



Business Innovation Observatory



Smart Factories

Smart process applications

Case study 25

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Smart process applications

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1. Executive summary

Smart Factories are recognised as fundamental to the future of competitive manufacturing in Europe. The capacity of companies in Europe to competitively produce high quality products depends on their ability to incorporate state-of-the-art ICT solutions in their manufacturing plants. Smart Process Applications offer such solutions.

Smart Process Applications are a new type of **software that combines the benefits of process applications and advanced analytics to help businesses and factories manage their resources, processes and systems more efficiently**. Data collected by devices across production lines, logistic systems and plant sites are processed and analysed to provide meaningful information to decision makers.

Smart Process Applications have a **tremendous market potential**. The market for Smart Process Applications is estimated to reach EUR 20.2 billion by 2015, and to grow at a Compound Annual Growth Rate of roughly 18% towards 2018.

Offering a mix of standardised packages and custom developed solutions, providers of Smart Process Applications for manufacturing environments are specialised software developers that have as their clients big and small manufacturing companies throughout Europe and the world, covering among others the automotive industry and the oil and gas sector.

Smart Process Applications allow manufacturing companies in these sectors to reshape their industry by working with toolsets that offer productivity advantages to engineers and plant operators in Europe and worldwide, and help them design, implement and operate more efficient manufacturing processes that reduce the energy consumption of factories and that reduce the ecological footprint of individual businesses and entire logistic systems.

Smart Process Applications require highly skilled workers to develop the software on which they are based, and similarly highly skilled workers to implement the applications at

manufacturing sites and to operate them in a production environment.

Smart Process Applications offer highly tangible benefits to manufacturing companies deploying them in their production processes. These include **efficiency gains and cost reductions**, and faster redevelopment and testing of manufacturing systems. However, uptake of Smart Application Processes in manufacturing environments is hampered by the fact that the benefits that Smart Process Applications offer are not always understood by all potential clients. Also, complex interactions with existing infrastructure, and the extent to which the market is ready to adopt a new way of thinking about manufacturing processes is slowing the uptake of this innovation.

The **drivers** that spur the development of Smart Process Applications include developments in Information and Communications Technology (ICT), connectivity and mobile devices, rising energy prices and tightening environmental regulation, and the general trend towards sustainable manufacturing.

Obstacles that hamper the implementation and uptake of Smart Process Applications include limited access to finance, the slow pace of EU funding decisions, limited availability of skilled engineers, inefficient bureaucracy, and operational and technical challenges stemming from multi-vendor approaches.

Policy approaches to address these challenges could focus on:

- Shortening decision time on EU funding applications;
- Improving the labour market supply of highly specialised engineers;
- Establishing a revolving green fund for large scale efficiency projects based on Smart Process Applications;
- Addressing bureaucracy to reduce the strain on small companies while maintaining accountability;
- Considering standardisation and showcasing initiatives.



2. Smart Process Applications

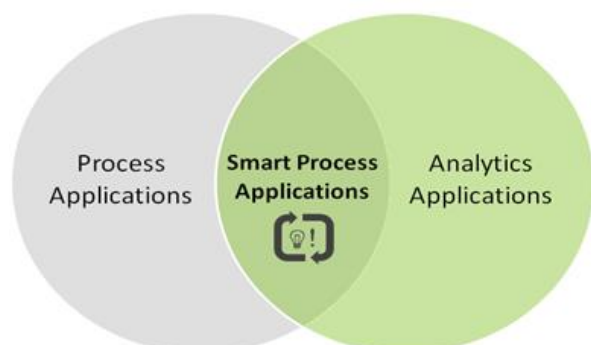
Smart Process Applications are pivotal in the rise of the **smart factory and the factory of the future**. The smart factory is an important concept in the reindustrialisation of Europe, which is expected to be a key aspect for putting the European economy back on an upward path of growth and job creation by drastically improving its capacity to deliver high-quality innovative products at low cost.¹

Also, smart factories address several megatrends, including resource scarcity and environmental developments. Smart Process Applications enable the factory of the future to engage these trends through increased production speed, improved operating precision, and optimised energy and materials consumption.

As manufacturing processes become increasingly more automated and IT-driven, Smart Process Applications as a form of ICT-enabled intelligent manufacturing can help manufacturers deliver their products faster, safer, and in a more sustainable manner.

First used as a term by analysts at Forester,² Smart Process Applications describe a new type of software that **helps businesses and factories manage their resources, processes and systems**. Combining the benefits of process applications and advanced analytics, Smart Process Applications process and analyse data collected by devices across production lines, logistic systems and plant sites to provide meaningful information to decision makers (Figure 1).

Figure 1: Smart Process Applications as combination of process applications and analytics application



Source: Logi Analytics, *Why is Embedded Analytics So Hot Right Now?*³

To do so, Smart Process Applications access and collect production data in real time and tag it to historical statistics, they obtain and analyse information directly from pumping systems, fans, on-valve measurement instruments, actuators and energy meters, and they capture plant management information on production status, performance monitoring, and quality assurance. Also, they draw on advanced computations to aid in model creation and test hundreds of designs and operating conditions in little time.

Smart Process Applications can help businesses in various ways, enhancing real-time online collaboration, improving capture and analysis of documents and data, increasing the understanding of customer preferences and behaviour, and more. This report will focus on Smart Process Applications within and related to manufacturing environments.

Driven by technological developments in ICT, infrastructural developments that improve connectivity, and increasing pressure on energy prices and environmental regulations, Smart Process Applications in a manufacturing environment sport a good market potential that is continuously getting better as businesses discover the benefits these applications can offer. Simultaneously, both companies providing Smart Process Application solutions and companies deploying these solutions in their manufacturing processes create highly skilled jobs that are situated in relatively close proximity to the educational institutions that provide them with the talent they require.

This report will investigate the socio-economic relevance of the trend in more detail, and assess the drivers and obstacles related to Smart Process Applications, resulting in policy recommendations towards improving the potential for successful development and commercialisation of Smart Process Applications.



3. Socio-Economic Relevance

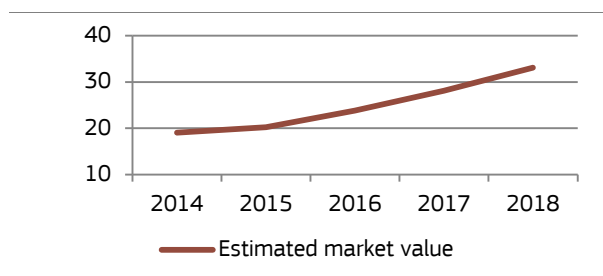
3.1. The market potential of the trend

By outfitting production plants and systems with advanced analytics and functionality that enables monitoring of process and machine performance, Smart Process Applications engage the full breadth of manufacturing industries. Consequently, Smart Process Applications offer innovative tools both in mature and in emerging markets.

Providers of Smart Process Applications for manufacturing environments are specialised software developers that offer a mix of standardised packages and custom developed solutions. Their clients are big and small manufacturing companies throughout Europe and the world, that aim to improve the management of their manufacturing processes. This offers Smart Process Applications a very broad scope of industries in which to be deployed, covering among others the automotive industry and the oil and gas sector.

Globally, the **market for industrial automation solutions** is gauged at **EUR 114 billion**, 35% of which in Europe.⁴ This number is estimated to grow to EUR 140 billion by 2015,⁵ and encompasses Smart Process Applications. The market for Smart Process Applications is estimated to reach EUR 20.2 billion by 2015,⁶ and to grow at a Compound Annual Growth Rate of 17.88 percent towards 2018 (Figure 2).⁷

Figure 2: Estimated Smart Application Processes market value (in EUR billion)



Source: Forrester, 2013, *The Forrester Wave: Smart Process Applications* and CNBC.com, 2014, *Research and Markets: Smart Process Application Report*^{8,9}

Entrepreneurs that venture into Smart Process Applications for manufacturing environments feel that the market potential for their solutions is huge, although some barriers need to be addressed for the market potential to come to full fruition. Combined with the estimations of market analysts, the market potential for Smart Process Applications within manufacturing environments can be said to be on the rise, especially as manufacturers increasingly face challenges to which Smart Process Applications are an answer that might turn out to be rather cost-effective.

The companies featured in this case study are a mix of young, small companies and companies that are more mature. Most of them are strongly R&D oriented and have strong ties to the academic research community. Table 1 provides an overview of the company cases referred to in this case study.

Table 1: Overview of the company cases referred to in this case study

Company	Location	Business innovation	Signals of success
Werusys	Germany	Custom systems that generate information on efficiency, utilisation and availability of plants and machinery.	- Werusys has a well-developed client portfolio targeted at clients that deal with specific regulations on energy efficiency and environmental protection, which includes companies from high tech sectors such as the automotive industry
Numecca	Belgium	A solution that allows for vast amounts of high-speed virtual testing of manufacturing set-ups.	- Numecca's products and services are positively reviewed on multiple websites, and they have excellent relations both with manufacturing companies that want to test new manufacturing system layouts and with the academic community that invites them to their research consortia.
Intelligent Sensing Anywhere (ISA)	Portugal	Monitoring solutions that allow companies to minimise Costs and maximise efficiency throughout their distribution chain.	- ISA has established a high-class product portfolio that is aimed both at businesses that look to Optimise the energy and materials costs of their plants and locations, and at utilities that wish to optimise their logistical systems.



Company	Location	Business innovation	Signals of success
Canary Labs	USA	A solution that can record and store huge amounts of on-site measurement data on manufacturing processes and equipment.	Canary Labs occupies what it refers to as a sweet spot in the market, where they are one of the most technologically advanced solution suppliers but by far not the most expensive. Subsequently, they are looking to rapidly expand their market share.

3.2. The benefits of Smart Application processes

Smart Process Applications can have several benefits for manufacturers that implement them in their production processes:

- Smart Process Applications provide accurate, transparent data on plant processes, for instance on energy usage. This can create an awareness effect which has staff turn into hunters for energy-saving opportunities, saving energy and costs;
- Smart Process Applications collect, process and consolidate information and analyses, simplifying records and reporting processes and integrating all manufacturing processes in one validated documentation system;
- Smart Process Applications help optimising the use of machinery and logistics, thereby increasing throughput and reducing costs.

Within an industrial environment that faces strategic and operational challenges that may stem from energy security and pricing, or from environmental concerns related to formal regulations as well as public relations, and that moves forward with the introduction of smart manufacturing systems including robotics, Smart process Applications offer plant managers the tools needed to optimise their production process, to perform high-speed testing of advanced manufacturing designs, to optimise all logistics, and to record and store massive amounts of data.

Production process optimisation – In order to optimise a production process, its related IT infrastructure should be geared towards transferring all needed information in an efficient manner.

Innovative solution 1 – **Werusys** offers a system that accesses production data in real time and tags it to historical statistics, making information tangible on efficiency, utilisation and availability of plants and machines. This allows for optimisation of the production process either as a stand-alone application or through integration with SAP platforms.

Energy monitoring system developed by Werusys

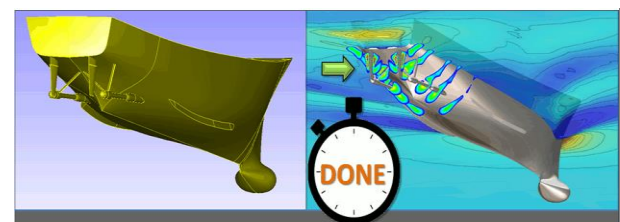


Source: Werusys

High-speed virtual testing – Advanced manufacturing designs require intensive testing and vast amounts of calculations, which are expensive and time consuming.

Innovative solution 2 – **Numeca** is focused on innovation in CFD and multiphysics analysis and optimization and tries to turn the physical world into a virtual playground, through developing Full Hex Automatic Meshing Solutions and Integrated CAD Cleaning, Ultra-Fast Multiphysics CFD solvers, Full unsteady multistage turbo machinery simulation and more.

Numeca was founded in 1993 and is located in Brussels, Belgium



Source: Numeca

Logistics optimisation – Oil and gas companies are looking increasingly to minimise costs and maximise efficiency throughout the distribution chain. Given the rising competitive pressures and the decrease of retail margins, there is a need across the whole sector to optimise processes that are complex, and that feature a high number of variables and restrictions.



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Innovative solution 3 – ISA has developed monitoring solutions that help all levels of the distribution sector, from the management up to the programming of supply routes. It obtains and analyses information in real-time information from pumping systems, fans, on-valve measurement instruments, actuators and energy meters.

Intelligent Sensing Anywhere's M2M solutions for Smart Cities



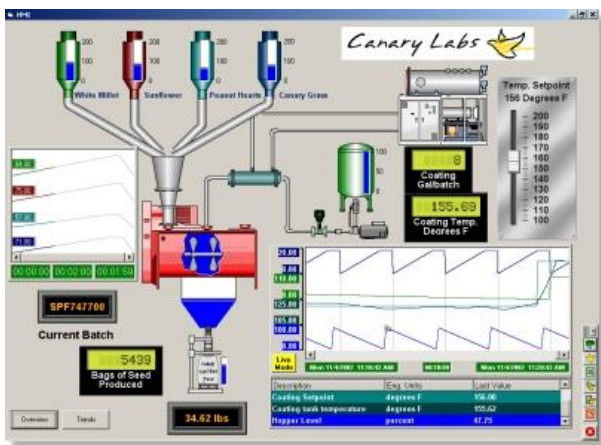
Source: ICT 4 save energy

Recording and storing massive amounts of performance data

– On-site measurement on manufacturing processes and equipment generates a large volume of information that can prove valuable when recorded and stored over time. Yet the data collection and storage can ask a lot from the associated IT systems.

Innovative solution 4 – Canary Labs's historian captures plant management information on production status, performance monitoring, quality assurance, working with large volumes of data used in applications ranging from 100 tags to over 1 million tags, with a high-speed throughput rate of more than 3.6 million tvqs per second.

Canary Labs was founded in 1985 and is located in Martinsburg, PA USA



Source: Canary Labs

3.3. The creation of new markets and jobs

Smart Process Applications allow manufacturing companies to work with toolsets that have the potential to reshape their industries, offering productivity advantages to engineers and plant operators in Europe and worldwide and generating more efficient manufacturing processes, reducing energy consumption of factories and reducing the ecological footprint of businesses and entire logistic systems.

These applications positively influence the demand for high-skilled workers, both directly and indirectly, and at the same time have implications for manufacturing education, underlining the need for enhanced collaboration between industrial actors and educators.

Smart Process Applications require highly skilled workers to develop the software, and similarly highly skilled workers to implement the applications at manufacturing sites and operate them in a production environment. Thus, deployment of Smart Process Applications in manufacturing environments will generate more knowledge-intensive jobs and will require more knowledge workers to perform them.

The notion of running Smart Process Applications in manufacturing environment has implications for **manufacturing education**. Educational institutions will have to prepare future workers for working with smart factories that feature human-oriented automated manufacturing solutions, and that require well-developed analytical skills for optimisation of manufacturing processes and associated usage of energy and materials, as well as the related costs.

It can already be observed that solution providers in the field of Smart Process Applications partner with educational institutions to organise specific apprenticeships. Through these apprenticeship programmes, students are offered classes by an educational institution and obtain practical skills and knowledge within a company, in order to bridge the divide between the world of manufacturing education on one end and cutting-edge developments in the manufacturing industry on the other.

Collaborations such as these show a renewed importance of industrial actors operating in close physical proximity to academic institutions and educators, sourcing talent from local communities. This ties into the notion of re-shoring manufacturing jobs to Europe, as it inclines manufacturers to set up shop close to where talent and knowledge can be obtained rather than low-cost labour.



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Also, as factories continue to become smarter, and increasingly generate more knowledge-intensive jobs, they also **generate more indirect jobs for support functions and activities**, either within their own organisation or at a supplier company. Studies tentatively report employment multipliers of four times the number of workers directly employed in manufacturing,¹⁰ demonstrating how Smart Application Processes within a manufacturing environment can help to preserve and create European jobs.

3.4. Client perspectives and challenges related to the uptake of the trend

Smart Process Applications offer highly tangible benefits to manufacturing companies deploying them in their production processes. These include efficiency gains and cost reductions, faster redevelopment and testing of manufacturing systems, and a straight-forward business rationale for implementation as a result.

However, uptake of Smart Application Processes in manufacturing environments is somewhat hampered by the fact that not all potential clients understand the benefits that Smart Process Applications can offer, by complex interactions with existing infrastructure within manufacturing plants, and by the extent to which the market is ready to adopt a new way of thinking about manufacturing processes.

Smart Process Applications help businesses and factories manage their resources, their processes, and their systems,

“The competition for the right ICT developers is fierce, so we work with universities to organise apprenticeship programmes that combine working at our company with academic training. Typically, such apprentices stay with us and this is how we grow.” –

Werusys

which can lead to efficiency gains and cost reductions. Advanced computations become available for every step in a product’s process, from model creation, to manufacturing, to post processing. State-of-the-art data collection and processing software allow for real-time historic comparisons that offer detailed analytics to engineers and operators. Moreover, smart process applications can speed up developments by running computations extremely fast, or testing hundreds of designs and operating conditions in very little time.

The business rationale for implementing Smart Process Applications seems rather straightforward. An **initial investment** is required in software, the return on which **could materialise within one or two years** via savings on energy, materials, throughput time, and associated costs.

Basic implementation of Smart Process Applications can be possible with an investment of about EUR 40,000. However, more sophisticated deployment projects for Smart Application Processes in manufacturing environments may include custom software development, process redesign, procurement and installation of new hardware, and training and up skilling of personnel. This significantly increases the associated investment value.

For these more complex programmes, the associated improvements, savings, and returns are not always easy to explain and describe in advance. Providers of Smart Process Applications find it difficult at times to convince potential clients of the expected benefits their solution offers. This is partly due to the limited sense of urgency they perceive on the client side. Some providers profess they would require thirty minutes to demonstrate the advantages of their solution through a live demo, after which most potential clients are easily convinced. Yet regularly they are allowed no more than two or three sentences to explain their product, which is often not enough to bring about an understanding of what their product actually brings to the table.

Also, Smart Process Applications need work **in tandem with existing plant infrastructure**. The level of sophistication

“If our clients don’t have a good infrastructure prepared, that’s difficult” – Intelligent Sensing Anywhere

of this infrastructure and related logistic systems determines the potential success and costs related to the deployment of Smart Process Applications. A more sophisticated infrastructure allows for easier and earlier benefits. A less sophisticated infrastructure requires more adaptation and customisation of systems and software and entails more complex deployment trajectories. Providers of Smart Process Applications report that this is one of the major challenges when engaging the market.

Another challenge related to the large-scale uptake of Smart Process Applications in manufacturing environments is that it requires a new way of thinking

“You need to think in a new way about something, and that’s always a barrier” –

Werusys

about manufacturing processes and installations. The companies interviewed for this case study indicate that, for the most part, the manufacturing industry seems not yet ready to accept the transition that deployment and uptake of Smart Process Applications entail. More success stories seem to be needed, and these would need to be well described and well disseminated in order to prove the value and benefits of the smart Factory concept.



4. Drivers and obstacles

Smart Process Applications leverage the combination of increasing possibilities in ICT, connectivity and mobile developments, and environmental and regulatory pressures on manufacturing companies to provide solutions that add to the realisation of the factory of the future. Uptake of Smart Process Applications is not without its challenges however, and this section will attempt to shed light on the perspectives and challenges related to Smart Process Applications in a manufacturing environment.

4.1. Developments in ICT, connectivity and mobile devices

The development and uptake of Smart Process Applications in manufacturing environments is driven in part by developments in ICT, connectivity and mobile devices. Overall developments in information and communication technology allow ever-more sophisticated data processing with increased computation speed. As this technology field keeps advancing, the possibilities of Smart Process Applications will become increasingly more appealing to manufacturers and plant operators.

Smart Process Applications are closely connected to the concept of **Internet of Things** and to real-time accessibility of monitoring and operations functionality. Therefore, internet connectivity and especially the availability of broadband and wireless data transmission services are crucial for the deployment of Smart Process Applications. As broadband and wireless connectivity throughout Europe improves, the potential for successful Smart Process Applications can be expected to increase.

Part of the appeal of Smart Process Applications in manufacturing environments is the possibility to monitor and operate manufacturing equipment distantly, and to analyse and act upon performance information in real-time. As such, Smart Process Applications are driven by increased sophistication and uptake of advanced mobile devices. As mobile devices acquire more capabilities, the possibilities for off-site plant operation and monitoring will increase. As state-of-the-art mobile devices become more wide-spread, deployment and proliferation of Smart Process Applications in manufacturing environments becomes less disruptive and less complicated.

4.2. Energy prices and environmental regulation

As Smart Process Applications can deliver **energy-efficiency gains** and allow for improved monitoring of manufacturing output and site performance, there is a

noticeable connection between the uptake of such products on the one end and energy prices and environmental regulations on the other. One of the companies in this study reported to have developed a specific business case based on environmental regulations in Germany, helping manufacturers to comply with standards by structuring their product to guide plant operators and engineers step by step through the environmental requirements stipulated in environmental regulations.

As **environmental regulations** become more strict, and the prices of energy rise, manufacturers have increasing incentive to adopt smart manufacturing processes, and to deploy Smart Process Applications, for instance to help them monitor and manage resource utilisation or to help them assure adherence to rules and regulations.

4.3. The trend towards sustainable manufacturing

Even regardless of prices and regulations, an overall trend is prevalent towards sustainable manufacturing that drives smart production processes, and by extension drives the uptake of Smart Process Applications. Manufacturing companies face public relations challenges related to their environmental footprint, encouraging them to redesign their processes in a way that allows for more energy-efficient methods that generate less pollution and are less damaging to the environment. Also, manufacturers face strategic pressures regarding resource scarcity, climate change, and the notion of global social responsibility that conditions them to address the issue of sustainability of their operations, to which Smart Process Applications could contribute significantly. Moreover, decision-makers in manufacturing slowly but steadily demonstrate more awareness of the impact their choices have on the environment and the sustainability of their business practices.

4.4. Access to finance

Some of the companies in this case study mentioned that their limited access to finance poses a barrier to their development. Especially for prototyping and early-market penetrations stages, a mixture of risk-bearing and non-risk-bearing capital is needed, but both bank loans and post-FFF/Angle capital reportedly are hard to come by. This is particularly true for companies approaching the mid-cap range (EUR 2 million to EUR 10 million), as this is where business angels can no longer help the company, and IPOs and institutional investments are not yet applicable. Table 2 shows the sources of funding for the company cases featured in this report.



The hesitation of banks to provide these companies with capital, combined with the underdeveloped venture capital market in Europe, generates a funding gap for these companies, which hampers their capacity to grow in terms of company size and product portfolio, and which directly impacting the extent to which these companies can create additional jobs in Europe.

Credit facilities offered by the European Investment Bank (EIB) seem to have not yet reached these companies, and some companies report to have no contact and little knowledge of the EIB, while others think interventions such as the Jessica programme are too complicated for them to work with considering the additional requirement and regulations put in place by local banks that participate in the implementation of the programme. As a result, providers and developers of Smart Process Applications have as yet not been able to benefit from these instruments.

Table 2: Source of funding for company cases

Company	Source of funding
Werusys	Operational revenue combined with national research grants
Numeca	Operational revenue combined with European research grants
Intelligent Sensing Anywhere (ISA)	Operational revenue combined with bank loans
Canary Labs	Operational revenue combined with bank loans for working capital

4.5. Speed of EU funding decisions

Some young SMEs and start-ups that develop Smart Application Processes in an R&D-heavy fashion rely on research grants to co-fund their development activities. They typically are well connected to the R&D community in their field and join European and national research projects as close-to-market participants.

These companies point out that once an R&D grant is secured, it can serve as a steady lifeline for those companies' development activities. At the same time, these development activities need to be organised in a flexible way that allows the company to respond to market opportunities with some agility. The **waiting period attached to grant proposals sometimes does not fit this agile outlook**, limiting the extent to which these companies can rapidly engage market demand. Even as the European Commission has committed itself to reduce the time to grant to a maximum period of eight months, this is still considered a long period of time for small technology companies. The Fast Track to Innovation programme aims to have a time to grant of less than six months, yet small technology companies think in terms of weeks.

4.6. Availability of skilled engineers

Smart Process Application companies rely on high-skilled workers to develop and improve the software and hardware solutions that make up their products. However, companies involved in the development of Smart Process Applications find it hard to attract the university graduates and PhDs in the very specific technology fields in which they operate.

"We could generate more business if more talented people were available" – Numeca

Especially engineers with a university degree are in high demand, and some companies claim the only thing holding them back from generating more business is the lack of skilled people available. To cope, these companies turn to talent from outside of Europe, in some instances assisting in the migration of entire families to bring in the specific combination of skills and knowledge they require. Other companies have established partnerships with universities in their region, organising apprenticeships that let students in graduate schools obtain working experience within their companies, introducing them to the state-of-the-art solutions they are trying to bring to the market.

The ICT skills mismatch reported by the companies in this case study has also been observed by the Task Force on Advanced Manufacturing for Clean Production, which states that the demand for ICT practitioners grows by 3% per year, while the number of ICT graduates in the labour market actually decreases.¹¹

4.7. Bureaucracy

Some of the small technology companies in this report lament the time, energy and man power they need to spend on red tape produced by their national governments, which has a negative effect on their productivity. They report that even for social security reasons alone, yearly twelve documents per employee need to be prepared and submitted. Some small technology companies deal with over twenty government-initiated and required processes that have them prepare and submit more than ten documents per employee per year. For some of these companies, this is a reason not to participate in any support schemes or innovation facilities, as the amount of reporting and documentation involved, which in some cases can exceed 700 pages of reporting per project per year, would require too much time and effort from their staff.



4.8. Multi-vendor challenges

As the number of Smart Process Application providers increases, so does the number of applications and solutions on offer, as well as the complexity of the type of solutions provided. Manufacturing companies that use a multi-vendor approach, procuring different Smart Process Applications from different providers and deploying them in tandem, invite operational and technical issues that are very hard to solve.¹² The difficulties encountered while integrating various

Smart Process Applications in one manufacturing or logistical system can be so severe that this has a negative impact on the image of Smart Process Applications in manufacturing environments all together.

“For certain grants, we are required to evidence all costs via bank statements, paid bills, accountant reports and so on. Reimbursement requests can be over 700 pages.” – Intelligent Sensing Anywhere

5. Policy recommendations

On the basis of the analysis performed, policy recommendations for developing a business environment conducive to the uptake of Smart Process Applications in manufacturing environments are presented below. From our analysis, it follows that companies involved with Smart Process Applications can benefit from a shortened decision time on EU funding applications, from an improved labour-market supply of highly specialised engineers and ICT experts, from a revolving green fund for large-scale energy efficiency projects, from a continued and strengthened effort to drive back bureaucratic hurdles, and from standardisation and showcasing initiatives focussed on Smart Process Applications within a manufacturing environment.

5.1. Shortening decision time on EU funding applications

Although the European Commission already reduces time to grant in Horizon 2020 and even more in the Fast Track to Innovation programme which is announced for 2015, a time to grant that is measured in months is still rather far removed from the reality of small technology companies that would rather know within weeks if and how they can develop solutions that respond to sudden market opportunities.¹³

The Fast Track to Innovation programme is recognised as a positive development in this sense, although the fixed cut-off dates it features appear to be a mixed blessing. On the one hand, the fixed dates offer a clear sense of transparency and predictability which helps companies to plan and strategize around them. On the other hand, a company spotting an opportunity close to a cut-off date or shortly after the date has passed would still have to wait approximately four months for the new cut-off date to pass, after which additional waiting time should be expected for review, refereeing and grant contracting. Such companies could greatly benefit from a time to grant that is reduced to weeks.

5.2. Improving the labour market supply of highly specialised engineers

Smart Process Application developers require highly skilled, university-graduated engineers in ICT, preferably specialised in smart process applications. According to some of the companies in this case study, labour-market supply of such candidates is insufficient, while at the same time additional talented staff is all these companies require to grow. Improving the number of ICT graduates with a focus on smart manufacturing could benefit these companies, for instance through EU-wide targeted skills programmes that focus on specific technology areas.

Moreover, it could be attempted to bring Smart Process Applications to the foreground of existing initiatives that address ICT skill gaps, such as the Grand Coalition for Digital Jobs, which engages the lack of digital skills in Europe and the several hundred of thousands of unfilled ICT-related vacancies through the support for and implementation of national e-skills programmes throughout the EU.¹⁴ As such, addressing the high-skill employment needs of companies involved with Smart Process Applications in a manufacturing environment could be positioned as one of the approaches towards tackling youth unemployment throughout Europe.

5.3. Establishing a green fund

The **funding gap** experienced by small technology companies, including providers of Smart Process Applications solutions, is so severe and dangerous to their survival, it is commonly referred to as the “Valley of Death”. As Smart Process Applications in manufacturing environments also address societal challenges, some companies have suggested that national governments or the European Commission establishes a green fund that helps manufacturers implement large-scale energy efficiency projects based. Such a fund would finance initial



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implementation, and recoup the financed amount through levying part of the financial savings the manufacturer generates on reduced energy expenditure. For implementation projects of EUR 500,000, companies expect that the fund could recoup the full amount after two years. For larger projects, their experience is that full earn-back can be achieved after a period of up to seven years.

Revolving green funds are a relatively new development, and are typically implemented by large organisations to increase their own energy efficiency or limit their environmental footprint. Deploying either their own funds or those of a third party, these organisations offer the opportunity to departments or business units within their organisation to develop and introduce 'green' initiatives that generate cost reductions which flow back into the fund. An example of such a fund is the Green Revolving Fund of Harvard University, which saves the university over EUR 4 million per year and achieves annual returns that average around thirty percent.¹⁵

Similarly, the Revolving Green Fund of the Higher Education Funding Council for England offers the same opportunities at a national level, and targets higher education institutions, offering them loans of up to EUR 42 million for small-scale energy efficiency programmes or large-scale projects that achieve cost savings and reduce carbon emissions.¹⁶

Such a revolving green fund could be developed and implemented at the European level, targeting large-scale energy efficiency projects that are expected to generate cost savings on the medium term. Especially when focussed on the manufacturing industry, such a programme could increase the opportunities for Smart Process Applications to obtain even more traction.

5.4. Addressing bureaucracy

The amount of time and energy that small technology companies need to spend on dealing with information requests and reporting requirements from national and local governments can have a negative impact on their innovation potential and their business success, and needs to be addressed. Implementation of the Small Business Act can reduce the bureaucratic burden that small technology companies engaged in Smart Process Application

development experience, especially when e-government concepts such as digital one-stop shops can integrate e-signatures, online tax payment services, e-reporting, online VAT registration, e-invoicing, e-procurement and online business registers, in a way that minimises overlapping information requests and that can be adjusted both to the size and complexity of a company and to its current position in the life-cycle of a business.¹⁷

Naturally, innovative SMEs involved in Smart Process Applications within a manufacturing environment need to adhere to the law and need to fulfil all formal reporting requirements. Similarly, when they receive tax-payer money in the form of subsidies, grants, or investments from government and near-government institutions, they will need to demonstrate prudence, accuracy, and accountability concerning the deployment of such financial means.

However, steps can be taken to assure the above while limiting the administrative burden on SMEs, including those involved in Smart Application Processes. In Germany for instance, attempts have been made to reduce the extent to which disclosure requirements apply to microenterprises, and to have them exempted from parts of EU accounting law. Also, German policymakers have attempted to speed-up tax audits and to limit the number of years that tax-relevant records need to be kept and maintained.¹⁸

5.5. Considering standardisation and showcasing initiatives

As a large share of the market for Smart Process Applications in manufacturing environments is not yet fully convinced of the added value and benefits of deploying Smart Process Applications within their manufacturing and logistical systems, solution providers could benefit from a **show-casing effort** that displays and disseminates instances in which factories have evidently become smarter and more efficient through the implementation of Smart Process Applications. Similarly, the image of Smart Process Application can be influenced negatively by multi-vendor challenges and associated frustrations and waste. A degree of standardisation of development and implementation practices could prevent Smart Application Processes implementation projects from being regarded as full of head-aches and worries.



6. Appendix

6.1. Interviews

Company	Interviewee	Position
Werusys	Dr Klaus Reckert	Public Relations Manager
Numeca	Dr Marc Tombroff	General Manager
Intelligent Sensing Anywhere (ISA)	Dr Luisa Matos	ISA Academy Director
Canary Labs	Jack Wilkins	Director of Sales

6.2. Websites

Werusys	werusys.de
Numeca	www.numeca.com
Intelligent Sensing Anywhere (ISA)	www.isasensing.com
Canary Labs	www.canarylabs.com

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¹⁵ Harvard University, 2011, Harvard University: Green Loan Fund, Available at <http://greenbillion.org/case-study/harvard-university-green-loan-fund/>, accessed August 2014

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¹⁷ European Commission, 2012, Progress on the Implementation of SBA in Europe

¹⁸ Federal Ministry of Economics and Technology (BMWi), 2011, Building on SMEs: Greater Responsibility - Greater Freedom