



Future of manufacturing **COMODULE OÜ –** **Value chain case study**

[Born globals and their value chains](#)

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Eurofound reference number: WPFOMEEF18014

Related reports: This case study is one of the seven case studies conducted in the framework of the project Future of Manufacturing in Europe and produced by Kingston University Enterprises Limited and IKEI Research Consultancy S.A.: Blue Ocean Robotics, COMODULE OÜ, Frog Bikes, Graphenea, Khar & Partners, KristallTurm, Reconnect.

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This is a publication from *The Future of Manufacturing in Europe (FOME)* project.

FOME is a Pilot Project proposed by the European Parliament and delegated to Eurofound by the European Commission (DG GROW).

More information on the FOME project, including available and forthcoming publications and events and relevant data can be found on the FOME page of the EUROFOUND website.

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1. General identification of the born global enterprise and the global value chain members

1.1. Description of the born global enterprise: COMODULE

In order to manage over-populated cities and decrease air pollution, using clean forms of transport that would require less space and maintenance is getting increasingly necessary. Light vehicles, particularly electric bikes and scooters, are regarded as one of the possible solutions as they represent a green mode of transport. Electric bikes, in particular, are designed to make travelling more comfortable and keep a healthy lifestyle. However, light electric vehicles need specific ICT solutions, and the born global COMODULE provides them for various international bike and scooter producers.

The four founders of COMODULE first came together in Tallinn University of Technology, Estonia, in the framework of an engineering and product development project called Formula Student. Under the management of Kristjan Maruste (who would have then become the CEO of COMODULE), they developed and built fully electric racing cars and competed against other universities around the world. They proved to be one of the best young automotive engineering teams in the world, ranking in the top five amongst 500 teams globally. From the electric racing car development experience, Mr Maruste started to commercialise the technology by co-founding the company Prismattery OÜ in 2013. The company provided engineering services for electric vehicles and focused on the development of energy storage solutions for electric vehicles and renewable energies. From the clients' feedback, the team developed their current product, connectivity technology, for which they perceived a high potential international commercial success. Similarly, the team found that the market for connectivity technology is much larger compared to markets of electric bikes or scooters. They started developing connectivity solutions for light electric vehicles (a data monitoring platform for electric vehicles) and publicly presented their universal operating system for light electric vehicles (e-bikes and e-scooters) for the first time as a prototype at the Barcelona Mobile World Congress in February 2014. There were about 300 teams competing and the Estonian team under the management of Mr Maruste was among the top six (Brzoska, Online; Nergi, 2016).

In the summer of the same year (2014), the team formally established the Estonian company COMODULE OÜ (NACE code 2651 'Manufacture of instruments and appliances for measuring, testing and navigation'), deciding to focus on only connectivity technology. After the founding of COMODULE, the activity of Prismattery was discontinued. In 2014, the German company COMODULE GmbH was established to focus on international markets and their opportunities, and the COMODULE management restructured the ownership of the companies by transforming the German company into a parent enterprise. Having a German company enabled COMODULE to receive investment from the German public-private venture capital investment fund High-Tech Gründerfonds (henceforth HTGF), the biggest investor into start-ups in Germany. The company established their first contact with HTGF after being admitted into the Berlin business accelerator '[Startupbootcamp Smart Transportation & Energy](#)' (for more information see section 6.2; henceforth Startupbootcamp) and participating in their three-month Startupbootcamp programme. The investment by HTGF made it easier to forge ahead with the hardware and software development, marketing and pitching to potential clients. As a result, COMODULE has become a global, mostly B2B, company headquartered in Berlin (in Germany; with only one sales employee), with a development and engineering office in Tallinn (Estonia). COMODULE GmbH belongs to COMODULE's four Estonian founder members, angel investors (for example, the CEO and owner of AVS Electronics – see section 4.2; 'Startupbootcamp Smart Transportation & Energy' – see section 6.2) and HTGF. More than 70% of COMODULE GmbH belongs to founder members. This structure has developed in the process of finding investors in Western Europe and strengthening COMODULE's position in the international market to overcome the reputational challenges associated with being an Eastern European company, which until then had prevented them from establishing solid business contacts with potential future partners. Additionally, Germany is the main target market for COMODULE in Europe.

COMODULE's product reached its first-end consumer in May 2015 (Brzoska, Online; Nergi, 2016; Startupbootcamp, 2014).

Traditionally, the product value chain between vehicle manufacturers and customers is a one-way street from the component manufacturers to the end user with little understanding of what happens in subsequent steps and vehicle manufacturers have very little contact with the end consumer (manufacturers do not know what customers prefer, or how they use and enjoy their product).

COMODULE is turning this one-way street into a multi-directional highway, allowing the manufacturers to gather user-data as well as data from the dealers (Nergi, 2016).

COMODULE's product is an electric vehicle data monitoring platform that combines hardware and software and allows bike and scooter manufacturers to implement three types of Internet of Things (IoT) solutions for quicker product development, better client engagement and improved riding experience (Nergi, 2016):

1. **Communication Hardware.** COMODULE hardware (a tiny hardware module that is integrated and hidden either inside a bike's frame or in the display) enables control and collection of data on vehicles' technical performance as well as user behaviour, such as battery performance and common journeys, from the vehicle's subsystems.
2. **Smartphone Application.** This allows the user to track the vehicle when it is stolen and provides battery information, navigation, route tracking and real-time support through direct communication with dealers, who get the possibility of substantially growing their inventory by having automatic service notifications as well as updates of new product releases for the users.
3. **Cloud Analytics Platform.** The COMODULE cloud platform is designed for manufacturers to manage warranties, analyse the data of the usage for better product development decisions, update software remotely and engage directly with the customers.

In the beginning, COMODULE's clients used Bluetooth-only solutions, although later they started using connectivity technology platforms that connect light electric vehicles to manufacturers as well. Producers are not the only customers of COMODULE; for example, in spring 2017 there were negotiations with some companies in European cities to develop free-floating scooter sharing systems.

Moreover, COMODULE is extending its product portfolio. Connected Display, designed for e-bikes is the first in its product family called 'Display Family'. The unit gathers data from communication interfaces and connects with the COMODULE smartphone application via Bluetooth connection.

The innovative aspect of COMODULE's product is end-user-driven connectivity. This could be regarded as a further development of the general principle of connectivity that was used already by Tesla Inc., the leading US electric car producer. However, there had been no connectivity technology implemented in case of bikes, and at the moment of presenting COMODULE's product to the public there were only a small number of people in the world who could use such technology. Nowadays, the principle of connectivity is much more commonly used (for example, connectivity between various applications and extensions of Google Chrome, Amazon Alexa, Apple Inc.'s Siri).

COMODULE won international awards that recognised the innovativeness of its product. It received the [Eurobike Gold Award](#) in 2015, the highest recognition a new product can receive in the bike industry, as a result of the partnership with the German-based bicycle manufacturer Coboc. The co-founder and CEO Kristjan Maruste was awarded as one of the top tech entrepreneurs of the future in 2016 (among Forbes 30 under 30) and as one of the top 20 of Europe's most successful entrepreneurs under 30 by one of the leading start-up blogs [EU-Startups](#) in 2017).

Although a business opportunity was behind the creation of the enterprise, there were additional reasons to set up COMODULE: (1) a serious interest of the team in the electric vehicle industry, already during the university period, (2) a sense of mission and challenge to solve a problem in the field of connectivity technology (it is not widely used, not end-user-focused and not implemented in the field of light electric vehicles), and (3) a wish to prove oneself to run a successful business.

COMODULE is cooperating with companies who sell their products and thus pay a licence fee to COMODULE, and with companies who are developing products based on COMODULE's technology (the development of a new product takes up to two years until starting to charge licence fees). In the future, a licence fee for using COMODULE's technology will be the main income source for the company. These are fees for each produced light electric vehicle that has COMODULE's hardware and software or for using COMODULE's software integrated into a producer's hardware. The GSM-based connectivity solution expires one year after the purchase of an e-vehicle and the end users can extend the licence by paying renewal fees directly to COMODULE. This has turned the company partially into a business-to-consumer (B2C) company. COMODULE is working towards further monetisation of business opportunities linked to their product (for example, providing a competitive price of insurance for a bike through the app in cooperation with third companies based on data retrieved through connectivity technology solutions). Other revenue sources are the sale of hardware combined with software (that is followed by paying licence fees) and set up fees (for development work and demo versions, that is, ensuring compatibility of electronic communication, changing firmware codes, logistics, etc.). As of the first quarter 2017, demo integrations, set up fees and licence fees (together with revenue from sale of products) each comprise one-third of the company's revenue. During 2017 the share of licence fees will become dominant as a result of successful sales. All these fees are collected from producers. The Estonian company COMODULE OÜ, where the development team is located, issues invoices for development work. In total, approximately 70% of turnover comes directly through the Estonian company COMODULE OÜ, and the remaining approximately 30% through the company in Germany that is the main market for COMODULE.

In 2016, COMODULE moved from R&D only to product and market development activities. In that year they hired more employees for sales and business development than they did for engineering. Having had 64 business trips, COMODULE signed more than 60 agreements and contracts (that is, on average more than one a week), and 2017 is planned to be a year of mass adoption and production.

COMODULE does not experience any challenges with sales, and it managed to reach full cost coverage in 2016, which was above expectations. In 2016, there was a stable cash flow from business clients. The turnover target for 2017 agreed with investors is €500,000, and agreements signed during the first two months in 2017 are expected to generate half of the agreed sum.

As of spring 2017, the team of COMODULE includes 15 experts in digital media, marketing, wearables, connected vehicle technology, software and hardware development. The field of activities are distributed among the three co-founders and the other employees are organisationally associated with them: Kristjan Maruste is CEO and responsible for hardware and firmware (there are two part-time administrative employees reporting to the CEO), Teet Praks for sales and product development (with one affiliated employee based in Tallinn and another in Berlin), and Heigo Varik for software development. Additionally, Markus Hääl is a technical project manager, responsible for all processes and projects. However, there is no specific structure of the organisation and the responsibilities might change and overlap, as it is common for start-ups. The fourth co-founder left the start-up at the end of 2016 based on mutual agreement because his knowledge and personality traits no longer matched the development of COMODULE. All four co-founders are male and graduated from Estonian universities and three of them studied abroad for a short period (France, Chile and Iceland). Two of the co-founders had previous work experience (one in a large Estonian company and another in an international company). The team members are young (the age of the oldest is 31 in 2017) and consist of mostly male employees (there are only two female employees). The team is international with employees originally from Germany (working in Berlin), Greece and Singapore (there was one person from India who is no longer working in COMODULE).

There is no formalised business strategy as the company is rapidly developing as a start-up enterprise. Although the long-term objectives are clear (not disclosed by the interviewees), the short-term targets set in the business plan for six to twelve months are established at an operational level and have been continuously evolving due to changing market and clients' needs. The business plan itself is drafted by co-founders and, among other aspects, focuses on product development and plans connected to

contract signing with international clients. Between the last quarter of 2016 and the first quarter of 2017, the COMODULE product road map changed 10 times. As of spring 2017, the priority for the company is to get the certificate of [quality management systems standards ISO 9001](#) in order to ensure cooperation with large corporations. The preparation for obtaining ISO certificate documents improved COMODULE's internal processes.

The partners and customers of COMODULE are pioneers and industry leaders from Europe, the USA and Asia. Some of the renowned companies with which COMODULE cooperates are Faraday Bicycles Inc. (USA), Coboc GmbH & Co. KG (Germany) and Ampler Bikes (Estonia).

As stressed by the interviewees, in terms of competitors, there are a couple of other companies who have tried and are trying to develop similar technologies. One of the most well-known is Deutsche Telekom, which saw a huge opportunity in mobile connectivity in the bike sector, but COMODULE as a start-up enterprise gained a competitive advantage by being faster and more flexible compared to the big corporation. The direct competitor globally is E-Social Bike (rebranded as ESB) that has a similar product, but COMODULE has several advantages: their hardware is smaller, their software is more efficient, the whole package consisting of product and related services is more comprehensive, and customer relations are more professional (especially in terms of customer responsiveness). There are other companies that produce products focusing on one of the dimensions of COMODULE's product. Some e-bike manufacturers are also trying to develop similar technologies by themselves, but building a connectivity platform is not their core competence (Nergi, 2016).

1.2. Description of global value chain member 1: Materflow Oy

Materflow Oy was created in July 2013 and is located in the town of Lahti (Finland). Three people founded the company, who are still working in Materflow as a result of performing a task within a university entrepreneurship course. Materflow is an online 3D printing service provider and manufacturer that prototypes, designs, networks, buys and sells custom 3D printed products. There are various services that Materflow provides to its customers: 3D printing service; dyeing of 3D printed products (this is one of the most used additional services and a recent addition to their package of services that proves Materflow's constant development of services); polishing service; replacement parts service (by delivering 3D models of replacement parts to Materflow's product library or making a digital model of any replacement part; bringing those parts on demand to customers' warehouses or straight to customers' clients); design service (approximately 95% of the products are designed by customers); 3D modelling and visualisation service; and micro-seminars (duration is a couple of hours; free of charge; it is meant for companies in order to present possibilities and benefits of 3D printing). The business started with an investment of about €400,000 from a group of 10 investors and the three co-founders (the co-founder's share formed about €70,000 of the whole investment), with the major part of investment for purchasing a 3D printer. (Etelä-Suomen Sanomat, 2014).

According to the interview with the Materflow manager, there are five people (together with the CEO) working in the company and approximately 350 clients in total as of the first quarter of 2017. About 90% of the turnover is from Finnish companies, but the clients include also companies from the Baltic States and other EU countries of the European Union (EU). There is no regular cooperation with companies outside the EU, but Materflow delivers products to some third countries on occasion. Materflow's clients include both small and medium-sized enterprises as well as large engineering companies from various sectors (Etelä-Suomen Sanomat, 2014).

Since obtaining the 3D machine in the first quarter of 2014 and starting the production process, Materflow's revenue has increased by 100% each year, achieving €0.5 million in 2016. The business has been profitable since 2015. Materflow started cooperating with a new, coincidentally found Finnish investor in 2015, a business angel of a start-up community in Finland who invested €100,000 into Materflow. This investment enabled Materflow to extend their production capacities with two new 3D printing machines in December 2016. At the same time, Materflow constantly develops its package of services; during the second quarter of 2017, Materflow should be able to offer different types of polymers and metal 3D printing services to their customers.

The success of the company is based on the low competition of 3D printing in Finland. There are only three suppliers of 3D printed products in Finland and a couple of smaller ones who use small, not industrial type 3D printers.

1.3. Description of global value chain member 2: AVS Electronics (HK) Ltd.

Located in Hong Kong, the business-to-business (B2B) company AVS Electronics (HK) Ltd. was founded in 2008 as a subsidiary to MBV Far East, a leader in healthcare products with the aim to develop and bring unique sport and health lifestyle products to the global market. AVS Electronics focuses on sport-related electronic solutions, telematic applications and consulting and development services for the car electronics/automotive industry. For example, as one of the interviewees pointed out, the CEO and owner of the company as a consultant provides quality control of displays to one well-known international company that produces household appliances. It is managed by a person who has approximately 20 years of experience in electronics and who is the sole owner since 2016.

The products sold by AVS Electronics have been changing over the years. In the beginning, the company sold only GPS navigation products, but during the last few years it has evolved into a converting company, rather than a sourcing company. There are some re-sales of products for some customers when products are slightly modified for example, the customisation of languages or package design, or some changes in the products themselves. Nonetheless, usually AVS Electronics adds some value to their products through cooperation with various companies, and they are developing more own products for the vehicle and e-vehicle industries. Most of their products have originally been designed by AVS Electronics but are sold under their customers' brand name. AVS Electronics tries to focus more on industrial and embedded solutions than on pure consumer electronics because the profit margin in consumer electronics, like notebooks and smartwatches, is very low and AVS Electronics is trying to move away from that kind of business in the coming years.

According to the interview, AVS Electronics has offices in Taiwan, Germany, the UK and China. In total, there are seven regular employees (three of them in Germany, three in the UK and one in Shenzhen) and seven freelancers (in Taiwan and Hong Kong). The Taiwan office is an engineering office, where products are developed, while the offices in Europe are sales marketing and service offices. The software development takes place in Taiwan, China, and Germany. If AVS Electronics cannot manufacture a product in the venture in Shenzhen (China) (AVS Electronics is one of the owners of the factory; the share was not disclosed), it outsources electronics manufacturing services (EMS) to third-party factories.

The company sells the products worldwide and its business is profitable. The major part of the turnover comes from the USA, Germany, and Australia. Other important markets are the UK, Japan, China, Taiwan, Malaysia, Singapore, and Indonesia. In 2016, the turnover was about USD 25 million (approximately €23 million) and there were about 100 different products developed for customers.

2. Internationalisation activities of the interviewed born global enterprise

2.1. Internationalisation activities of the company and start year of internationalisation activities

According to the interviews conducted for this case study, internationalisation activities were undertaken by COMODULE from the start of the activities by presenting its first prototype product in the international event in Barcelona (Spain), subsequent admission into a business accelerator in Berlin (Germany), establishing headquarters in Berlin and searching for the first major investment (received in Germany) (see sections 1.1 and 6.2). COMODULE applied for admittance to two accelerators (Startupbootcamp in Germany and Startup Wise Guys in Estonia) and was accepted to both. The company decided to join the German accelerator as it was focused on transportation and energy and it enabled participation in a three-month programme in the country where most of its clients are located (Startupbootcamp, 2014).

COMODULE's internationalisation process consists of setting production and sales activities in various countries.

The software and hardware development of COMODULE's product takes place in Estonia, but the hardware is produced by subcontractors due to constant business growth and easier expansion capabilities of having no upfront investment costs associated with their own factory. The European COMODULE team is responsible for sales in Europe and the USA. Given the differences between the Asian and European business cultures, for the sales activities in this region the company established an international commercial cooperation with their strategic partner AVS Electronics, located in Taiwan (see sections 1.3 and 4.2). In the USA, some partners input into sales activities by promoting their products based on the COMODULE's technology. Additionally, COMODULE engages in cross-border partnerships by looking for international investors (see section 2.4).

COMODULE provides services for customisation of existing products or their integration to some systems of various companies and public organisations (for example, local municipality) around the world. It sells its products to different companies producing electric bikes and scooters or their parts. By selling products to an international company that might have or could generate cooperation with companies in other countries, COMODULE can gain access to a range of other markets. This is the reason why COMODULE conceptualises its target markets by regions and not countries. Additionally, COMODULE's cloud platform is based on Google's server systems located in the USA.

2.2. Importance of internationalisation activities for the company and main served markets

Internationalisation activities are an integral part of COMODULE's business to get access to foreign direct investments, to produce hardware cost-effectively and quickly, to reach its customers located around the world and to implement effective sales projects. COMODULE is integrated into international activities on a daily basis, and its present business model is sustainable only in the international context, mostly because of the markets' sizes. The main served markets for COMODULE are Europe, by focusing on German electric bike producers (more than 90% of the revenue comes from Europe), and Northern America. There is a strategic plan to develop its activities in Asia as well; as of spring 2017 there are two clients in Taiwan who sell light electric vehicles to Europe. COMODULE is constantly developing its strategic alliances, partnerships and cooperation networks.

2.3. Reasons to go international and for the specific target market selection

The co-founders acknowledged from the start that there was nearly a non-existent local market for their product in Estonia (electric bikes in Estonia are not popular because of their high price of €2,000–€3,000), so it was essential to engage internationally.

While China produces 41 out of the 47–49 million electric bikes produced in the world yearly, Chinese e-bikes are very simple and therefore China is not a target market for COMODULE whose product is regarded as a premium product for wealthier customers. The largest number of e-bikes among other countries is produced in Germany with companies selling their products around Europe, and this was one of the reasons to set up its headquarters in this European country (see section 1.1). Other target markets for COMODULE are inevitably defined by the sales of electric bikes and established partnerships with electric bikes and scooter producers.

2.4. Main obstacles/challenges to engage in internationalisation activities and solutions adopted by the enterprise to solve/face these obstacles/challenges

Legal differences, technical barriers and different business systems in different countries are regarded as dominant challenges for COMODULE.

The main **technical barrier** to engage efficiently in internationalisation activities is related to the different wireless telephone technologies (2G, 3G or 4G) applied in different countries. COMODULE products can be connected only to a 2G network. Therefore, it cannot be sold, for example, to Canada and Hong Kong. As one of the interviewees stated, an updated version of the COMODULE hardware available from mid-April 2017 should be able to connect to a 3G network.

Countries also differ in terms of openness to create partnerships with foreign companies. Asia is a region where these differences are especially visible. Some Asian countries have business systems that are more open to international cooperation (for example, Taiwan) while others are more closed and conservative (for example, Japan).

COMODULE does not expand its business to China that has a **business culture** different from the European one. COMODULE is afraid of possible unfair competition (unlicensed copying of electronic products and selling at much lower prices) and possible obstacles to protect intellectual rights in the Chinese legal environment even being secured by non-disclosure agreements. From COMODULE's perspective, one should prepare thoroughly, find a strong local partner and have a specific business focus in order to enter the Chinese market. COMODULE has its own strategic partner in Asia which represents COMODULE in the whole region.

Legal differences are mainly related to product regulations and standards. The EU positively stands out with its harmonised directives. However, the existence of common regulations might not decrease the complexity to operate in foreign target markets. Certification-related directives and regulations in the EU, and especially in the USA, are interpreted differently in different countries. As the interviewee from AVS Electronics implied, regulations of the electric bicycle and electric scooter industry across countries are different and not unified and regulations of selected regions or countries might not apply to technology used by AVS Electronics. AVS Electronics expects that their customers provide information about regulations and standards regarding products. For example, functional safety is gradually becoming mandatory for light electric vehicles and customers should inform the producer AVS Electronics whether this technology should be considered and thus tested. However, as the development of the light electric vehicle industry is faster than amendments of legal acts and customers might not have dealt with connectivity technology before, AVS Electronics might take an active role and advice their customers on regulative requirements during the process of product development.

Another obstacle is related to the **small size of the home market** in Estonia that could impede efforts to find national companies to share experiences. For example, COMODULE has to approach local officers and officers of the EU institutions to get information regarding specific certification-related questions.

Moreover, the smallness of the home market appears to be a shortage if a start-up tries to find large-scale investments as venture capital investments are rather limited in a small country (that is, limited **access to finance**). Thus, in order to further develop the company (including finding more employees and covering certification costs), COMODULE is looking for international investors through personal

contacts and their wide business network, mostly through HTGF. COMODULE with its B2B model and resulting longer business cycle is not attractive for traditional venture capital funds; more productive cooperation is expected with institutionalised funds that invest large companies' capital (for example, funds of one Austrian industrial group and one Norwegian hydroelectricity producer). As stated by the interviewee of AVS Electronics, which is one of the investors in COMODULE, the support of COMODULE by their shareholders and investors will continue in their transition period to a company with stable cash flow because of their unique technology.

According to the interviewees, there are other obstacles for COMODULE to engage in internationalisation activities, related to **administrative issues** and **bureaucracy**. Applications for state support are regarded by start-up companies as too slow. Due to constant rapid changes of the context, start-ups often need a much faster access to financial support. The same is observed in relation to some instruments funded by the EU (such as the [SME Instrument](#) and [venture capital funds-of-funds](#)), where a born global would need to prepare an extensive documentation or proceed through multiple meetings (conversely, a much better decision process is organised in case of [European Angels Fund](#)). As a result, EU grants tend to favour so-called 'good writers' of projects which support a new market for consultancy companies instead of those which have good ideas.

COMODULE also perceives three main internal obstacles. First, the company would be able to develop technology and its products more quickly and generate more sales if it had more employees (that is, **human resources** related internal obstacle). Therefore, COMODULE is looking to raise business finance as discussed above.

Another, although less significant, challenge that is common for B2B industrial companies is a **long sales cycle**: in the case of COMODULE it takes about two years before partners' products equipped with COMODULE's technology and/or parts are sold to individual consumers, generating cash flows. Therefore, initial investments are essential for born globals in their first operating years.

Additionally, COMODULE is in the process of patenting one part of their innovative connectivity technology in order to raise the interest of potential investors and credibility in cooperation with large companies. However, the process of obtaining the grant of a patent turns to be a complex issue as there is a range of **patented solutions that overlap** with COMODULE's solution (for example, radio wave based communication of a bicycle). However, a patent is not a priority for COMODULE because technology develops rapidly and the company is focusing its efforts on providing a competitive package of its product and associated services. Therefore, COMODULE handed over the patenting issue to a patent attorney.

3. Global value chains of the born global enterprise

3.1. Identification of global value chain(s) in which the interviewed enterprise participates

COMODULE is a B2B company and its role is twofold: it is a client when COMODULE subcontracts other companies to produce hardware of its product (that is, ‘upstream’ value chain by participating in global value chains of other companies) and a supplier when COMODULE sells its products to other companies and provides development services (that is, ‘downstream’ value chain by having its own value chain).

Within its value chain, COMODULE focuses on component suppliers (drivetrains, batteries, displays), like Materflow and AVS Electronics (see section 4.2), and vehicle manufacturers (bicycles, electric bikes and scooters).

3.2. Main roles/tasks of the born global enterprise and its partners, fields of activity and governance issues

While hardware production and production of prototypes are subcontracted by COMODULE, the development of hardware, its design, software, smartphone applications, cloud analytics platforms and its front end, also prototypes (for example, prototypes of waterproof and vibration resistant cases for hardware installed on scooters) and marketing materials are carried out by COMODULE’s team itself. COMODULE’s team also takes care of development of customer services. However, while Android-based software is developed by COMODULE itself, iOS-based software development is subcontracted to a freelancer who is located in Estonia and will become part of COMODULE’s team in June 2017.

The location of the production activities depends on the location of the production of the final products, the number of units to be produced, objectives of further activities, and the location cooperation partners. International partners of the ‘upstream’ value chain are located in Estonia, Finland and Asia (production in China and Taiwan through its strategic partner in Asia, AVS Electronics), whereas partners of the ‘downstream’ value chain are located in Europe, Northern America, and Asia. For example, the Estonian company Tradex AS (100% Estonian capital based company that provides clients with electronic equipment manufacturing services, from prototype to mass production) produces COMODULE’s hardware for the Estonian electric bike producer Ampler Bikes, whereas one of the components is in turn subcontracted to Brander PCB OÜ, also located in Estonia. The mass production of displays for light electric vehicles will begin in the near future in Taiwan, but the prototypes have been produced by the Finnish partner Materflow Oy (see sections 1.2 and 4.2). In the case of small series of displays, the hardware is produced by an Estonian company, the plastic part of displays is produced by Materflow Oy, and screens by AVS Electronics in Taiwan.

While the cooperation with ‘downstream’ value chain partners is formalised in form of agreements (that prescribe the conditions of licence payments, among other aspects), in the case of ‘upstream’ value chain partners, the cooperation is informal and financial duties are processed based on invoices.

4. Cooperation between the born global and its selected international partners in value chains

4.1. Brief history of the cooperation(s) and reasons for initiating these cooperation(s)

COMODULE initiated the cooperation with Materflow in February 2016, having found Materflow via Google search. The CEO of COMODULE contacted Materflow by email. The reason for initiating cooperation was the absence of companies in the Baltic States that could supply large amounts of 3D printed parts at a competitive price. Local 3D printing organisations request a too high price for the same work (for example, Tallinn University of Technology quoted €100 for one piece and Materflow €15 for the same product unit due to the scale effects in Materflow). Materflow could also deliver the same number of products faster compared to other European competitors with the same price.

A mentor of Startupbootcamp (not COMODULE's mentor) organised the initial contact between COMODULE and AVS Electronics in 2015. The mentor was a friend of the CEO and owner of AVS Electronics. The CEOs of both companies met in Berlin two months after they were introduced. It was an opportunity for AVS Electronics to diversify its package of products and for COMODULE to expand its business to new target markets in Asia. Importantly, one of the major reasons why COMODULE wanted to cooperate with AVS Electronics was a plan to integrate COMODULE's technology into displays produced by AVS Electronics for scooters.

4.2. Roles/tasks/activities carried out by the born global and the selected partner(s) within the value chain and role of ICT and logistics services in sustaining the cooperation

Materflow as a 3D printing manufacturer produces various mechanically durable parts for COMODULE: mostly prototypes (for example, two or three prototypes of displays for testing on the final product before mass production) and sometimes also small series of parts. COMODULE also orders some post-processing services from Materflow, like polishing, colouring, dyeing, and different types surface treatments of the parts.

Materflow's uniqueness is related to low prices, high quality production and geographic proximity to the COMODULE development team in Estonia, which enables quick delivery of the requested prototypes. Moreover, there are only a few companies that offer post-processing services in the 3D printing industry in Finland. However, Materflow's services are used only in case of production of up to 100 units because traditional production of a larger number of products is more cost-efficient. COMODULE has not yet investigated whether there are some 3D printing manufacturers which could produce more than 100 units of a product at a lower price compared to traditional production technology.

Communication between COMODULE and Materflow is mostly email based, with some communication by phone. The first face-to-face meeting took place in April 2017.

AVS Electronics as a strategic partner of COMODULE is an international production value chain partner in Asia whose responsibility is organising all the needed activities, especially production in the Asian market, and also acting as an official contact of COMODULE in the region. This means that AVS Electronics is responsible for negotiations and network development with Asian companies. AVS Electronics' CEO has a wide contact network in the electronics industry, in Asia particularly, and specific knowledge about the Asian market and various legal and technological requirements of local markets (for example, import and export restrictions).

COMODULE and AVS Electronics do not trade any final products with each other. All products are jointly developed using knowledge of both parties. The major role of AVS Electronics is the production of hardware for COMODULE's product to be integrated with software and then sold or licenced to electric bike and scooter producers, sometimes also to regular bike manufacturers.

Additionally, AVS Electronics produces some parts that are meant not only for the Asian market, for example, screens for displays. ‘Display Family’ (see section 1.1) is a joint product development of the two companies: COMODULE is responsible for software, connectivity and design, and AVS Electronics is responsible for the production of hardware parts of displays. AVS Electronics also provides some consultations about the Asian market to COMODULE and overall support in the context of Asia (free of charge as a strategic partner based on mutual beneficial interests).

COMODULE is unique for AVS Electronics in terms of producing an innovative product that is used in production activities in the Asian market and cannot be replaced by any possible competitor. Uniqueness of cooperation between the two companies is perceived through a transparent and fair partnership. Importantly, AVS Electronics’ investment of €100,000 into COMODULE in summer 2016 fostered their partnership. The aim of the investment was to tighten the mutually beneficial strategic cooperation in the long term (see also section 6.2). COMODULE was looking for investors at that moment, and AVS Electronics was interested in ensuring a long-term partnership with the company producing innovative products.

The Internet is also the main means of communication between the CEO and sales manager of COMODULE (or sometimes project manager concerning supply chain questions) and the CEO of AVS Electronics: emails, Skype, WhatsApp, but also phone calls on occasion are used in communication. As the partnership between COMODULE and AVS Electronics is strategic, CEOs or other employees meet face-to-face regularly (every two to three months), either in Europe (mostly Berlin or Estonia) or in Asia to discuss current topics, including participation in various Asian tradeshows. Joint projects might force communication on a daily basis between employees of both companies who might talk together to their customers on conference calls.

4.3. Governance issues and formalisation of the cooperation

The cooperation with Materflow is not formalised. It is based on submitting orders and issuing invoices to be paid by COMODULE. Materflow’s production and engineering manager and sales manager are responsible for maintaining cooperation with COMODULE. COMODULE, which submits orders to Materflow, dominates the relationship between the two parties. However, Materflow contributes to their beneficial cooperation with its effective and efficient work and its promotion of new services that potentially meet any specific COMODULE’s needs now or in the future.

The partnership between COMODULE and AVS Electronics itself is not formalised (though there are informal cooperation principles), except the investment contract (see section 4.2). As regards the product development, in most of cases there is an agreement between three parties: COMODULE, AVS Electronics and the customer, meaning that both COMODULE and AVS Electronics work together to meet customers’ needs. Regarding the invoices, if the customer is located in Asia, then most of the invoicing goes through AVS Electronics. The relationship between the two companies is balanced and the power relationship is equivalent, though COMODULE is more active in enhancing the cooperation as AVS Electronics has many other different customers, investments, and projects. The CEOs of both companies are responsible for coordinating the partnership.

4.4. Evolution of the cooperation over time

As perceived by the interviewee from Materflow, COMODULE has been more active during the third quarter 2016 and first quarter 2017 than previously. The number of orders is increasing. As the period of cooperation has been short, that is, a little more than one year as of spring 2017, there have been no observable changes in the cooperation. However, in April 2017 there was a discussion between COMODULE and Materflow about producing prototypes with stereolithography, which is a 3D-printing technology for producing more accurate parts. The cooperation proved to be effective and COMODULE is satisfied with their customer service communication, their professionalism, quality of materials, price level, and flexibility in terms of paying invoices.

The partnership between COMODULE and AVS Electronics started slowly but then became relatively successful, resulting in finding different cooperation possibilities. As a result, the partnership has

proved to be mutually beneficial and sustainable. A significant change in the partnership was a small, but for AVS Electronics strategic, investment into COMODULE in summer 2016 (see section 4.2) that changed the role of AVS Electronics from partner to investor and that facilitates their long-term strategic cooperation (for example, more effective communication and problem solving regarding manufacturing processes). Eventually, successful cooperation enabled the co-development of products for all COMODULE's current and potential markets, and not only for the Asian market (see section 4.2).

4.5. Results of the international cooperation for the different enterprises

For COMODULE, the cooperation with Materflow resulted in an improved quality of prototypes that at least improved customers' first impression about their products. With its high quality of work, and fast and efficient customer service, Materflow indirectly supports COMODULE's sales.

COMODULE's improved position in Asian markets and production of products for the needs of Asian markets are supported by local activities of AVS Electronics. Having one strong strategic manufacturing and sales partner in Asia, COMODULE has no obstacles to enter any Asian market and can rely on AVS Electronics in international activities. In one occasion AVS Electronics managed the production of COMODULE's technology in mainland China and supported COMODULE in sales activities to a Danish company. AVS Electronics has proved to be good in producing hardware and display technologies for e-bikes or scooters or other products, while COMODULE is highly competent in software and some hardware design. Capitalisation on the knowledge of producing displays by AVS Electronics allowed COMODULE to jointly develop with them a new type of display for electric bikes and scooters and thereby to find new customers who have already placed orders.

For Materflow, COMODULE was the start of business in Estonia that motivated Materflow to commission a research about business opportunities in the Baltic countries and Poland. Materflow's own preliminary investigation showed a huge potential for their 3D printing business in the Baltic countries mainly because of a small number of competitors. In addition to getting some contacts from COMODULE, the feedback from its Estonian partner about the produced items contributes to constant improvement of Materflow's business activities. This feedback helps to develop the company in a direction where Materflow can serve more companies on the international market. No impact of the cooperation with COMODULE on employment-related results is perceived by Materflow. The share of COMODULE in the total number of orders is much less than 1%.

As AVS Electronics is interested in developing its company as a converting, not a sourcing company, COMODULE facilitated such conversion mainly through joint product development activities. Moreover, the partnership with COMODULE enabled acquiring new knowledge about IoT technologies in the bicycle industry and consequently allows setting the industry trend with joint efforts. Now AVS Electronics has to employ more people to realise joint projects (for example, new employees will be hired in design in Taiwan and in a factory in Shenzhen in China) and to extend the production line of the factory to be able to produce the products for COMODULE. Additionally, AVS Electronics received some first contacts in Europe through COMODULE; the same vice versa in Asia.

5. Main obstacles/challenges to engage in international cooperation activities

5.1. External/internal-to-the company barriers/obstacles

Based on the interviewees conducted for this study, no specific internal barriers could be identified for COMODULE, except limited human resources (see section 2.4).

The following external obstacles to engage in international cooperation activities are perceived by COMODULE:

1. The main obstacles for COMODULE to cooperate internationally are manufacturing costs and production time within COMODULE's supply chain. To meet its customers' needs, COMODULE promises to deliver within three months after the order placement.
2. Large international companies have a high potential for born globals to increase sales. The negotiation process with traditional large international companies operating for a long period is much more complicated and time-consuming because of bureaucracy and corporate business traditions (for example, it is hard to explain why the change of technology is good). It might take, for example, more than one and a half years to reach a partnership agreement with an established company compared to two weeks with a relatively new company.
3. A negative image of Eastern European countries in the minds of Western European business people (however, smaller Western Europe countries are more open compared to large countries), who often perceive the former Soviet markets of Eastern Europe as being less developed and using old technology which might impede negotiations between companies (see section 7.2 about the image of Estonia as a technologically advanced country).

As an interviewee from Materflow stated, there are neither external nor internal obstacles for the company to engage in international activities. A more extensive exchange of information about business activities of both companies (for example, any specific information related to new or modified products) could generate more mutually beneficial cooperation with COMODULE.

There are several obstacles for AVS Electronics to engage in international cooperation activities and they are related to:

1. Regulations. There are too many regulations in Europe, which are considered complicated for users (for example, whether some specific requirement is mandatory or recommended). Additionally, it is not easy to find whether an EU regulation is adopted in all EU member states. AVS Electronics faces this obstacle almost every day.
2. Access to information about legal issues, including the ones related to product regulations.
3. Access to finance, especially in the context of the German office that is operating as a start-up company and sells various technological solutions for hotels. Banks avoid supporting start-up enterprises. It took approximately two years to get a credit from a bank.

5.2. Solutions adopted by enterprise to solve/face these obstacles/challenges

COMODULE adopts various relevant solutions to solve the obstacles mentioned in the previous subsection.

1. COMODULE always tries to ask for price offers from multiple companies. In case the manufacturing partner cannot commit to COMODULE's order by the requested shipping deadline, COMODULE tries to explain their needs and expectations with reasons behind it and through a negotiation process aims to reach a compromise with a manufacturer.
2. COMODULE is targeted to changing transportation patterns in the world and aware that traditional companies operating for a long period have a great potential to contribute to the diffusion of COMODULE's innovative technology. As such, COMODULE is ready to invest time into negotiation processes with such companies and tries to deliver relevant information to each more efficiently. Additionally, the Forbes '30 under 30' award to the CEO of

COMODULE enabled the company to increase the credibility in minds of large companies with a traditional business approach.

3. State institutions try to position Estonia as a technology-advanced country to strengthen the position of Estonia in the international market and to change the perception of Estonia as being part of Eastern Europe with its relatively negative image. However, the change of the country image is a long-term process. Therefore, COMODULE has established its headquarters in Germany. COMODULE always mentions that the development and engineering work is conducted in Estonia. Moreover, COMODULE discovered that the best strategy is to get a customer to visit them in Tallinn. Visits to Estonia have a very positive impact on a customer because of their low pre-visit expectations.

To serve possible interests of all its customers, Materflow is trying to improve the quality of the information about their services on its webpage by mid-2017. This pertains mostly to the availability of information about extra services (for example, different types of post-processing and painting) and an online calculator for 3D printed parts.

AVS Electronics tries to familiarise itself more thoroughly with the EU directives and regulations of other countries, as they consider professional legal advice too expensive on average to be used. Experiencing limited access to finance, especially in the context of Europe, AVS Electronics uses funding provided by business angels and existing investors.

6. External sources of support as regards internationalisation and international cooperation

6.1. Main identified needs for external support

COMODULE and Materflow have two similar types of needs to support their internationalisation and international cooperation:

1. Access to finance:
 - a. For COMODULE to develop products and grow business;
 - b. For Materflow to purchase mainly new 3D printing machines.
2. Assistance and advice:
 - a. For COMODULE together with the need for facilitating business cooperation and networking with international partners in order to support various internationalisation and international cooperation activities;
 - b. For Materflow together with the need for consultancy services on various issues regarding internationalisation and international cooperation activities, including: information on country/sectors/rules and regulations/procedures/trade barriers; identification of international potential of products/services, information on market opportunities; search and identification of potential foreign suppliers and business partners; facilitation of business cooperation and networking activities with international partners.

Additionally, Materflow has two further needs for support:

1. Legal advice to be sure that the company meets all requirements of legal acts in various countries to enter new markets.
2. Support for protecting intellectual property rights.

The interviewee from AVS Electronics stated that it is easy to open and run a company in Hong Kong, without any restrictions to cooperate with international companies. Additionally, as tax rates are low in Hong Kong, there is little governmental support for business. Given such context, there are few identified needs of external support for AVS Electronics: legal advice on foreign market restrictions and financial support for participation in trade fairs.

6.2. Use of external support by the enterprises

COMODULE and Materflow have benefitted from various external support measures for their internationalisation and international cooperation activities. One of the major types of support needs pertains to **access to finance**.

COMODULE, [Startupbootcamp](#), funding: Funding from Startupbootcamp in August 2014 (the amount was not disclosed; see ‘COMODULE, Startupbootcamp, accelerator programme’ below; the information was taken from the website of Amcham Finland).

COMODULE, business angels: Financial support from Estonian and German business angels in the beginning of COMODULE’s business activities (November 2014) and before receiving funding from HTGF. Business angels were found through personal contact networks (except one of them, which was through Startupbootcamp).

COMODULE, [HTGF](#): The first significant investment of €500,000 in June 2015 from the German public-private venture capital investment fund HTGF, which is the largest investor into start-ups in Germany. An investment manager is appointed for each company that receives an investment from HTGF. There is a constant communication with the manager and other professionals; COMODULE presents its monthly report on the state of the company’s affairs and receives feedback. Thus, though access to finance is the main objective of this external measure, it provides also opportunities of extending **business networks** and receiving **assistance and advice** for start-ups’ internationalisation from HTGF’s professionals.

COMODULE, an investment round: An investment round in October 2016 by HTGF, AVS Electronics and two business angels (personal acquaintances of COMODULE's CEO; Americans who now live in Europe). The amount of investment was not disclosed.

COMODULE, 'a series A round': COMODULE is preparing for the first significant round of venture capital financing, so-called 'a series A round', for an amount of €2 to €3 million. As it is hard to find an investment of more than €1 million in Estonia (see section 2.4), COMODULE is trying to secure funding from abroad.

Materflow, [ELY-keskus](#): Investment into two new 3D printing machines in December 2016 through the local ELY-keskus (the Centres for Economic Development, Transport and the Environment that are responsible for the regional implementation and development tasks of the central government in Finland). The policy measure Business Development Support (in Finnish) (*Toimintaympäristön kehittämisavustus*) covered 20% of the costs; 80% was covered by Materflow's own capital (through a €100,000 investment based on the cooperation with a business angel in 2015 – see section 1.2).

Two other important types of support needs are the **facilitation of business cooperation and networking activities with international partners**, as well as **assistance and advice and consultancy services on internationalisation issues**. Each source of support provides both types of external support for COMODULE.

COMODULE, Startupbootcamp, accelerator programme: In 2014, COMODULE was admitted into Startupbootcamp and the company participated in a [three-month accelerator programme](#) that among others enabled COMODULE to receive mentoring from business and technology specialists and funding for product development, and find first customers. As this accelerator is one of the COMODULE's shareholders, COMODULE is entitled to approach the accelerator's professionals for consultations.

COMODULE, [Climate-KIC Start-Ups Acceleration Programme](#): Participation in the stage 2 'Validation' and the stage 3 'Delivery' (in total 12 months) of the Climate-KIC Start-Ups Acceleration Programme starting from April 2015 in Germany. As stated on the Climate-KIC Accelerator's website, this is the only EU acceleration programme focused on climate impact by cleantech commercialisation. Two co-founders participated in the programme and each received a scholarship of €1,400 per month during six months within stage 2 for verifying business assumptions by focusing on developing products and talking to customers and €4,000 for service outsourcing to support starting business activities. COMODULE spent €4,000 on creating a corporate visual identity and a website.

COMODULE, start-up ecosystems: Events and communication within the Estonian and German and other start-up ecosystems (for example, the annual conference Latitude59 in Estonia; getting advice and sharing experience with start-up ecosystem actors, including other enterprises, such as in the Tallinn Science Park Tehnopol; various events like [Capital on Stage event](#) in Germany where venture capital funds present themselves; Germany's leading start-up conference [HTGF Family Day 2017](#); and Barcelona International Motor Show 'AUTOMOBILE BARCELONA' with a focus on connected vehicles in 2017). The Estonian start-up ecosystem is developed within the activities of the Estonian policy measure Startup Estonia (a governmental programme for developing: (1) an ecosystem of start-ups aimed at increasing the potential for entrepreneurship in people so that start-ups would be established, and their team, product, customer and business model developed as a whole, and (2) a financing model for start-ups that would help them become successful – as presented by the Ministry of Economic Affairs and Communications).

As it can be concluded based on the interview with the manager from Materflow, alongside the need for **assistance and advice, and consultancy services on various issues**, the company also needs support in the form of information on country/sectors/rules and regulations/ procedures/trade barriers; identification of international potential of products/services, information on market opportunities; search and identification of potential foreign suppliers and business partners; and facilitation of business cooperation and networking activities with international partners.

Materflow, Tekes: Funding to develop the company from one of the Finnish innovation funds (the most important publicly funded expert organisation for financing research, development and innovation in Finland) by carrying out a market research about the potential of Materflow's business (focusing on the Baltic countries and Poland), making a survey among current and new customers, a plan for international growth, etc. The service name is [Tempo](#); the project budget is €50,000 and approximately 10%–20% is covered by Tekes. Activities were conducted by an external company starting from late 2016 and finished by the end of May 2017.

Materflow, LADEC: Cooperation with professional advisers of Lahti Region Development LADEC Ltd (original name *Lahden Seudun Kehitys LADEC Oy*; an organisation that develops the business conditions, competitiveness and attractiveness in the Lahti region by providing services for individuals starting up business, existing companies to develop, to grow and to internationalise and helping companies to relocate in the Lahti region). A membership fee gives access to the expert knowledge of LADEC. Materflow engages in LADEC's activities on average once every two to three months (for example, participation in conferences and seminars; cooperation in the organisation of an educational programme on 3D printing by Materflow).

There are other sources of support identified based on the interviews with COMODULE and Materflow conducted for this case study.

Expert knowledge of business angels connected with born globals themselves: Born globals use expert knowledge of business angels who are the company's investors and management board members (for example, one of the COMODULE's investors helps to build up the company's financial system). Materflow communicates with various board members approximately once every two weeks in addition to a regular board meeting on a monthly basis.

Private companies' services: Born globals do not rely solely on external support measures and undertake other necessary activities to support their internationalisation and international activities, including using private companies' services. For example, in addition to the 'Innovation voucher' (see below), COMODULE participated in the certification training of the private company [Bureau Veritas \(in Estonian\)](#), a global leader in testing, inspection and certification. Materflow uses advisers from private companies of various industries and fields with working experience of 20 years and more to help the management board with general issues and to engage in international activities. The selection of acclaimed advisers depends on the topic of the issue. Lawyers from law offices help Materflow analyse foreign market requirements of present and future target markets. However, private companies might help born globals free of charge. For example, COMODULE occasionally cooperated with another company to receive feedback on a smartphone application through voluntary control testing.

Intellectual Property Rights, COMODULE: COMODULE would like to patent one product and the company received funding through the [Innovation voucher](#) from Enterprise Estonia (EAS), which is the national institution for providing financial support counselling, cooperation opportunities and training for entrepreneurs, research institutions, the public and non-profit sectors. The Innovation voucher offers a small grant to be used for conducting patent-related research; the patent is not yet registered.

AVS Electronics is using only one external source of support to engage in international activities by getting compensation of about 50% of the costs of participating in the [Hong Kong Electronic Fair](#) (that is, **participation in trade fairs** as a type of the external sources of support). Funding is provided by the Hong Kong Trade Development Council (HKTDC), a statutory body dedicated to promoting Hong Kong trade by exploring opportunities for Hong Kong companies, especially SMEs and connecting them with business partners around the world. In general, AVS Electronics tries to support its internationalisation and international activities with its own knowledge and efforts and on occasion uses external legal services.

Moreover, COMODULE considers that there is a positive impact of the image of Estonia as a technologically advanced country on COMODULE. For example, a smartphone application was required as a precondition for registration for the international contest '2014 Barcelona Mobile World

Congress'. Not having a ready smartphone application, COMODULE committed to develop it within the two weeks before the event. An exception was made for this team from Estonia and COMODULE was accepted to the international contest.

6.3. Assessment of this external policy support

COMODULE expressed satisfaction with the services that helped and is helping COMODULE to facilitate international cooperation and extend its business network, especially receiving help from Estonian start-up ecosystem. Though capital available through business angels is not significant, they provide valuable consultations and help if needed. As the interviewees pointed out, COMODULE highly values the experiences of using services of the business accelerator Startupbootcamp by having received professional advice, feedback on all aspects of its business and knowledge about various types of financing and financing methods during its early stage of business (Startupbootcamp, 2014). Though the process of applying for funding from HTGF was stressful with some rounds of investment committees, this first significant investment in COMODULE is considered by the company as the most important external source of support. HTGF's investment enabled the company to hire a sufficient number of new employees to further develop the product. COMODULE considers HTGF as one of the most efficient tools for the distribution of governmental help through a very professional venture capital organisation.

One of the missing support measures from the perspective of COMODULE is legal advice (see section 6.1). It is complicated to understand the requirements of EU directives and consultancy services might be too expensive for start-ups. Support in the form of legal advice on foreign market regulations is perceived to be missing also for AVS Electronics.

From COMODULE's perspective, it is necessary to develop the start-up ecosystem in Estonia to make it more attractive for start-ups (for example, by inviting international guests to present their success stories, including the ways their projects were funded). As one of the interviewees pointed out, the services of EAS (which provided financing for COMODULE's patent research activities) are generally not perceived as relevant enough for start-ups as they are designed to support specific activities rather than to fund overall activities related to product and team development. Therefore, start-ups prefer using venture capital financing. As it is hard for start-ups to find investments in the amount of more than €1 million in Estonia, COMODULE suggested to facilitate the availability of venture capital funds in Estonia.

The interviewee from Materflow expressed satisfaction with external sources of support they use. However, in case of services by ELY-keskus, it was felt that their decisions to support business should be based on the knowledge of research studies and/or expert knowledge. Materflow did not get funding from ELY-keskus for their first application in 2014 based on the assessment that supporting 3D printing services is not 'a good investment'. Materflow's second application was approved, and from Materflow's perspective, the recognised potential of 3D printing at the moment of application processing helped Materflow to receive support from ELY-keskus. ELY-keskus' policy measure 'Business Development Support' enables businesses to significantly expand business and increase the turnover (as in the case of Materflow; see section 1.2) by applying for grants for those business activities that are perceived important by the enterprise. Tekes' policy measure 'Tempo' is found to be attractive for rapidly growing companies and valuable in terms of a wide range of eligible activities. A LADEC's varied calendar of events enables its members to actively participate in activities of the start-up ecosystem community and expand business networks. The combination of other minor external sources of support (for example, expert knowledge of business angels who are members of the company's management board, advisers from private companies of various industries, and legal outsourcing) might be regarded as an effective triangulation of available sources of expert information to facilitate Materflow's internationalisation and international activities.

In the context of minimal intervention by the state, AVS Electronics regards the financial support by the Hong Kong Trade Development Council effective and valuable for the company's needs.

7. Concluding remarks

7.1. Future plans regarding internationalisation and international cooperation

COMODULE plans to extend its international activities and products to support emissionless (that is, emission-free or zero-emission) transport and make IoT platforms available for all electric vehicles (whereas specific services might be developed by business partners, for example, to develop health care services for bikes used by older people, including an emergency call in case of an accident). One possible further product development activity is to empower the company's aftermarket strategy by developing parts of the software and cloud platform of the current product as an autonomous product.

COMODULE's product development is also targeted towards co-creating in the near and far future. In 2015, at the world's leading trade fair for the cycling industry Eurobike in Germany, COMODULE showed a smartphone-controlled, three-wheeled e-bike prototype. Such a vehicle could be utilised in the near future, such as using it as an autonomous bicycle to accompany postal service workers on deliveries, or attaching a rubbish bin to the front to help park cleaners. There are also more ambitious uses envisaged for further down the line, such as autonomous deliveries in urban areas (Wood, 2015).

The production of e-bikes by COMODULE itself has been discussed by the team several times.

Though the company would like to focus its efforts on developing technology, COMODULE does not exclude the possibility of own e-bike production in the future. The same pertains to all other various types of e-transport solutions.

COMODULE tries to attract investors to grow its business, including product development (also regarding development of the second and third type of displays) and enabling large-scale production.

Materflow is trying to leverage its customer base by expanding international activities in the Baltics and Poland, and other European markets. Materflow has noticed and increased demand for 3D-printed products in all of the target markets. In 2017 the company was making plans for further investments in new industrial scale 3D-printers. Customer-driven demand requires bigger production capacity, and is expected to double Materflow's annual turnover.

In addition to replacing some not profitable businesses and looking for companies in different industries to make investments (COMODULE is possibly one of them), AVS Electronics considers the cooperation with COMODULE successful in the long run because of positive future prospects of the e-mobility industry. One of the ways of increasing the cooperation with COMODULE in the nearest future, as perceived by the interviewee AVS Electronics, is joint participation in trade fairs.

7.2. Lessons learned and conclusions

The following success factors are regarded as underpinning COMODULE's internationalisation and international cooperation activities:

1. Innovativeness of the product (especially being connected to rapidly increasing target markets, for example, 30% of increase in the e-bike industry in 2016 in Germany, whereas some e-bike markets, like Northern America, Australia, South-East Asia, are still emerging);
2. Participation in international competitions to increase the visibility, foster good reputation and prove its innovativeness for enabling subsequent access to finance (for example, the 2014 Barcelona Mobile World Congress and the international award Eurobike Gold Award);
3. Development of strong business networks (for example, AVS Electronics as a strategic partner in the Asian markets);
4. Effective context-specific exploitation of international cooperation networks (for example, cooperation with a range of companies to enable integrating local SIM cards for the product in India where foreign SIM cards could be used only up to three months and a foreign company cannot purchase local SIM cards);
5. Focus on core activities (developing connectivity technology and, for example, not producing e-bikes at least during first business operating years);

6. Ability to effectively cooperate with others (for example, reaching a compromise on shipping deadlines); and
7. A strong team consisting of professionals and a charismatic and ambitious CEO.

Another success factor, particularly in the case of start-up enterprises, is flexibility combined with devotion and hard work. Moreover, COMODULE acknowledges a positive impact of the image of Estonia as a technologically advanced country on start-ups (see section 6.2) and positively values the competitive Estonian tax system, the efficient and effective Estonian e-governance services and low level of bureaucracy.

There are positive prospects of using light electric vehicles in the world and in case of COMODULE there is a proven interest of investors towards supporting the development of unique technology. The company predicts higher sales in the near future based on negotiation results with large companies. All these factors allow the conclusion that COMODULE will continue its success in changing the way people move by developing technology for emission-free modes of transport.

References

All Eurofound publications are available at www.eurofound.europa.eu

AVS Electronics (HK) company website, available at <http://www.avs-electronics.com>

LinkedIn, AVS Electronics (HK) Ltd.'s profile, available at <https://www.linkedin.com/company/avs-electronics-hk-ltd/>

ExtraEnergy, *AVS Electronics (HK) Ltd. auf der TBW 2015 – ExtraEnergy*, available at <http://extraenergy.org/main.php?language=de&id=80912> (in German)

Bloomberg, *Company Overview of Prismattery LLC*, available at <https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=268079090>

Maruste K., *Silicon Tallinn: coModule featured in the official magazine of Volkswagen Group*, available at <https://comodule.com/blog/silicon-tallinn-comodule-featured-in-the-official-magazine-of-volkswagen-group> (accessed on 14 November 2018).

F6S Network Limited, *COMODULE - F6S*, available at <https://www.f6s.com/comodule>

LinkedIn, *COMODULE: Overview*, available at <https://www.linkedin.com/company/comodule>

COMODULE company website, available at <http://www.comodule.com/>

Etelä-Suomen Sanomat (2014), *Lahdessa myllyttää 3D-tulostuksen design-yhteisö - ESS.fi*, available at <http://www.ess.fi/uutiset/talous/2014/06/06/lahdessa-myllyttaa-3d-tulostuksen-design-yhteiso> (in Finnish)

EU-Startups.com website, available at <http://www.eu-startups.com/>

Trade with Estonia, *Exporters database - COMODULE OÜ - Trade with Estonia*, available at <https://www.tradewithestonia.com/estonian-export-companies/view/6734/comodule-o>

IDTechEx Ltd, *Future of light electric vehicles: Connected & autonomous*, available at <http://www.idtechex.com/electric-vehicles-usa/show/en/previous-speakers/7676/future-of-light-electric-vehicles-connected-and-autonomous>

Materflow Oy company website, available at <http://www.materflow.com/en>


Nergi, A.-M., *Life in Estonia (2016), coModule brings Tesla Grade Connectivity to Light Electric Vehicles*, available at https://issuu.com/eas-estonia/docs/lie_spring_2016_issuu/36

Startupbootcamp (2014), *Interview with Kristjan Maruste of coModule – Startupbootcamp*, available at <https://www.startupbootcamp.org/blog/2014/08/interview-with-kristyan-maruste-of-comodule>

Wood, C., *New Atlas (2015), CoModule shows autonomous e-bike concept at Eurobike*, available at <http://newatlas.com/comodule-automated-e-bike-eurobike/39160/>

All accessed on 16 October 2018.

WPFOMEEF18014



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