1 Introduction:

The digitalisation of industry – Industry 4.0 – is rapidly transforming all stages of the production value chain of goods globally. Advances in robotics, data collection, cybersecurity and other technologies are creating increasingly efficient, flexible and tailored manufacturing processes. If exploited, these technologies could create huge growth in European industries.

ECSEL Joint Undertaking (ECSEL-JU) is an EU-driven public-private partnership, funding innovation in electronic components and systems (www.ecsel.eu). Through the ECSEL-JU, European industry, SMEs and Research and Technology Organisations are supported and co-financed by ECSEL participating states and the European Union. ECSEL-JU has created "Lighthouse initiatives" as they identified the need to better coordinate and link Research, Development and Innovation (RDI) activities taking place in order to help European industry achieve digital transition and strengthen Europe's competitiveness and leadership. Three Lighthouses have been launched to date; **Industry4.E**, Mobility.E and Health.E.

The **Industry4.E Lighthouse** has a special focus on all means of microelectronics and Information and Communications Technology (ICT) for Digital Industry. Operating across project, funding, and national boundaries, Industry4.E is expected to bring together relevant Research, Development and Innovation (RDI) projects funded across various programmes, helping projects to connect with each other and the end-user/stakeholder community.

To support the implementation of activities in relation to the Industry4.E Lighthouse, ECSEL JU via Horizon 2020 have funded a Coordination and Support Action (CSA) for 24 months which started in October 2018. CSA-Industry4.E intends to:

- Support the Lighthouse Initiative Advisory Service (LIASE) in establishing the Lighthouse
- Actively assist in enabling successful execution of the Digital Industry roadmap
- Engage research communities - coordinate the relevant stakeholders, project consortia and policymakers
- Facilitate, support and assist Industry4.E projects in effectively exploiting project results
- Promote the Lighthouse visibility
- Develop and implement a public engagement and outreach strategy to raise the visibility of Industry4.E to the broader public and related initiatives

Objective for developing SME Engagement material

CSA-Industry4.E supports the Industry4.E LIASE in developing a strategy for engaging the different research communities in collaboration. As part of this work one of the main objectives is to elaborate the added value of Industry4.E and stimulate the participation of SMEs.

2 Aim of interviews with successfully engaged SMEs:

The idea behind the interviews is to share the process and the benefits of being involved with ESCEL-JU projects, from the perspective of successfully engaged SMEs, with other SMEs to encourage their involvement in the ECSEL-JU programme.

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3 Questions and Answers with Mateusz Bonecki (DAC)

The following is our interview with Mateusz Bonecki (DAC).

Q1. As an SME (or any industry partner), why did you decide ECSEL-JU was a good way of funding your R&D?

First of all, because of technology. DAC is interested in IoT security, IoT integration or DevOps for embedded systems engineering. In addition, data analytics applications that use data from IoT.

Of course, application domains are also relevant. We develop systems for industry, logistics and urban mobility, and we were looking for a place that will be open to demonstrators, tests and pilot deployments in these areas. We found it in the ECS Strategic Research Agenda and, in consequence, in ECSEL.

Finally, innovation actions, also those with an active research component, are focused on bringing innovation to the market, and therefore on commercialization. This approach is specific for the entire Horizon 2020, and ECSEL in particular. In general, the EU-funded research projects leverage the R&D expenditure. But on top of that, ECSEL-scale projects give access to numerous companies and research organizations brought together in large consortia. You may meet there your competitors, your suppliers, and perhaps also your potential clients.

There are other advantages significant from the industry point of view. ECSEL addresses relatively mature technologies, say, TRL 6 or 7. It is also an industry-driven initiative, so the use cases and demonstrators are defined by industrial partners.

Of course, there are some drawbacks of working in large consortia. You might invest a couple of months in work on a proposal, and then it suddenly turns out that the consortium breaks up because the largest enterprise coordinating the application process changed its strategy and now quits the team. Or there is a merger with another consortium, and your topic of interest is off the table overnight. However, such a risk is present in all the business. The sales process looks exactly alike: how many offers have salespeople drafted that led nowhere?

Q2. What were your initial steps? Had you previously been involved in other EU projects before ECSEL-JU?

Our first experience with European programmes starts with the 7th Framework Programme. More precisely, it began with the predecessor of ECSEL-JU, the ARTEMIS Joint Undertaking, call of 2012. It was, moreover, the first call in which Polish partners took part as back then Poland has just joined the JU.

The goal of the project was to implement a semantic middleware platform supporting the integration of urban cyber-physical systems, using methodology and architectures typical for systems of systems engineering. The platform was intended to reduce the time needed for the development of smart city software applications which will utilize capabilities of systems across different urban domains such as energy, mobility, security, smart buildings, and so forth.

The project concluded not only with a successful pilot deployment in Gdańsk, our hometown, but also led to some commercial follow-ups. Certain components our company developed as part of the platform are still in use. Recently, we've boasted of finishing the work on a solution supporting real-time and open access to urban mobility data. We use the semantic middleware components, ensuring secure access to data offered by safety-critical systems such as, for example, intelligent transportation systems controlling traffic lights.

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Q3. Was your first experience of ECSEL-JU project application successful?

Unfortunately not. In the first call of the newly created ECSEL-JU in 2014, we failed with the consortium coordinated by Fraunhofer-Gesellschaft. Together with over 30 partners, we proposed an adaptive control architecture for cyber-physical systems. We were interested in the application of this technology in the field of smart city, more precisely, in the field of smart urban mobility due to our presence on this market. Still, we've learned a lot as a team during this first ECSEL application process, which helped us in the following calls.

Q4. How many ECSEL-JU applications have you been involved in?

At ECSEL-JU, our company has been a member of 15 consortia so far. But we have been successful in three cases, which gives a 20% success rate. We focused mainly on projects on the borderline of smart mobility and digital industry, which fits our portfolio of solutions for logistics 4.0 and the broadly understood transportation, logistics, and shipping sector.

In 2017 we succeeded with the AFarCloud project, which in due course undertook the topic of cyber-physical systems for smart agriculture, which was quite neglected at ECSEL. This year we have just started working in the Arrowhead Tools consortium.

And earlier, in 2016, funding was granted for Productive4.0 project, which perfectly fit the needs of the European economy facing the challenge of industry digitalization. In this case, a consortium of more than a hundred partners responded with one voice to the needs identified in the Digitizing European Industry strategy concerning industrial platforms and large scale pilots. What worked here is almost thirty industrial use cases handled within a unified approach towards industry digitalization.

Q5. Of the applications you were involved in, what are the differences between those that were successful and those that weren't?

ECSEL is a sectoral program dedicated to the European electronics, embedded systems and cyber-physical systems domain. To my mind, it is the right consortium what makes a successful proposal: consortium coordinated by large industrial players, that meets the needs and priorities outlined in the MASP and work programme, but also the economic needs of the EU member states.

It is the case in ECSEL because once independent experts evaluate the submitted proposals, the floor is given to the panel of public authorities, who have an impact on the final ranking list. Their assessment says how the project fits the needs of state-level economies and respective policies and strategies. That is why it is so important to be aware of the demand of the European economy. Good proposals capture technological, political, and economic *Zeitgeist*.

Q6. What has your company achieved through engagement in ECSEL-JU that you think it wouldn't have otherwise?

Three things are unique about the ECSEL funding instrument. Firstly, it supports large-scale ecosystem projects, where all stages of the value chain are represented. A consortium of fifty, seventy partners is nothing unusual. Some consortia gather even more than 100 partners. Secondly, ECSEL projects provide partners, especially SMEs, with access to engineering frameworks and technology platforms which are of interest for industry leaders. Thirdly, these projects are driven by large enterprises who have position and capacity to shape future industrial and business landscape. This is an opportunity

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for smaller companies as we can learn about requirements and strategic technology developments taking place in big, multinational corporations.

So, to my understanding, ECSEL is about bringing together complete value chains, from semiconductor companies to manufacturers of standalone embedded systems to OEMs and, finally, to downstream solutions providers. Such ecosystem projects create something like “engineering sandbox” for end-to-end value chains. Different parties can experiment with each other's technologies in a way that wouldn't be otherwise possible. Each project ignites new partnerships due to the diversity of partners, their needs and competencies.

The benefits of experimenting in the living value chain offered by huge, ecosystemic projects are vital to the company's development. For example, in the Productive4.0 project DAC found partners, potential customers, with whom we worked on the requirements for our technological solutions. But, up the value chain, we have also got connected to our suppliers. We have undertaken cooperation with Infineon or NXP in the field of reliable run-time environments compliant with the standards of Trusted Computing Group or concerning the application of Secure Element integrated circuits in development of trusted and secure IoT devices.

Q7. How important is having a large EU network to engage in ECSEL-JU?

Business-wise, ECSEL Joint Undertaking, the Horizon 2020 program, and any other public funding instrument alike are, among others, means to leverage R&D investments. So from the entrepreneur’s point of view, collaborative research is a part of the business. And just like in business, having partners is a condition of successful operations.

We don't live in a void: a more extensive network translates into a better understanding of the industry, cooperation prospects, access to know-how, contractors, suppliers, and finally – also customers.

Q8. How important is it to get engaged with partners who are already involved in ECSEL-JU?

Just like in business, having experienced, proven partners is crucial, but also very demanding. In business, this requires investment in networking, presence at fairs, promotion, understanding the industry and market dynamics, and developing lasting relationships with partners.

At ECSEL, but also in European collaborative research in general, the right partners can be reached through brokerage events. We have the EFECS conference that brings together all the actors of the ECS value chain. There are online match-making tools to find business-soulmates, join forces and forge alliances.

But, on the other hand, ECSEL is an industry-driven program. And very often it happens that functioning on the European or global market is a step towards collaborative R&D where the cost of this experiment is partially covered by public funds. So the usual practise outside the collaborative research and public funding can be brought into it: companies and research organizations focus on common interests and goals, OEMs and their suppliers or contractors pursue new products and markets, competing companies can work together to do certain things faster and cheaper, they can reduce R&D costs, use common testbeds or split costs related to standardization processes. In ECSEL, all this can happen in one project.

And this applies also to small businesses and start-ups. In ECSEL, we often observe that large enterprises, when setting up or joining a consortium, bring along start-ups or SMEs. They use ECSEL

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projects as an environment to leverage risks related to testing, integration or absorption of some unique technologies smaller entities are working on.

Q9. What advice would you give to an SME (or any industry partner) trying to get involved in ECSEL-JU?

The essential advice would be that one must understand what the specificity of working in ECSEL projects is and what they can offer. And all in all, this is easiest to explain by showing the differences between the different funding mechanisms.

To start with, the European Innovation Council implements the SME Instrument programme, which has been designed to leverage R&D investment and commercialization costs in single, smaller entities. These projects can be carried out in twelve to eighteen months. They are perfect for start-ups and SMEs who have to quickly develop MVP and introduce it to the market as fast as possible to win a reasonable market share. So if you have some disruptive technology at hand, that's the place for you: you're on your own, concerned only with your product or technology.

On the other hand, typical collaborative Horizon 2020 research or innovation projects have entirely different structure and pace. They usually involve academic and research partners as well as industry, both large and small enterprises. Here you are supposed to solve a technical, organizational, or societal problem. But you need to work with five, maybe ten other partners in the consortium. You need to synchronize, plan together, share requirements, coordinate development, integrate components released by various parties. This workflow could be painful if you want to proceed fast. There is a risk that your competition will outrun you. I can imagine a situation where half of the start-up team is stuck on teleconference calls, discussing work packages, deliverables, and deadlines, while competitors focus on business models, building a customer base, and developing a go-to-market strategy.

Now, try to extend this picture so that it includes a complete value chain, the entire European electronics market, involved OEMs and their suppliers, and so forth. In ECSEL projects, the protagonists are complete value chains. Their task is to jointly check whether the European electronics sector, together with companies that use its products, has the chance to develop long-term, sustainable, innovative products or solutions. So ECSEL takes the perspective of the entire ECS sector, and if you can find your place in it, that's great.

In ECSEL projects, partners are not bound by a specific product or a specific technical problem, which is to be solved. Here, the binder consists of market relations and joint market outlook. Expected impacts of the project foreseen in the proposal are defined in terms of the EU competitiveness, an increase of European export volume, GDP growth, or job creation in the EU. It's macroeconomics.

So, my advice to SMEs and any other industrial partner would be: think of your existing partners, suppliers, and consumers as they might be part of the ecosystem already. If you are working locally with a university or research organization, draw their attention to ECSEL, they might have already a connection to experienced players, insiders. Or simply attend one of the ECS community events and approach your desirable partners, suppliers, or customers directly, face-to-face. If you are a part of their value network and you have something to offer, sooner or later you will find a consortium where your competencies are required.

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Q10. What do you think that ECSEL-JU should do to support further SME engagement?

Recently, the ARTEMIS Industry Association, one of the private members of the ECSEL-JU, has taken part in the fourth Viva Technology conference in Paris. Many small companies and start-ups were interested in what we are up to, and some of them decided to join our association.

Why? I believe that they have understood something important about the dynamics of today's digital, connected world. During VivaTech, Jean-Luc di Paola Galloni, the president of ARTEMIS, took the opportunity and presented main findings of the report, recently released by the association, on trends and challenges in the embedded intelligence sector. In general, the point is that the embedded intelligence is at the very core of the "new industrial revolution", bridging between the world of physical processes and digital services. The study foresees that the value is shifting along the electronics value chain itself: it moves from electronic components towards systems of systems and complex applications. By 2025 the value of the last stages of the chain, which are fully integrated systems and downstream applications, will grow by 22 times while the value of electronic components segment will just double.

I think that this is the opportunity for ECSEL to attract smaller companies. There is a place for dynamic, agile innovators who will play an important role in generating value through applications and solutions developed on top of smart, connected, intelligent systems.

Interestingly, this trend is quite visible nowadays. Large, multinational OEMs are recently more and more interested in SMEs and start-ups that develop value-added services and applications in the last segments of the value chain. The best example is car manufacturers' investments in companies emerging in the field of mobility as a service, car sharing, last-mile logistics, and so on. For instance, in the last two years, BMW has invested in several companies working on carpooling apps, roadside assistance platform, or smart parking solutions.

Q11. What recommendations would you make to the ECSEL-JU for future funding?

From a small enterprise perspective, although probably not only, you need a standard, predictable payment flow. But at the moment, there are significant discrepancies between consortia in how pre-financing and interim payments are done. And I don't mean the procedure of the JU transferring funds to the coordinator, because it is very clearly written in the grant agreement and complied.

We are currently involved in three ECSEL consortia, and the method of disbursement of funds by the coordinator to consortium members was different each time. Sometimes the pre-financing part is retained by the coordinator and paid out after some time. Sometimes the advance payment quote transferred to partners is lower than the quote indicated in the grant agreement. These issues should, of course, be regulated by the project consortium agreement. However, the final document is usually negotiated already in the course of the project. It could be that this process will last even until the end of the first year of the project, or even longer.

As said before, I am aware that it's not up to ECSEL to intervene because it is the internal issue of each consortium. Nonetheless, it would be worth looking at this issue and maybe proposing some good practices, in particular regarding payment planning and timely notification to consortium members. The thing is that for SMEs, in particular, delays, and unclarity about payment process might be severe as it affects budget planning and financial liquidity.

The other thing is how national funding is handled. Last year at EFECS 2018 in Lisbon, I had a pleasure to take part in a panel discussion concerning the situation of SMEs in the ECSEL ecosystem. Among others, we have discussed cases of undefined national budgets. It turned out that in some of the

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consortia under ECSEL, there are partners who learned, once the project was already selected for funding or even already going on, that there will be no national funding in a call that has been just closed! This should be known in advance, prior to the call announcement, because, again – especially for SMEs, preparation of a proposal is a considerable effort and investment.

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