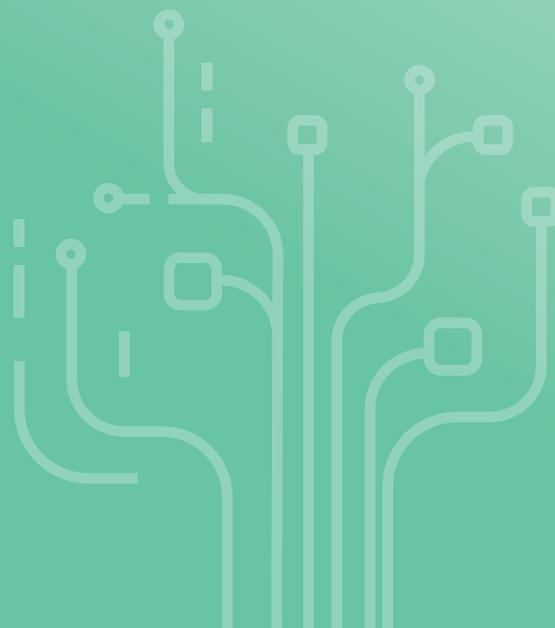


Study on the impact of ECSEL funded actions

Summary Report

July 2020



This study is carried out for the **ECSEL Joint Undertaking** by:

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1

Context - Measuring the impact of ECSEL funded actions

This document summarises the main impacts achieved by the ECSEL Joint Undertaking since its setup in 2014. ECSEL is a public-private partnership established under Horizon 2020, the research and innovation programme of the European Union. It addresses the area of Electronics Components and Systems (ECS) and it is based on a tripartite governance structure involving the European Commission and 30 ECSEL Participating States (EPS) on the public side, and the relevant industry associations on the private side.

ECSEL in figures - (2014-2018¹):

Funded projects:	67	
Participations:	2100	with > 1,000 individual research organisations and private companies
European and national funding:	1.6	B€
R&I investment:	3.4	B€
Lighthouse initiatives:	3	

The main impacts described in this report have been identified and analysed through an independent study, which followed a solid approach starting from the definition of an intervention logic or “theory of change” for the Joint Undertaking. The complete report is available separately. The study relied on a very wide range of data collection activities and data sources.

Primary data sources supporting the study

Online survey:	476	respondents out of 2100 project participations. (Very significant and statistically representative sample)
Interviews:	70	Interviews carried out with European, national and industry stakeholders. 18 interviews with project coordinators and project participants (covering ~25% of projects)
Case studies interviews with 26 participants from 8 ECSEL projects:		Productive 4.0, Senate, WayToGo Fast, Reaction, InForMed, SCOTT, 3C Car, ENABLE S3

In addition to data collection activities, the study team also conducted 1) a project analysis covering all ECSEL funded actions, 2) an analysis of the key features of the ECS market and 3) a network analysis linking all projects participants to each other. This document contains the main messages emerging from all these data collection and analysis steps.

¹ Projects selected from the calls 2019 are not yet operational. The study took into account the projects until 2018.

2

Creating an innovative and sustainable research and innovation ECS ecosystem

Increased levels of research and innovation (R&I) cooperation between organisations is the single most important realised benefit of the ECSEL programme. Participation in ECSEL projects results in higher R&D spending for all categories of project participants and, ultimately, this yields a stronger and more innovative ecosystem of ECS players which can tackle EU societal and industrial challenges better.

The R&I ecosystem fostered by ECSEL presents many important characteristics that lead to higher levels of innovation:

- **Inclusivity:** Although there is a core of ‘repeat collaborators’ in ECSEL (which represent a majority of key market players), they are not isolated from the wider network of participating organisations; rather, they function as core partners facilitating contact with others in the network. In this respect, the ecosystem is inclusive and it continuously evolves and integrates new players.
- **Multi-sectorial approach:** ECSEL projects attract many participants from other sectors, some of which are traditionally close or reliant on ECS. This is due to the ubiquity of ECS in modern industry, but it is also a key feature of the programme, which is considered one of the rare frameworks under which cross-sectorial R&I collaboration of this scale can happen.
- **Win-win relation between industry and research organisations:** ECSEL projects tend to follow a basic ‘recipe’ for problem solving which has proven very successful and entails strong collaboration between industry and academia. A core ingredient in this recipe, in fact, tends to be the role of reputable and sizeable RTOs, which are highly valued by enterprises. This shows that the programme maximises the complementarity of skills between project participants.
- **Inclusion of SMEs:** SMEs participating in ECSEL projects benefit from very high returns on investment. Rather than just increasing their R&I capacity, they can also use the programme to gain both the trust of pivotal players and a place in the wider ecosystem.
- **Openness and knowledge sharing:** ECSEL projects go very far in implementing the principle of “open innovation” and knowledge sharing. Their outcomes are made available to the wider industry, often during the projects themselves. This entails that the programme contributes not only to raising the research and innovative capacity of a limited number of key players (which are more successful in accessing the funding), but also to increasing overall innovation in the ECS ecosystem in Europe.
- **Trust and risk taking:** ECSEL programme fosters a culture of trust and risk taking amongst project participants, which also helps increase R&I spending.
- **Bridging to other funding programmes in Europe:** with its Lighthouse initiatives and by allowing participants to recur to additional funding opportunities (through a multi funding approach) the ECSEL programme builds bridges to other funding programmes. This leads to more synergies and higher impacts.

*By bringing together Europe’s semiconductor companies, research institutes and Original Equipment Manufacturers (OEMs), the **Auto Drive** project gathers the critical mass required to improve the technologies underpinning automated driving.*

*We believe **ECSEL stimulates risk taking** and supports truly innovative and disruptive ideas.*

As it can be expected, increased innovation in the ECS ecosystem can also have direct effects on the competitiveness of its players, as R&I is a precondition for industry growth and sustainability. ECSEL therefore directly contributes to supporting European Industry Leadership by providing a well performing R&I base, which is essential for innovation.

By contributing to the development of an innovative and sustainable R&I ECS ecosystem, the ECSEL programme ensures that the EU possesses the right research and innovation capabilities to address its existing and forthcoming societal and industry challenges.

3

Supporting the European Competitiveness in a growing ECS market

There is an overwhelming consensus on the fact that ECSEL funded actions have considerably helped to develop and maintain a strong competitive ECS industry in Europe and that, without ECSEL and its predecessors ARTEMIS and ENIAC, the European ECS ecosystem would not look as vibrant as it looks today. The positive macro-level effect of ECSEL on the ecosystem is explained by the micro-level impacts of its funded projects and in particular their ability to:

- Strengthen firm competitiveness and increase organisations' market shares, turnover and employment: strengthened firm competitiveness is experienced by almost one participant out of two and is generally explained by the fact that ECSEL helps increasing efficiency and productivity, increasing turnover and market shares and improving human resource capacities.
- Strengthen performance of SMEs within the value chain: SMEs participating in ECSEL projects benefit by increasing their R&I capacity, and gaining the trust of pivotal players and a place in the wider ecosystem.

Efficiency and productivity gains

In some cases, efficiency gains were estimated to go up to 50% for participating organisations. More frequently, efficiency and productivity gains linked to ECSEL projects seemed to be in the range of 10-30%, which has nonetheless a considerable impact on organisations' performances. These gains are generally reached through piloting of production lines, integration of digitalized systems for production management, improvement of prior modelling, etc.

Increasing turnover and market share

Stakeholders provided many examples of increased turnover (i.e. "up to 2mio euro for the launch of 4 new products", "several million euro" after the deployment of a new production line or even "doubling turnover" over a period of a few years thanks to the technology developed under the project). ECSEL funded projects have a positive impact on turnover and market shares for European companies thanks to their support for cutting edge technologies (such as Fully Depleted Silicon on Insulator – FD SOI) and the creation of an environment for cooperation where technology suppliers and users can closely interact beyond research actions addressing aspects such as technology validation and demonstration in close to real life scenarios before they are integrated in products and services.

Employment impacts

ECSEL funded projects entailed direct job creation for almost one organisation out of two. For a few organisations, participating in ECSEL funded projects had impressive or rather transformative employment effects: i.e. 550 jobs created over a period of 3 years following the end of the project and doubling the number of FTEs (from 45 to 102) in order to exploit projects' results.

4

Fostering the digitalisation of industry and society

Electronic Components and Systems are the core of the connected devices whose rapid take up is radically transforming our personal and professional lives. The ECSEL programme is greatly contributing to the successful adoption of connected devices by EU industry and society, particularly by ensuring that these technologies (and especially Internet of Things components) are safe, secure and efficient for everybody to use.

From an industry perspective, ECSEL funded actions accompany and sustain the ECS ecosystem in the digitalisation and inclusion of IoT systems in production processes and in the shift towards a more data driven economy. They contribute to the development of key horizontal components and systems, hardware and software, which constitute “building blocks” accelerating the digitalisation of the EU industry in general. These building blocks are essential components and systems requiring large and encompassing projects to be established and having the potential to be used by the entire industrial ecosystem. The open innovation approach fostered by ECSEL further contributes to the dissemination of these outputs, which then become real game-changing assets for positioning the EU industry at the forefront of Industry 4.0.

*The ECSEL programmes provides the **necessary R&I Framework** for the development of horizontal Industry 4.0 solutions.*

The impact of ECSEL is however not restricted to the digitalisation of industry. On the contrary, the programme has a significant impact on European citizens’ digital life and on the wider digitalisation of society as it provides the indispensable enabling technologies for many applications, and especially technologies for advanced digital components and their packaging. Challenges in this domain also concern the safety, sustainability and comfort of the increasingly digital spaces we inhabit. Widespread use of sensors and IoT devices also creates “anticipating” spaces, which can offer the right service at the right moment. ECSEL projects work on all of these digital life challenges, seeking to utilise ECS technologies in an effort to build smart, safe digital spaces. Projects focus on a wide array of applications, such as smart cities or smart buildings and many of these innovations are also relevant in the health, energy, and environmental sectors.

5

Contributing to the mission of the EU Green Deal

Worldwide, the ECS sector has been essential in the development of innovative technologies that consume less energy and help achieving environmental goals. In Europe, sustaining innovation in this sector represents a key ingredient to achieve the mission of the newly launched Green Deal.

The ECSEL programme has already contributed to major progress in this domain. One of the key ECS challenges from an energy perspective is determining how to develop power electronics that allow for more efficient energy flow control, both for systems (e.g. automotive) and for the energy grid. Several ECSEL projects are focusing specifically on this area, with the objective of developing “more efficient and more compact applications for energy generation, transformation and usage” by working on key materials like Silicon Carbide (SiC) and Gallium Nitride (GaN). Improving the performance of components based on these materials enable significant thermal conductivity gains and power loss reduction.

This is an area in which the ECSEL programme already had very important impact and should strive for more.

FDSOI potential is largely included in ECSEL projects

Furthermore, ECSEL projects are addressing the energy challenges linked to the miniaturisation of transistors and to the Moore’s law which states that the number of transistors in dense integrated circuits doubles every two years. The development of the Fully Depleted Silicon On Insulator (FDSOI) technologies under the ECSEL programme represents a true “European” success which has strong potential: FDSOI technologies allow reducing transistors’ size while maintaining their performance and consuming up to 50% less energy than traditional bulk transistor technologies. Today, FDSOI constitutes the basis for many cell phone and smartphone components and their take up will increase in the future as they also provide energy efficient solutions for cloud computing and artificial intelligence.

The development of energy friendly ECS solutions, which are reused across sectors, has a significant impact on many other domains and generate energy reduction spill-over effects. While it is difficult to quantify the energy-saving impacts of those technologies due to their ubiquity, supporting the development and take-up of energy efficient ECS solutions is a pre-condition for meeting the ambitious energy and environmental objectives of the EU.

6

Pushing for a sustainable mobility and transport sector

According to the ECSEL Multi-Annual Strategic Plan 2019, Europe is currently facing four major challenges in the area of transport and mobility:



The development of clean, affordable and sustainable transport and the reduction of fossil fuel consumption.



The provision of secure connected, cooperative and automated mobility and transportation.



The management of interaction between humans and vehicles.



The implementation of infrastructure and services for smart personal mobility and logistics.

ECSEL supports the European provision of clean and affordable transport

ECSEL acts on these challenges and especially supports the European provision of clean and affordable transport. Its funded projects enable the development of new components for cleaner vehicles while also improving the vehicles' production processes. Most of these projects have clear EU-level ambitions, such as an increased production of electric cars from 9% in 2020 to 27% (of the total car production) in 2030, or an increase in the electrical vehicle market by 50% over the same period.

Besides supporting the development of cleaner transport, ECSEL-funded projects also work on the safety and security of connected vehicles. Current projects focus specifically on road transport, but also cover other transportation and application domains, due to the fact that ECS are the basis for any type of connected vehicle. Many projects also investigate how to improve vehicle-human communication through Automated Cyber Physical Systems. Finally, some of the ECSEL-funded projects are currently working towards addressing challenges related to Mobility-as-a-Service, such as road congestion or accessibility for disabled persons.

ECSEL projects currently help establish solutions which will shape the size and characteristics of the automated and connected vehicles market. ECSEL thus sustains the efforts of the ECS industry in a high potential domain and, by doing so, helps both the market to develop and the society to benefit from these market developments.



Developing innovation for sustainable healthcare

By 2030, the global population will have grown to 8.5 billion people, with some 1.3 billion over 65 years of age. The demand for access to healthcare facilities and services will increase in parallel, jeopardising the sustainability of current health systems, as well as the quality and affordability of the care.

The ECSEL funding programme has already led to important innovations directly applicable to the healthcare field, and has caused spill-over effects which have the potential to positively shape the future of EU healthcare.

The Scott project developed an indoor localisation system for hospitals, to support assisted living in elderly community care.

In particular, ECSEL is currently supporting the strengthening of an ECS-healthcare ecosystem and the development of core technologies. Fostering a closer cooperation between industry and academia within the ECS and healthcare domains, the projects funded under ECSEL have already developed new solutions in various fields that will continue to help improve patient wellbeing.

Examples of innovative healthcare solutions developed under ECSEL include smart catheters and image guided therapy systems.

ECSEL funded projects directly benefit European citizens, from patients to healthcare professionals transport

By funding ECS medical innovation, ECSEL also sustains the restructuring of healthcare delivery systems, from supply-driven to patient-oriented. The outcome of ECSEL funded projects can help engage individuals more actively in their own health and wellbeing. By developing components and platforms for wearables/implants, data analytics, Artificial Intelligence for precision medicine and personalised healthcare, ECSEL projects can improve access to healthcare and reduce inefficiencies. They can also significantly improve the quality of work and life of the healthcare personnel by providing them with reliable tools, ultimately decreasing workload and optimising healthcare system resources.

ECSEL funded projects therefore already directly benefit European citizens, from patients to healthcare professionals. can thrive and innovate.



Conclusions – ECSEL establishing the conditions for future innovation

ECSEL-funded actions have already led to **significant achievements at both the economic and societal levels.**

ECSEL is a key instrument for innovation

By building on the strengths of the ECS sector in terms of research and innovation and by providing a positive framework for trust building and risk taking, the ECSEL programme has become instrumental for the ECS players and a key pillar of their R&I strategies. Rather than simply impacting innovation outcomes, the ECSEL JU clearly contributed to establishing the right condition or environment for innovation to occur. Its impacts on the overall ECS ecosystem in Europe materialise simultaneously at the project level, through the development of innovative solutions and increased innovativeness of project participants, and at the programme level, by arranging the right conditions of trust and collaboration in which the ecosystem can thrive and innovate.

- **ECSEL** provides a positive framework for trust building and risk taking.
- **ECSEL** establishes the right “condition or environment” for innovation to occur.

ECSEL directly benefits EU citizens

Very importantly, by improving innovation of the ECS ecosystem, ECSEL is able to foster research and development of solutions directly benefitting European citizens and addressing societal challenges. This societal impact and these direct benefits for citizens are particularly strong in the energy and environment, transport and health domains due to the current strategic focus of the programme and the existence of vibrant ECS ecosystems in these areas. Across these domains, the programme and its funded actions facilitate cooperation on key challenges like clean mobility or energy efficient industry, and develop concrete solutions to them. Some of these solutions have incredible potential for the future of the ECS industry as well as for all other economic sectors.

Both the programme, through the provision of a strategic mission and a framework for collaboration, and its funded projects, through the development of specific solutions, address some of the key EU economic and societal challenges. In many instances, the importance and impact of the ECSEL programme is likely to increase in the future.

