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Table of Contents

SO-PC-Pro has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 609190

1 Executive summary

The EU FP7 Project SO-PC-Pro (Subject-Orientation for People-Centred Production) was launched in October 2013 with the goal to develop methods and tools for the holistic design and management of workplaces in production companies thereby *aligning business goals and human needs*. This vision is based on a view of production companies as complex, socio-technical systems of people, processes and machines that flexibly interact. Facilitating this goal requires (i) methods supporting the people-centred design and creation of workplaces without neglecting the business needs and (ii) technologies and tools to enable the implementation of such workspaces. In addressing these demands for methodological and tool support SO-PC-Pro achieved to following key outputs:

- Methods and tools for analyzing and improving processes supporting the people-centred (*re-)design* of workplaces
- A bottom-up and fully people-centred workplace improvement methodology considering work context
- A method and tool supporting seamless process management bringing production, and business processes closer together enabling the flexible interaction of people, processes, sensors, and machines

2 Project context & objectives

European production companies face a variety of challenges arising from the increasingly complex and dynamic environment in which they operate. These challenges have been understood mostly in economic terms based on the time-cost-quality triangle. The main approach to tackling these challenges has been to rationalise production processes through standardised work procedures and automated systems, aiming to reduce cost and increase productivity. However, the predominant focus on functionality and efficiency neglects a critical factor for sustainable organisational success: the human being. While worker satisfaction, motivation and empowerment have been recognised as critical for healthy production organisations, these human factors are often viewed at odds with the economic goals of a company.

The global goal of SO-PC-Pro (**S**ubject-**O**rientation for **P**eople-**C**entred **P**roduction) is to develop methods and tools for holistic design and management of workplaces in production companies, thereby aligning business goals and human needs. It is based on a view of production companies as complex, socio-technical systems of people, processes and machines that flexibly interact. This view is well captured in the "subject-oriented" methodology for Business Process Management. SO-PC-Pro applies this methodology for the first time to modelling processes and interactions in the production domain, resulting in a new set of ICT-based technologies which can be mapped to the following project objectives:

- Objective 1: Subject-oriented modelling of production workplaces
- Objective 2: Subject-oriented Workplace Re-Design
- Objective 3: Seamless Integration of Production and Business Processes

Objective 1 (*Subject-oriented modelling of production workplaces*)
Subject-oriented modelling, through its focus on interactions, enables the adaptation of machines, processes and context to the human worker. Objective 1 comprises augmenting the

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coverage of subject-oriented modelling to explicitly represent interactions with machines and contextual information.

Objective 2 (*Subject-oriented re-design of production workplaces to empower workers and stimulate teamwork*) includes developing subject-oriented methods for workplace re-design according to business and human values, borrowing from and extending methods for value stream design (VSD), contextual design, analysis of change propagation, and wiki-based re-design collaboration. The methods are tailored to those with the deepest insight into human needs at work: the workers themselves. This Objective relates to the workers' empowerment by involving them in the responsible development of their workplaces, and the stimulation of teamwork.

Objective 3 (*Seamless integration of production and business processes as enabling technology for holistic workplace designs*) targets the development of enabling technologies through seamlessly integrating production and business processes across all levels of control. It is based on the subject-oriented modelling approach establishing a uniform representation for control systems in any area of application. Existing industry standards, including OPC UA (IEC 62541), are used for implementing the interfaces between subject-oriented models and the specific control systems including human and environmental sensor data. In addition, the subject-oriented workflow engine from Metasonic GmbH will be extended to provide real-time support for production control. Objective 3 also supports Objective 1 and 2, as the implementation of enhanced workplaces can be directly mapped onto changes in real-time production processes.

3 Main S&T Results and Foregrounds

The following section gives an overview of the most important S & T results of the project focusing on their future use and exploitation. This section should be seen as an addition to the reported list of scientific publications and deliverables documenting the scientific results of the project.
The main

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3.1 List of intellectual property rights

Type of IP Rights	Application reference(s)	Intellectual Property Organisation	Subject or title of application	Con-fiden-tial	Applicant(s) (as on the application)	URL of application	Status	Actions
Patent	GB1810785.9	UK Patent Office	Heart Blood Pressure Monitor		D MAJOE		Application filed, awaiting publication	
Copyright	550c3ab0-BSCW-1fc-29ce00-0001	UK Copyright Service	Tracker		D MAJOE		Copyright Certificate Received	

Table 1: List of Applications for patents, trademarks, registered designs, etc.

3.2 List of individual exploitable foregrounds

This section provides an overview of anticipated exploitable foregrounds in SO-PC-Pro. Section 3.2.1 provides a coarse overview of exploitable foregrounds which are described in detail in the subsequent section. The mapping between the overview and the detailed description is indicated by a unique identifier (e.g., MAS_1).

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3.2.1 Overview of exploitable foregrounds

No	Type of exploitable foreground	Exploitable Foreground (description)	Exploitable product(s) or measure(s)	Sector(s) of application	Timetable for commercial use or any other use	IPR	Owner & Other Beneficiary(s) involved
BYE_1	General advancement of knowledge	People-centred workplace improvement methodology considering work context	Methodology description, , training materials	-Scientific research and development	Estimated time to market is half a year after project end, i.e. March 2017		ByElement (Owner) Metasonic / FBK (tool provider)
BYE_2	General advancement of knowledge	Context Information management for Critical incidents in care situations (health care)	Methodology, Tool support, Training		End of 2016		ByElement (Owner)
C_A_1	General advancement of knowledge	Application Experiences related to people-centred workplace design	Experience Reports, Method application and transfer reports	-Scientific research and development			Cesaro & Associati (Owner of application knowledge) JKU (approach development) Metasonic (tool support) FBK (IT tool support) ByElement (context analysis)
C_A_2	General advancement of knowledge	Trainings for Consultancy companies for people-centred	Training materials, Educational designs	-Education			

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		workplace design					
CEN_1	Commercial exploitation of R&D results	One-stop-shop for Business and IT Integration	Consulting Services for the Slovak market	-Information and communication -Consulting			Centire (Owner of Slovak Consulting materials) JKU, ByElement (approach development Metasonic (tool support) FBK (IT tool support)
FBK_1	General advancement of knowledge	Collaborative workplace improvement tool	Software tool	-Scientific research and development, -Information and communication			FBK (Owner) Metasonic GmbH (tool contributor in terms of process support)
FIMAP_1	General advancement of knowledge	Know-How/Experience on method and tool application related to people-centred workplace re-design	Experience reports, Case Study Implementation report	-Scientific research and development -Education -Information and communication			FIMAP (On-Site Experience - Owner) Metasonic (Tool) FBK (Tool) ByElement (context awareness) JKU (overall methodological framework)
JKU_1	General advancement of knowledge	Fine-grain behavior oriented S-BPM modeling approach	Guidelines for method application, Training material	-Scientific research and development, -Information and communication			JKU (Owner) Metasonic GmbH (tool provider)
MAS_1	Commercial exploitation of R&D results	Wearable ring for heart signal, , blood pulse wave volume, skin	BioRing	-Scientific research and development			MA Systems (Owner) Metasonic GmbH (ring system integration)

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		conductance or local bio-impedance and physical activity + dedicated iPad/iPhone App.		-Human health activities -Manu-facturing -Information and communicatio n			JKU (ring system integration and testing)
MAS_ 2	Commercial exploitation of R&D results	Tracker for continuous advertising of its presence designed to be easily tagged to any manufacturing workpiece + dedicated iPad/iPhone App.	Tracker	-Scientific research and development -Manu-facturing -Information and communicatio n			MA Systems (Owner) Metasonic GmbH (ring system integration and testing) Centire (ring system integration and testing)
MET_ 1	Commercial exploitation of R&D results	Seamless process management across the IEC 62264 control hierarchy	Software	-Information and communicatio n			Metasonic (software Owner) JKU (Conceptualization)
MET_ 2	Commercial exploitation of R&D results	Contextual design support	Software	-Scientific research and development -Manu-facturing -Information and communicatio n			Metasonic (software owner)

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MET_3	Commercial exploitation of R&D results	Process improvement methods	Method	-Scientific research and development -Manu-facturing -Information and communicatio n			Metasonic (Owner)
TCContact_1	General advancement of knowledge	Seamless process management through transparent communication	Experience reports, Case Study Implementation report	-Scientific research and development -Education -Information and communicatio n			TC Contact (On-Site Experience - Owner) Metasonic (Tool) JKU (overall methodological framework)
AXX_1	General advancement of knowledge	SO-PC-Pro pilot in	Experience reports, Case Study Implementation report	Bimbo - we dedicated one additional month executing a second round of the of SO-PC-Pro pilot in another branch of El Globo, as a presale effort to demonstrate to the executive team platform			AXXIS, Metasonic (Tool) JKU (overall methodological framework)

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				capabilities and to evaluate some business key indicators achieved in order to explore the possibility of some budget allocation for next year.			
AXX_2	General advancement of knowledge	Business Plan to exploit SO-PC-Pro Platform at the region with Value proposition, Elevator pitch, CANVAS framework analysis, Pipeline definition	Experience reports, Case Study Implementation report + SO-PC-Pro Pilot	Example of potential partners and prospects we are considering: FESTO, Italika, Mabe, IRIZAR, SuKarne, Sigma Alimentos, CLAUT, Metalsa, Vitro, Koblenz, CONACYT, UTT			AXXIS, Metasonic (Tool) JKU (overall methodological framework)

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3.2.2 BYE_1: Workplace improvement methodology considering work context

This exploitable result represents a new and people-centred workplace improvement methodology consists and is derived from
* Delivery of the main project outcomes with FIMAP.
* Development of methodologies for calculating potential benefits of SO-PC-Pro. This part has been started. The use case of SO-PC-Pro is very important for the validation of ideas.
* Promoting the SO-PC-Pro methodology leveraging the existing system of educational and consulting activities organized for various stakeholders e.g. Swiss manufacturing programs (like manufuture.ch).
* ByElement is awaiting some running prototypes and case study material such as handouts and factsheets. The aim is to start this exploitation activity in the beginning of the year three.

Innovativeness introduced compared to already existing Products/Services	*Bottom-up and fully people-centred workplace improvement methodology considering work context*
Unique Selling Point (competitive advantages)	*Independent, comprehensive and scientific-based approach*
Product/Service Market Size	*The target Market is the Swiss mechanical and electrical engineering industry and associated technology-oriented sector. * Swissmem is the Swiss association of mechanical and electrical engineering industries (MEM industries) and represents the interests of 1.000 member companies in economic, social and educational matters. The engineering, electrical and metal industry occupies a key position in the Swiss national economy: it is the largest industrial employer, with approximately 330,000 employees in Switzerland and contributes 32.5 percent of the goods exported from Switzerland, with exports at a value of CHF 65 billion (2013).* *Adjustment of the SO-PC-Pro approach to the Swiss context with focus on Swiss Watch Industry, Public Transport and Swiss Mechanical and Electrical Engineering Industry*
Market Trends/Public Acceptance	*With the sudden massive appreciation of the Swiss franc and uncertainty over the future of the Bilateral Agreements, has resulted in a perceptible decline in Switzerland's attractiveness as a location for manufacturing industry. Companies have downgraded their business expectations for the twelve months ahead accordingly, and pressure on margins has once again risen dramatically. firms will*

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	do everything in their power to cut costs, improve work processes and regain their competitiveness. The SO-PC-PRO workplace improvement tools and methodology can be an attractive and new proceeding and opportunity to improve workplaces and identify new business value potential.
Product/Service Positioning	*The SO-PC-PRO will be positioned as a professional people-centred workplace improvement approach. This would include methodology, tools (software), training and workplace analytics.*
Legal or normative or ethical requirements (need for authorisations, compliance to standards, norms, etc.)	*None*
Competitors	*Other consulting companies* *Other Business Improvement Approaches (Six Sigma, Kaizen, continuous improvement initiatives)*
Prospects/Customers	*A customer can be any organisation (SME, large Enterprise, public organisation,…) in need of process improvement and organisational development* *ByElement is focussing on the* ***Swiss mechanical and electrical engineering industry e.g. watch industry via the SWISSMEM Association (Innovation and Education)*** *A customer can be also a consulting company interested in a workplace improvement methodology and people-centred approach (e.g. HR Consulting, Supply Chain Management consulting)*
Cost of Implementation (before Exploitation)	*Before exploiting the approach the results of the case study at Fimap and the SO-PC-PRO software solutions must be available and need to be evaluated. The Methodology itself needs to be presented in an attractive way (factsheets, marketing material, naming, internet presence)* *Costs for the creation of marketing material > 6000 CHF.*
Time to market	*The methodological service could be ready within half a year after the end of SO-PC-Pro.*
Foreseen Product/Service Price	*The fee depends on the consulting model applied (e.g. hourly rates, daily consulting rate, performance based rate,…..) and the size of the project in which it is applied.* *In general a Workplace Improvement Project*

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	based on the people-centred SO-PC-Pro approach could start as of 15000-30000CHF for training and project set-up.
Adequateness of Consortium Staff	*For the approach validation further use cases and use case companies would be beneficial*
External Experts/Partners to be involved	*Work psychologists and Business Analysts might be beneficial to discuss the approach and experiences in the field. (Could be done at scientific conferences, workshops, industrial fairs)*
Status of IPR: Background (type and partner owner)	*Metasonic/FBK- > Software tools ByElement → Context dimensions workplace and Analytics*
Status of IPR: Foreground (type and partner owner)	*Metasonic/FBK- > Software tools ByElement → Context dimensions workplace and Analytics*
Status of IPR: Exploitation Forms (type and partner owner) e.g. direct industrial use, patenting, technology transfer, license agreement, publications, standards, etc.	*Direct industrial use, Licence agreement in case of software use*
Which partner contributes to what (main contributions in terms of know-how, patents, etc.)	*FIMAP → Potential of work context for business improvement*
Partner/s involved expectations	
Sources of financing foreseen after the end of the project (venture capital, loans, other grants, etc.)	*Self-financing*

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3.2.3 C_A_1: SO-PC-Pro Consultancy – Transfer and Application of Experiences related to people-centred workplace design

From a consulting perspective C&A can exploit SO-PC-Pro experiences and translate them to other factories. Moreover on the training side C&A can start to develop this culture to managers and entrepreneurs and try to make them familiar to SO-PC-Pro approach and results. Thus exploiting the given outcomes could be a perfect solution in order to offer to C&A customers a wider span of solutions which are brand new and recognized by European Commission as well as the Intelligent Manufacturing Systems organisation. Furthermore, C&A's network of IT consultant and IT partners in the project can help us out in order to create an IT consultancy service, useful to implement IT systems connected with the project.

Innovativeness introduced compared to already existing Products/Services	*The SO-PC-Pro approach gives us the possibility give our consultancy clients a new approach for their production site, based not only on process analysis but also on a way to empower people, putting them in the centre of the consultancy intervention.*
Unique Selling Point (competitive advantages)	*Right now there aren't consultancy companies who can have this people-centred approach while analysing process and people commitment.*
Product/Service Market Size	*The target market is composed by all small and medium businesses that have a production site. Based on our experience as consultancy provider we can estimate a turn-over in 4 years in the worst-case scenario, as follows:* *Assuming a consulting rate of € 1000/day* *Consulting days for C&A/year:* *First Year 20 days → 20.000 €* *Second Year 24 days → 24.000 €* *Third Year 42 days → 42.000 €* *Fourth Year 66 days → 66.000 €* *This could be the target size for C&A to which we could add the side of the IT consultancy activity estimated in 5000 € in 4 years.*
Market Trends/Public Acceptance	*At the moment, in Italy, in many organizations management and entrepreneurs often declare high focus on people, but seldom they actively introduce policies and systems to favour empowerment along with process improvements.*
Product/Service Positioning	*The SO-PC-Pro approach can be applied to all SMEs that have a production site.*
Legal or normative or ethical requirements (need for authorisations, compliance to standards, norms, etc.)	*None*
Competitors	*At the moment in Italy there aren't consultancy*

SO-PC-Pro has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 609190

	firms that have such a People-centred approach.
Prospects/Customers	*Any SME with a production site. In Italy SMEs are 80% of the total. In Italy we have about 450.000 production SMEs (Istat, 2011)*
Cost of Implementation (before Exploitation)	*Before exploiting the approach further case studies (beyond FIMAP) need to be conducted and empirical data need to be gained for validating the approach. The personnel costs for this approach development are estimated with 55K Euros.*
Time to market	*The consulting service could be ready within one year after the end of SO-PC-Pro, during which we will have completed approach testing phases.*
Foreseen Product/Service Price	*The fee depends on the consulting model applied (e.g. hourly rates, daily consulting rate, performance based rate,...) and the size of the project in which it is applied.*
Adequateness of Consortium Staff	*For the approach validation further use cases and use case companies would be beneficial*
External Experts/Partners to be involved	*Psychologists, university researchers, engineers and IT experts. (Could be done at scientific conferences, workshops, industrial fairs)*
Status of IPR: Background (type and partner owner)	*C&A → Psychology and SME knowledge* *Metasonic → S-BPM knowledge (tools)* *JKU → S-BPM knowledge (method, application)* *FBK → IT knowledge* *ByElement → Context Knowledge*
Status of IPR: Foreground (type and partner owner)	*"People-Centred" approach ~ approach empower people and analyse process improvement.*
Status of IPR: Exploitation Forms (type and partner owner) **e.g. direct industrial use, patenting, technology transfer, license agreement, publications, standards, etc.**	*Direct industrial use and publications*
Which partner contributes to what (main contributions in terms of know how, patents, etc.)	*JKU: approach development* *Metasonic: tool support* *C&A: application of knowledge* *FBK: IT tool support* *ByElement: context analysis*
Partner/s involved expectations	*[C&A]: To apply a people-centred approach in order to empower people while improving business processes*
Sources of financing foreseen after the end of the project (venture capital, loans, other grants, etc.)	*As a private consultancy firm C&A will use internal sources of financing. Also further project proposals are considered necessary for*

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	exploitation after the project.

3.2.4 C_A_2: SO-PC-Pro Training and education

On the training side we can start to develop this culture to managers and entrepreneurs and try to make them familiar to SO-PC-Pro approach and results.
Thus exploiting the given outcomes could be a perfect solution in order to offer to our customers a wider span of solutions which are brand new and recognized by European Commission as well as the Intelligent Manufacturing Systems organisation.
Moreover, in the education field we can organize meetings and conferences with the vast network of people that we usually connect during our conventions. Also the support of and collaboration with Johannes Kepler University Linz and FBK provides a great opportunity for the purpose of spreading the word in the academic context.

Innovativeness introduced compared to already existing Products/Services	*The SO-PC-Pro approach gives us the possibility give our consultancy clients a new approach for their production site, based not only on process analysis but also on a way to empower people, putting them in the centre of the consultancy intervention. In this case we can intervene also with training and education both on workers and managers.*
Unique Selling Point (competitive advantages)	*Right now there aren't consultancy companies who can have this people-centred approach while analysing process and people commitment. Therefore there aren't specific training programs dedicated to this approach.*
Product/Service Market Size	*The target market is composed by all small and medium businesses that have a production site, and that have decided to apply this approach within their organizations. Based on our experience as training provider we can estimate a turn-over in 4 years in the worst-case scenario, as follows:* *Assuming a training rate of € 1500/training-program for C&A/year:* *First Year 2 programs → 3.000 €* *Second Year 4 programs → 6.000 €* *Third Year 4 programs → 6.000 €* *Fourth Year 8 programs → 12.000 €* *This could be the target size for C&A. to this we could add the part of education estimated in 7000 € in four years*
Market Trends/Public Acceptance	*At the moment, in Italy, in many organizations management and entrepreneurs often declare high focus on people, but seldom they actively introduce policies and systems to favour empowerment along with process*

SO-PC-Pro has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 609190

	improvements.
Product/Service Positioning	*The SOPC-Pro approach can be applied to all SMEs that have a production site. Through these training programs not only we can arise awareness but also give tools for future developments of the approach within the companies interested.*
Legal or normative or ethical requirements (need for authorisations, compliance to standards, norms, etc.)	*None*
Competitors	*At the moment in Italy there aren't consultancy firms that have such a People-centred-approach training programs.*
Prospects/Customers	*Any SME with a production site that is willing to implement the system*
Cost of Implementation (before Exploitation)	*Before exploiting the training programs we need to increase awareness through education, congresses, conventions and seminars. The personnel costs for this approach development are estimated within 55000 Euros.*
Time to market	*The training programs could be ready along with the consultancy service, within one year after the end of SO-PC-Pro, during which we will have completed approach testing phases.*
Foreseen Product/Service Price	*The fee of the training programs depends on the model applied (e.g. hourly rates, daily consulting rate, performance based rate,.....) and the size of the project in which it is applied.*
Adequateness of Consortium Staff	*For the approach validation further scientific reference and use case validation would be beneficial*
External Experts/Partners to be involved	*Psychologists, university researchers, engineers and IT experts. (Could be done at scientific conferences, workshops, industrial fairs)*
Status of IPR: Background (type and partner owner)	*C&A → Psychology and SME knowledge* *Metasonic → S-BPM knowledge (tools)* *JKU → scientific support* *FBK → IT knowledge*
Status of IPR: Foreground (type and partner owner)	*"People-Centred" approach ~ approach empowered people and analyse process improvement.*
Status of IPR: Exploitation Forms (type and partner owner) e.g. direct industrial use, patenting, technology transfer, license agreement, publications, standards, etc.	*Direct training use and publications*
Which partner contributes to what (main contributions in terms of know-how,	*JKU: scientific and conference support* *Metasonic: tool support*

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patents, etc.)	*C&A: application of knowledge* *FBK: IT tool support*
Partner/s involved expectations	*[C&A]: To apply a people-centred approach in order to empower people while improving business processes through a proper training*
Sources of financing foreseen after the end of the project (venture capital, loans, other grants, etc.)	*As a private consultancy firm C&A will use internal sources of financing. Also further project proposals are considered necessary for exploitation after the project.*

3.2.5 CEN_1: One-stop-shop for Business and IT Integration

For clients from the manufacturing sectors (small, medium, big enterprises) it is planned to provide all-in-one services aimed at the analysis of the current status of the selected processes, identification of their critical points. Simultaneously, the aim is to support clients regarding the change management related to the implementation of the proposed state in terms of organizational and technical point of view. Following the consulting outputs, full technological support services will be provided for our clients within the implementation of the proposed changes. This collaboration comprises of creating detailed functional specification of the information system, creating users interface, communication with the current vendors of information systems and company partners, development, testing, launching information system and operational support. The SO-PC-Pro methodology will be applied within all above mentioned steps.

Innovativeness introduced compared to already existing Products/Services	*The most innovative part is the approach for designing the new system with use of developed methodology with strong focus on employees. The idea of this concept is to support potential customer with full portfolio of services that covers all project lifecycle activities like analysis - design - implementation - testing - evaluation - next development. So the Customer should get all services regarding implementation of SO-PC-Pro methodology into his environment.*
Unique Selling Point (competitive advantages)	*The advantages compared to another vendors would be the SO-PC-Pro methodology toolkit - defining requirements, modelling the processes, prototyping, testing, using contextual data, evaluating.*
Product/Service Market Size	***Industry:*** *Based on the analysis of the Slovak market seven most trendiest production field were identified encompassing 33 000 organizations with total turnover exceeding 42,1 billion euros.* ***IT Vendors:*** *Over 90 vendors implementing more than 45*

SO-PC-Pro has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 609190

	ERP solutions operate within the indicated areas.
Market Trends/Public Acceptance	*Industry companies today are focusing on improving company internal processes implementation and resources planning. However, they follow rather a top-down approach aiming at standardized, effective and efficient processes and thereby neglect local, on-site workplace requirements. Thus, the SO-PC-Pro approach, representing a bottom-up (people-centred) approach to agile process development, is considered a significant distinguishing criterion.*
Product/Service Positioning	*The product will be positioned as a business and IT toolkit mainly for manufacturing industries.*
Legal or normative or ethical requirements (need for authorisations, compliance to standards, norms, etc.)	**-**
Competitors	*Potential competitors are the group of IT vendors or Consultancy companies providing their services Manufacturing industry.*
Prospects/Customers	*We perceive our potential customers as manufacturers of:* *- motor vehicles, trailers and semi-trailers* *- computer, electronic and optical products,* *- basic and fabricated metal products,* *- food products,* *- rubber and plastic products,* *- machinery and equipment.*
Cost of Implementation (before Exploitation)	*Mainly it's time that would be spent to finalize the SO-PC-Pro methodology toolkit. We predict 50 000 EUR to be spent to finalize the toolkit, next 20 000 EUR to prepare marketing materials and set up the product communication and next 15 000 EUR to support the business development activities.*
Time to market	*The product should be ready for implementation within one year after closing the SO-PC-Pro project.*
Foreseen Product/Service Price	*It would depend on the type of activity and price will vary from 400 EUR - 650 EUR per man day.*
Adequateness of Consortium Staff	*Basically all of the consortium partners will be required.*
External Experts/Partners to be involved	*Selected IT Vendors to provide a support in system interfaces of ERP systems for integration purposes.*

SO-PC-Pro has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 609190

Status of IPR: Background (type and partner owner)	-
Status of IPR: Foreground (type and partner owner)	-
Status of IPR: Exploitation Forms (type and partner owner) e.g. direct industrial use, patenting, technology transfer, license agreement, publications, standards, etc.	-
Which partner contributes to what (main contributions in terms of know-how, patents, etc.)	*Metasonic, MAS - integration* *ByElement, JKU - Methodology*
Partner/s involved expectations	*When integrating third party system we will need support from Metasonic to be able to integrate external systems.*
Sources of financing foreseen after the end of the project (venture capital, loans, other grants, etc.)	*20 % comes from own capital, the rest we would like to apply for a grant with cooperation with current consortium partners or local universities or manufacturing companies for further development of the methodology.*

3.2.6 FBK_1: Collaborative workplace improvement tool

This exploitable result represents a tool fostering the interaction between workers and management within a company where several and different work environments are foreseen.
In particular, the tool implements a set of facilities exploitable from workers for highlighting issues in the work environment or for advising about problems concerning external actors like suppliers.
Moreover, from the management point of view, the system allows to monitor suggestions and error reports provided by workers in order to equip the management with facilities able to provide corrective actions both on the work environment and workflow sides.
The approach has been applied by FBK within the alignment of the FIMAP Use Case scenario (Nov. 2014).

Innovativeness introduced compared to already existing Products/Services	*The outcome represents an innovative tool for monitoring work environment and for making workers in the middle of the company organization. No software on the market implements such features, they are limited to the analysis of data.*
Unique Selling Point (competitive advantages)	*The main USP of this tool is its easy-to-use interface for both workers and management for providing data.*

SO-PC-Pro has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 609190

Product/Service Market Size	*The target market is represented by all kind of production companies. At European level the number of companies that may be interested in this tool might be higher than 1K.*
Market Trends/Public Acceptance	*The market trend for software allowing the cooperation between workers and management in production companies is increasing due to the necessity from the management point of view of monitoring which might be the possible reasons for slow production or environment issues.*
Product/Service Positioning	*The tool will be positioned as a professional software service that, if needed, can be integrated in existing platforms.*
Legal or normative or ethical requirements (need for authorisations, compliance to standards, norms, etc.)	*None*
Competitors	*By considering the eclectic nature of the software, no competitors implementing all features have been identified.*
Prospects/Customers	*A customer can be any organisation (SME, large Enterprise, public organisation,…) in need of process improvement and organisational development.*
Cost of Implementation (before Exploitation)	*Before exploiting the approach further case studies (beyond FIMAP) need to be conducted and empirical data need to be gained for validating the approach. The personnel costs for this approach development are estimated with 50K Euros.*
Time to market	*The consulting service could be ready within one year after the end of SO-PC-Pro, during which we will have completed approach testing phases.*
Foreseen Product/Service Price	*The fee depends on the consulting model applied (e.g. hourly rates, daily consulting rate, performance based rate,…..) and the size of the project in which it is applied.*
Adequateness of Consortium Staff	*For the approach validation further use cases and use case companies would be beneficial*
External Experts/Partners to be involved	*Concerning the implementation of the entire platform, the Metasonic partner should be involved for the activation of the S-BPM suite.*
Status of IPR: Background (type and partner owner)	*Metasonic - > S-BPM knowledge (tools)*

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Status of IPR: Foreground (type and partner owner)	*FBK*
Status of IPR: Exploitation Forms (type and partner owner) e.g. direct industrial use, patenting, technology transfer, license agreement, publications, standards, etc.	*Modelling knowledge to be published in scientific papers.*
Which partner contributes to what (main contributions in terms of know-how, patents, etc.)	*FBK: approach and tool development* *Metasonic: tool support* *Consulting and industrial partners: application of knowledge*
Partner/s involved expectations	*[METASONIC]: To extend the S-BPM body of knowledge and enable organisations to create intelligible process representations by using an integrated version of S-BPM and MoKi*
Sources of financing foreseen after the end of the project (venture capital, loans, other grants, etc.)	*As a research institution FBK will depend on financing from consulting or industrial partners to further develop the approach. For this reason also further project proposals are considered necessary for exploitation after the project.*

3.2.7 FIMAP_1: People-centred workplace re-design

The SO-PC-Pro methodology is applied in FIMAP on two levels. Collecting information and suggestions from daily work and analysing them a company can:

- Improve the efficiency of the process
- Improve the working conditions (empowerment) of the worker and increase his productivity.

Within the application of the SO-PC-Pro methodology know-how and experience will be developed at FIMAP. This know-how and experience is anticipated as foreground of FIMAP within the project.

Innovativeness introduced compared to already existing Products/Services	*The innovativeness of this approach is related to the use of new information technology tools. These tools allow all workers to easily insert error reports and suggestions and allow the management to analyse the change propagation and keep track of the status of each process constantly*
Unique Selling Point (competitive advantages)	*The main advantages are: efficiency in the task of inserting data, the possibility of having automatic analysis and automatic reactions if some scenario gets triggered, more control over a process and in depth comprehension of it. Moreover there will be a new approach towards people-centred production that will increase workers empowerment as well as organizational climate.*

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Product/Service Market Size	*For Fimap the exploitation plan is:* *Extending the approach and tools to other producing areas in Fimap plant* *Exporting it to our partner companies in the Comac group* *Recommending it and showing results to some key suppliers.*
Market Trends/Public Acceptance	*In the last decades the working environment has been changing gradually becoming more people centred. Organizational and technological developments are improving workers situation. Ethical values and ecological sustainability is a great leverage in every market campaign.* *In the last few years social media has been growing exponentially. SO-PC-PRO approach and methodology merge these trends perfectly up to date.*
Product/Service Positioning	*This approach and methodology is considered like a professional service that a business consultancy agency can offer*
Legal or normative or ethical requirements (need for authorisations, compliance to standards, norms, etc.)	*Unions and labour laws have to be taken into consideration*
Competitors	*Other consultancy agencies could offer other ethical approaches like SA800, management systems like ISO 9001 etc*
Prospects/Customers	*A customer can be any organisation (SME, large Enterprise, public organisation,…) in need of process improvement and organisational development.*
Cost of Implementation (before Exploitation)	*Before exploiting the approach further case studies need to be conducted and empirical data need to be gained for validating the approach. The personnel costs for this approach development are estimated with 50K Euros.*
Time to market	*The consulting service could be ready within one year after the end of SO-PC-Pro, during which we will have completed approach testing phases.*
Foreseen Product/Service Price	*The fee depends on the consulting model applied (e.g. hourly rates, daily consulting rate, performance based rate,...) and the size of the project in which it is applied.*
Adequateness of Consortium Staff	*For the approach validation further use cases and use case companies would be beneficial. Different consortium partners can contribute each one supporting their specific field of*

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	knowledge.
External Experts/Partners to be involved	*Any company or organization will need a consultant agency expert in that field to adapt the approach to the specific use case, so new partners will be necessary*
Status of IPR: Background (type and partner owner)	
Status of IPR: Foreground (type and partner owner)	
Status of IPR: Exploitation Forms (type and partner owner) e.g. direct industrial use, patenting, technology transfer, license agreement, publications, standards, etc.	
Which partner contributes to what (main contributions in terms of know how, patents, etc.)	*JKU: approach development* *Metasonic: tool support* *FBK: IT support* *Cesaro & Associati: application of knowledge and psychological aspects*
Partner/s involved expectations	*Our expectations are:* • *improving the team work of our workers, improving their working environment and so their productivity* • *improving the efficiency of the process improving the traceability of data and it's analysis.*
Sources of financing foreseen after the end of the project (venture capital, loans, other grants, etc.)	*After the project Fimap and other Comac group companies will see what is reusable and what needs to be modified. Will be evaluated the cost/benefit ratio and in case of the decision of purchasing more equipment/consultancy services we have the financial means of financing*

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3.2.8 JKU_1: S-BPM [de-]constructed

This exploitable result represents a modelling approach for S-BPM that seeks to model subjects rather as fine-grain behaviours of actors (e.g. location sensing, power sensing, quality checking) than roles (e.g. Quality Checker, Location sensor,…). Applying S-BPM in such a way, organisational behaviours are represented as activities/functions and required communication related to these activities/functions. The revealed behaviours may be assigned to actors (i.e. humans, machines) depending on their capabilities and skills. This may allow for dynamic allocation of tasks to humans and machines, process execution support based on skill levels, revealing performed behaviours of actors and [de-] constructing organisational behaviours.
The approach has been applied by JKU within the alignment of the TCContact Use Case scenario (Nov. 2014).

Innovativeness introduced compared to already existing Products/Services	*This results represents an S-BPM modelling method innovation. So far, S-BPM processes have been modelled rather as roles that behaviours. A behaviour oriented approach reveals fine grain behaviours of organisational actors (humans, machines) and may serve as basis for generating job descriptions, communicating required skills for jobs, changing responsibilities of actors, dynamically allocating tasks to humans based on competencies,…*
Unique Selling Point (competitive advantages)	*The main USP of this S-BPM extension is considered to be the intelligibility of the revealed process models, the ability to immediately execute such models and individually configure them for organisations.*
Product/Service Market Size	*The target market is BPM Consulting – specifically process elicitation, change management. Forrester estimated the total global BPM market for 2016 to have a volume of $7.6 billion.* *Assuming a consulting rate of € 1500/day and 24 Consulting days for JKU/year -> 30K/Year could be the target size for JKU.*
Market Trends/Public Acceptance	*Highly volatile and changing environments force today's organisations to be flexible and continuously adapt. Recent developments in the field of BPM focus on stakeholder-oriented elicitation of process knowledge and immediate validation of the revealed knowledge. The given exploitable approach targets to reveal fine grain behaviours of organisational actors in an intelligible way.*

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	Such representations provide the basis for sharing of process knowledge among process actors, dynamically assigning suitable actors to behaviours, and for organisational changes.
Product/Service Positioning	*This modelling approach is considered an extension of the S-BPM. As such it may be applied in any S-BPM project when eliciting processes or within organisational development projects. JKU as a research institution is interested in gathering further field data from industrial projects and in validating the approach in various domains (industrial, health care,…).*
Legal or normative or ethical requirements (need for authorisations, compliance to standards, norms, etc.)	*None*
Competitors	*Other BPM approaches and BPM Consulting providers (BPMN, ARIS, UML,…)*
Prospects/Customers	*A customer can be any organisation (SME, large Enterprise, public organisation,…) in need of process improvement and organisational development.*
Cost of Implementation (before Exploitation)	*Before exploiting the approach further case studies (beyond TC Contact) need to be conducted and empirical data need to be gained for validating the approach. The personnel costs for this approach development are estimated with 50K Euros.*
Time to market	*The consulting service could be ready within one year after the end of SO-PC-Pro, during which we will have completed approach testing phases.*
Foreseen Product/Service Price	*The fee depends on the consulting model applied (e.g. hourly rates, daily consulting rate, performance based rate,…..) and the size of the project in which it is applied.*
Adequateness of Consortium Staff	*For the approach validation further use cases and use case companies would be beneficial*
External Experts/Partners to be involved	*(S-)BPM practitioners and experts might be beneficial to discuss the approach and experiences in the field. (Could be done at scientific conferences, workshops, industrial fairs)*
Status of IPR: Background (type and partner owner)	*Metasonic - > S-BPM knowledge (tools)* *JKU -> S-BPM knowledge (method, application)*
Status of IPR: Foreground (type and partner owner)	*"S-BPM [de]constructed" approach ~ approach to elicit and model s-bpm processes. Originated from: JKU*

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Status of IPR: Exploitation Forms (type and partner owner) e.g. direct industrial use, patenting, technology transfer, license agreement, publications, standards, etc.	*Modelling knowledge to be published in scientific papers.*
Which partner contributes to what (main contributions in terms of know how, patents, etc.)	*JKU: approach development* *Metasonic: tool support* *Consulting and industrial partners: application of knowledge*
Partner/s involved expectations	*[JKU]: To extend the S-BPM body of knowledge and enable organisations to create intelligible process representations*
Sources of financing foreseen after the end of the project (venture capital, loans, other grants, etc.)	*As a research institution JKU will depend on financing from consulting or industrial partners to further develop the approach. For this reason also further project proposals are considered necessary for exploitation after the project.*

3.2.9 MAS_1 – The BioRing – a wearable ring for measuring physiological human data

Innovativeness introduced compared to already existing Products/Services	*The MAS Bioring developed for SO-PC-PRO provides a real time stream of feature set data extracted from the wearer's heart (electrocardiograph) signal, blood pulse wave volume (finger photplethysmograph), skin conductance or local bio-impedance and physical activity (accelerometer). The ring is designed to flexibly strap to a wide range of finger sizes and is easily controlled by a dedicated iPad/iPhone App. As far as we know no equivalent form factor and multi-factor bio sensor is available today.*
Unique Selling Point (competitive advantages)	*The main USP is the small form factor which facilitates non-invasive, ergonomic, wearable simplicity and ease of use. The ring is ideal for both research and production shop floor settings.*
Product/Service Market Size	*On the basis of selling 5K rings per year, the foreseeable market is between 1 and 2 million Euro per year.*
Market Trends/Public Acceptance	*The market trend for SMART wearables is gathering pace. The Mass Consumer market may not be ready (medically sophisticated) for this type of sensor. It is for this reason we restrict our focus to research and niche markets such as factory applications and other stress related work environments.*
Product/Service Positioning	*The product will be positioned as a professional device used in serious applications. This would include stress monitoring of adults in stressful work*

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	places. One should note that the ring is not sold on its own. It would be supported with services to integrate the data stream into the main application software and hardware, providing the client with a full turnkey solution.
Legal or normative or ethical requirements (need for authorisations, compliance to standards, norms, etc.)	*The product requires full CE and Medical Sensor ClassII approvals.*
Competitors	*All other medical sensors on the market are our competitors. One can purchase ECG, PPG, skin conductance and activity sensors from multiple vendors. However our USP and service proposition cannot be provided as far as we know by any competitor.*
Prospects/Customers	*Our prospective customers fall into several categories.* *Universities researching workplace stress* *Consultancies offering workplace stress management* *Software providers who require a sensor to bundle into their product for stress in the workplace* *Large Companies with large HR departments keen to tackle stress in the workplace* *Emergency and Military Services* *Specialist Medical*
Cost of Implementation (before Exploitation)	*20K Euros will be required to finalise the design produce and package the first inventory.20K Euros will be required to provide a first level online and marketing presence. 20K will be required to gain the relevant product approvals.*
Time to market	*The product could be ready within one year after the close of SO-PC-PRO, during which we will have completed concept testing phases.*
Foreseen Product/Service Price	*The ring will sell for around 250 Euros each in single orders with discounts arranged for quantity. Application integration will be charged on the basis of a contracted turnkey solution.*
Adequateness of Consortium Staff	*Since the first market segment we aim to address is consultancies, large firms and software developers, the consortium is totally adequate to test the concepts of this product.*
External Experts/Partners to be involved	*We will require regional actors to provide the interface and product support in different countries. For example in Switzerland we likely would team with SO-PC-Pro partner ByElement, in Germany METASONIC, in Austria JKU, Slovakia Centire and so on. So similarly we would need other partners in*

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	countries outside the partner mix, e.g. France, Holland etc..
Status of IPR: Background (type and partner owner)	*The bioring is patent applied for by MAS*
Status of IPR: Foreground (type and partner owner)	*The bioring is patent applied for by MAS*
Status of IPR: Exploitation Forms (type and partner owner) e.g. direct industrial use, patenting, technology transfer, license agreement, publications, standards, etc.	*The bioring is patent applied for by MAS*
Which partner contributes to what (main contributions in terms of know how, patents, etc.)	*JKU and METASONIC contribute to the rings system integration and testing*
Partner/s involved expectations	*Our Expectations are:* *to add a new product to the portfolio* *to compete in the market with a unique wearable technology*
Sources of financing foreseen after the end of the project (venture capital, loans, other grants, etc.)	*60% of the anticipated exploitation costs will be derived from own resources which will be boosted by a directors loan.* *We will apply for grants (e.g. Innovate UK 40%) for help in the production phase.*

3.2.10 MAS_2: Tracker for location tracking

Innovativeness introduced compared to already existing Products/Services	*The MAS Tracker developed for SO-PC-PRO provides a continuous advertising of its presence via Bluetooth transmitting the serial number of the workpiece to which it is attached. The tracker is designed to be easily tagged to any manufacturing workpiece. It is easily programmed with a new workpiece serial number using a dedicated iPad/iPhone App. There are similar devices on the market, some of them for home use as asset tags and there exist active RFID tags for industry. Our product is innovative in that it is custom integrated with iPod and iPad technologies, taking account that companies labelling methods and is customised to meet the demands of the specific customer.*
Unique Selling Point (competitive advantages)	*The main USP is the price point. The tags are individually low in price, however there is a one off customisation charge.*
Product/Service Market Size	*On the basis of selling 50K trackers per year, the foreseeable market is between 1 and 2 million Euro*

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	per year including the customisation charge.
Market Trends/Public Acceptance	*The market trend for asset tracking is growing rapidly. However the growth in tracker sales will depend on their interoperability with leading ERP systems. Our aim is to tackle the same market as METASONIC and achieve initial growth on the back of their deployed systems.*
Product/Service Positioning	*The product will be positioned as a rugged low cost tracker for use in many different factory environments providing location tracking, and the recording of workpiece or asset movement, temperature and magnetic fields. It would be supported with services to integrate the trackers with the main application software and hardware, providing the client with a full turn key solution.*
Legal or normative or ethical requirements (need for authorisations, compliance to standards, norms, etc.)	*The product requires full CE approvals. This will not be a problem as MAS will self certify the product.*
Competitors	*A number of competing tracking devices exist. The Tile is an example positioned towards the consumer market. For industry the trend has been to use passive RFID tracking since the devices are low cost and have no batteries. We are not addressing solutions that can be solved with passive RFID. Active RFID systems are emerging without a clear leader. Bluetooth based beacon systems are however rapidly emerging, however in our experience, each manufacturers situation may require special cases programmed into the tracker. There are very few to no active tracker vendors offering bespoke customisation. This is a service that very much depends on the company's cost base.*
Prospects/Customers	*Our prospective customers are METASONIC and the agents and consultants who support the METASONIC suite. We will sell to the end customer via this chain.*
Cost of Implementation (before Exploitation)	*20K Euros will be required to finalise the design produce and package the first inventory.20K Euros will be required to provide a first level online and marketing presence..*
Time to market	*The product could be ready within one year after the close of SO-PC-Pro, during which we will have completed concept testing phases.*
Foreseen Product/Service Price	*The tracker will sell for around 25 Euros each in single orders with discounts arranged for quantity.*

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	Application integration will be charged on the basis of a contracted turn key solution.
Adequateness of Consortium Staff	*Since the first market segment we aim to address is consultancies, large firms and software developers, the consortium is totally adequate to test the concepts of this product.*
External Experts/Partners to be involved	*We will require regional actors to provide the interface and product support in different countries. For example in Switzerland we likely would team with SO-PC-Pro partner ByElement, in Germany METASONIC, in Austria JKU, Slovakia Centire and so on. So similarly we would need other partners in countries outside the partner mix, e.g. France, Holland etc..*
Status of IPR: Background (type and partner owner)	*The tracker design is copyright of MAS*
Status of IPR: Foreground (type and partner owner)	*The tracker design is copyright of MAS*
Status of IPR: Exploitation Forms (type and partner owner) e.g. direct industrial use, patenting, technology transfer, license agreement, publications, standards, etc.	*The tracker design is copyright of MAS*
Which partner contributes to what (main contributions in terms of know how, patents, etc.)	*CENTIRE and METASONIC will contribute to the tracker's system integration and testing*
Partner/s involved expectations	*Our Expectations are:* *to add a new product to the portfolio* *to compete in the market with a unique tracking technology*
Sources of financing foreseen after the end of the project (venture capital, loans, other grants, etc.)	*60% of the anticipated exploitation costs will be derived from own resources which will be boosted by a directors loan.* *We will apply for grants (e.g. Innovate UK 40%) for help in the production phase.*

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3.2.11 MET_1: Seamless process management across the IEC 62264 control hierarchy

Innovativeness introduced compared to already existing Products/Services	*Toolset and methodology for seamless process management that enables:* • *intuitive modelling by business people and automation engineers* • *encapsulation of separate knowledge domains* • *process execution in real time and non-real time*
Unique Selling Point (competitive advantages)	*Integrated, understandable and executable modelling of complex processes in production enterprises*
Product/Service Market Size	*The market is composed of the global BPM market and the upcoming Internet of Things (IoT) manufacturing market* *Size of the global BPM market in 2014: $4.71 billion, which is estimated to rise to > $10 billion by 2019 (Source: Research and Markets, in 2015)* *Estimated size of the IoT manufacturing market ("Industrie 4.0") in Germany by 2020: > €10 billion (Source: Experton Group, in 2014)*
Market Trends/Public Acceptance	*Many companies have already invested in BPM solutions based on the BPMN process notation that is currently regarded as a "standard".*
Product/Service Positioning	*Large and medium sized production companies*
Legal or normative or ethical requirements (need for authorisations, compliance to standards, norms, etc.)	*Some certifications might be needed: OPC UA, PLCopen XML*
Competitors	*No clear competitors at this stage, but competition may rise from future "Industrie 4.0" projects and spin-offs from research institutes currently active in the IoT field (e.g. TU München)*
Prospects/Customers	*Production companies (as software users)*
Cost of Implementation (before Exploitation)	*€60000 (personnel cost for ca. 15 PMs)*
Time to market	*Experience and knowledge gained can be used immediately.* *Time to develop the demonstrator: 15 PMs*
Foreseen Product/Service Price	*Licensing: 250€ per user*

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	Consulting services (integration, training, maintenance/support): ca. 70000€ for a medium-sized project
Adequateness of Consortium Staff	*Lack of automation knowledge in the consortium*
External Experts/Partners to be involved	*Automation solutions (PLC) provider and/or relevant research institutions*
Status of IPR: Background (type and partner owner)	*Metasonic Suite, S-BPM approach*
Status of IPR: Foreground (type and partner owner)	*Metasonic owns the IP related to:* *-transformation of S-BPM to PLCopen XML* *-OPC UA refinement template* *-B2MML export*
Status of IPR: Exploitation Forms (type and partner owner) e.g. direct industrial use, patenting, technology transfer, license agreement, publications, standards, etc.	*License agreements* *White papers, success stories* *Scientific publications*
Which partner contributes to what (main contributions in terms of know how, patents, etc.)	*JKU, TCC (and potentially BIM): use and evaluation of demonstrator*
Partner/s involved expectations	*Expectations:* *-to add a new product and new services to the portfolio* *-to enter the upcoming IoT / Industrie 4.0 market* *-to strengthen the reputation of Metasonic as the leading innovator in BPM*
Sources of financing foreseen after the end of the project (venture capital, loans, other grants, etc.)	*Own resources* *Development partners*

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3.2.12 MET_2: Contextual design support

Innovativeness introduced compared to already existing Products/Services	*Tool that supports process design by modelling context information and improvement suggestions (captured using another foreground technology (FBK_1)) associated with particular elements of S-BPM process models. The tool acts as a viewing and analyzing feature for this information to identify issues and reuse possible (suggested) solutions. To date there is no other S-BPM tool that offers these capabilities.*
Unique Selling Point (competitive advantages)	*Rich representation for process designers that adds more detailed information about processes beyond abstract process models*
Product/Service Market Size	*The market is composed of the global BPM market whose size in 2014 was $4.71 billion. It is estimated to rise to > $10 billion by 2019 (Source: Research and Markets, in 2015)*
Market Trends/Public Acceptance	*As the tool is built as an add-on for the Metasonic Suite, no barriers to adoption are expected among existing Metasonic customers. For end-users that use other BPM tools than S-BPM/Metasonic, the same general barrier applies as described for MET_1.*
Product/Service Positioning	*Large and medium sized production companies*
Legal or normative or ethical requirements (need for authorisations, compliance to standards, norms, etc.)	*Not known at this stage*
Competitors	*No known competitors*
Prospects/Customers	*Any company using process management software*
Cost of Implementation (before Exploitation)	*€50000 (personnel cost for ca. 12 PMs)*
Time to market	*Experience and knowledge gained can be used immediately.* *Time to develop the demonstrator: 12 PMs*
Foreseen Product/Service Price	*The tool will be offered as part of the existing product Metasonic Suite, without additional licensing fees. Consulting services (integration, training, maintenance/support): ca. 50000€ for a medium-sized project*

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Adequateness of Consortium Staff	*The consortium is adequate*
External Experts/Partners to be involved	*Part of the tool (viewing/analysing improvement suggestions) will require implementation of the MoKi tool (FBK_1). Relevant expertise would then be needed from FBK. Otherwise no specific experts/partners are needed.*
Status of IPR: Background (type and partner owner)	*Metasonic Suite, S-BPM approach*
Status of IPR: Foreground (type and partner owner)	*Metasonic owns all the IP related to the tool*
Status of IPR: Exploitation Forms (type and partner owner) e.g. direct industrial use, patenting, technology transfer, license agreement, publications, standards, etc.	*License agreements* *White papers, success stories* *Scientific publications*
Which partner contributes to what (main contributions in terms of know how, patents, etc.)	*FIM (and potentially BIM): use and evaluation of demonstrator* *FBK: development of MoKi to provide the data to be displayed in the tool*
Partner/s involved expectations	*Expectations:* *-to enhance the existing Metasonic Suite* *-to strengthen the reputation of Metasonic as the leading innovator in BPM*
Sources of financing foreseen after the end of the project (venture capital, loans, other grants, etc.)	*Own resources* *Development partners*

3.2.13 MET_3: Process improvement methods

Innovativeness introduced compared to already existing Products/Services	*Methods and tools for analyzing and improving processes based on combinations of the S-BPM modelling approach and existing process improvement techniques from production and engineering design, including value stream design (VSD). No other BPM approach includes these techniques, because only S-BPM provides the modelling constructs needed to support VSD.*

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Unique Selling Point (competitive advantages)	*The use of process improvement techniques such as VSD allows streamlining business processes by identifying and reducing "lean waste" such as waiting times and inventory. The input data to these techniques can be directly collected from the KPI management capabilities of the Metasonic Suite. Process improvements can be directly modelled in the Metasonic Suite rather than with pen and paper (as is currently the case), which allows direct execution of process improvements.*
Product/Service Market Size	*The market is composed of the global BPM market whose size in 2014 was $4.71 billion. It is estimated to rise to > $10 billion by 2019 (Source: Research and Markets, in 2015)*
Market Trends/Public Acceptance	*Lean practitioners are generally reluctant about relying on software systems (such as BPM tools) to collect data for VSD. They often prefer getting their data from visually inspecting the process and taking notes with pen and paper, despite obvious drawbacks of such a manual data collection.*
Product/Service Positioning	*Large and medium sized production companies*
Legal or normative or ethical requirements (need for authorisations, compliance to standards, norms, etc.)	*Not known at this stage*
Competitors	*No known competitors*
Prospects/Customers	*Companies and organisations (business and production) interested in lean process improvement*
Cost of Implementation (before Exploitation)	*€50000 (personnel cost for ca. 12 PMs)*
Time to market	*Experience and knowledge gained can be used immediately.* *Time to develop the demonstrator: 18 PMs*
Foreseen Product/Service Price	*Consulting services (integration, training, maintenance/support): ca. 75000€ for a medium-sized project*
Adequateness of Consortium Staff	*The consortium is adequate*
External Experts/Partners to be involved	*Otherwise no specific experts/partners are needed.*

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Status of IPR: Background (type and partner owner)	*Metasonic Suite, S-BPM approach*
Status of IPR: Foreground (type and partner owner)	*Metasonic owns all the IP related to method and tool support*
Status of IPR: Exploitation Forms (type and partner owner) e.g. direct industrial use, patenting, technology transfer, license agreement, publications, standards, etc.	*License agreements* *White papers, success stories* *Scientific publications*
Which partner contributes to what (main contributions in terms of know how, patents, etc.)	*No partners involved*
Partner/s involved expectations	*Expectations:* *-to enhance existing S-BPM consulting services with process improvement expertise* *-to strengthen the reputation of Metasonic as the leading innovator in BPM*
Sources of financing foreseen after the end of the project (venture capital, loans, other grants, etc.)	*Own resources* *Development partners*

3.2.14 TCContact_1: Seamless process management through transparent communication

The SO-PC-Pro result for TC Contact comprises an information system, which will optimize the company production in combination with the existing information system and thus will increase the total work effectiveness in the company. The most important fact is that the work effectiveness increase, will neither be due to the exclusion of employees´ satisfaction, nor to the increase of the performance standards. The work effectiveness in the company will be raised by several means implemented in the new information system transformed into the people-centred production.

Innovativeness introduced compared to already existing Products/Services	*The most innovative thing is to use the bottom-up (people centred) approach for fulfilling company strategy. The idea is to be in better contact with employees on the shopfloor in each single step of manufacturing process - technological preparation, planning, manufacturing, quality testing and final assembly. We await that by involving employees in this crucial steps will increase employees motivation, makes communication between departments more efficient and hassle-free. All this aspect then should be enriched by contextual data so we can have the manufacturing process under full control, to be able to fulfil Customers expectations when*

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	delivering desired manufactured parts.
Unique Selling Point (competitive advantages)	*Employees can provide their feedback on the production plan, can suggest the changes in the daily operation plan, obtain the task overview for next days and be supported with relevant data from other department to eliminate the idle time.*
Product/Service Market Size	*Exploiting results to* *- Customers,* *- Company partners (co-production)*
Market Trends/Public Acceptance	*From our perspective, we can see that the working environment has change over past years. The main change was, that the employees that delivers value, are getting more in the center of attention. That's the reason why SO-PC-Pro is one-and-only way today when managing such complex environment.*
Product/Service Positioning	**-**
Legal or normative or ethical requirements (need for authorisations, compliance to standards, norms, etc.)	*Labour law and the workplace health and safety should be considered.*
Competitors	*Other manufacturing companies taking advantage of SO-PC-Pro Methodology.*
Prospects/Customers	*Other manufacturing companies or companies that would like to implement into their environment principles of SO-PC-Pro methodology.*
Cost of Implementation (before Exploitation)	*20 0000 EUR should cover the first implementation. Extending solution to other machines will cost approx. 35 000 EUR.*
Time to market	*In case of successfully prototyping phase, the solution for whole shopfloor should be running withig two years after project finish.*
Foreseen Product/Service Price	**-**
Adequateness of Consortium Staff	*Metasonic,* *MAS,* *Centire*
External Experts/Partners to be involved	**-**
Status of IPR: Background (type and partner owner)	**-**
Status of IPR: Foreground (type and partner owner)	**-**
Status of IPR: Exploitation Forms (type and partner owner) e.g. direct industrial use, patenting, technology transfer, license agreement, publications, standards, etc.	**-**
Which partner contributes to what (main contributions in terms of know how, patents, etc.)	*Metasonic - S-BPM modelling tools,* *MAS - sensors (location trackers),* *Centire - consultancy and system integration*

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Partner/s involved expectations	*- improving overview of the manufacturing process on the shopfloor,* *- internal process optimization,* *- providing hints on developing better motivational system,* *- calculating relevant data on machines utilization for better shopfloor economy overview*
Sources of financing foreseen after the end of the project (venture capital, loans, other grants, etc.)	*- 30% own funding, 70 % grant*

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4 Dissemination & Exploitation

The following section gives an overview of the main dissemination and exploitation results of SO-PC-Pro. All dissemination activities can also be found in the Participant Portal.

4.1 Section A - Dissemination

As reported in *D8.1 "Dissemination Plan"*, the main goals of the SO-PC-Pro dissemination strategy are:

- To ensure efficient usage and sharing of knowledge within the consortium
- To ensure dissemination of scientific project results in scientific communities
- To disseminate the SO-PC-Pro approach and technologies within companies and to potentially interested industry groups

To reach these goals different types of dissemination activities will be carried out. Dissemination activities considering the whole **consortium** such as internal knowledge **dissemination**, branding of the developed approach, web presence or the development of dissemination materials are planned. These activities target towards the efficient usage and sharing of knowledge within the consortium as well as towards general dissemination of the gained knowledge. **Academic dissemination** as described comprises efforts spent on disseminating knowledge among scientific communities by means of paper publications, presentations and workshops. Beyond mere academic dissemination, activities such as the development of easily understandable didactic material and case studies are planned to disseminate the gained knowledge within educational communities (**educational dissemination**). **Industrial dissemination** activities comprise activities of the industry partners and activities within the Intelligent Manufacturing Systems (IMS) community. These activities include on the one hand side internal dissemination at the industry partners and on the other hand activities targeted towards potential external partners, e.g. related IMS projects, related FoF projects, interested industry partners suitable for the application of the SO-PC-Pro approach. Details regarding the dissemination plans for the different target audiences (internal, academic, educational, industrial) are reported in D8.1. An overview on the selected dissemination instruments is given in Figure 1.

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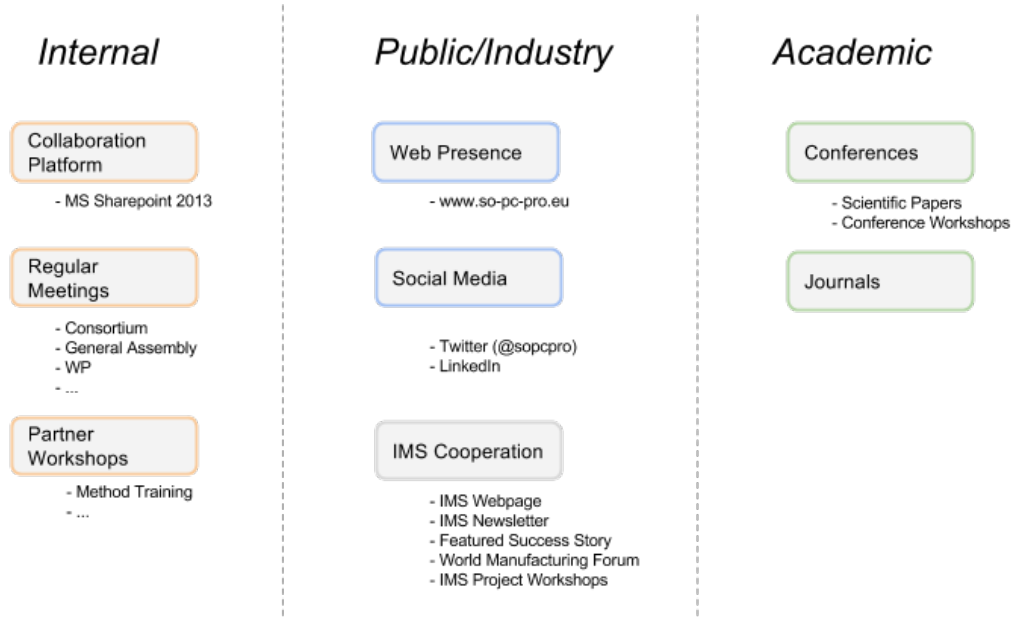

Figure 1: Selected Dissemination Instruments in SO-PC-Pro

Key subject of dissemination in SO-PC-Pro is a set of methods and tools for holistic design and management of people-centred workplaces in production companies. A description of selected exploitable methods and tools related to SO-PC-Pro is given in 3.2. In terms of scientific publications and dissemination activities a plan has been provided in D8.1. In the subsequent section an overview of already published and accepted scientific contributions is given. Further details on academic dissemination such as targeted conferences, journals and topics under consideration are presented in Deliverable D8.1 which is updated regularly. Besides the overview of scientific publications, a list of dissemination measures is presented in section 2.2.

4.2 Section B - Individual and consortium wide exploitation plans

The SO-PC-Pro exploitation can be split into two parts:

- What can we exploit as of today at the project end?
- What we can exploit, as a consortium, within 18 months time?

The previous sections have outlined the aspirations of each individual partner and their exploitation plans for what can be performed as of today.
The three use cases addressed during the project give us a great confidence that our approaches are well accepted and effective in the real world. For example TC Contact want to continue using the system and the improved trackers, Fimap want to roll out the system to the whole company,
Bimbo have asked AXXIS to quote on integration to a POS next year.
Meanwhile there is already great interest in the Bioring and Trackers as a general form of sensor and several organisations have expressed an interest to use the Bioring for stress in the workplace.

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What has become clear is that while on the one hand each industry partner, for example the consultants, have gained a great know how and therefore potential to use SO-PC-Pro in their sales pitch, on the other hand we have seen that during the preparation of the use cases each took a large multidisciplinary team and a long time to shape solutions that sufficiently met the needs of each case on a test pilot basis. So it would seem over ambitious for example to assume one consultant could by themselves achieve the same results.
In many cases we were able to perceive the benefits of SO-PC-Pro only with hindsight. This means we do not have sufficient experience and cannot express today what could be the benefits for a new use case scenario; at least not for sure. So we believe we need time to process the lessons learned.

What we do know is that our systems can only be deployed (or are most likely to be successfully deployed) to meet companies' needs if we rely on the SO-PC-Pro consultants, who have the most up to date experience. Moreover since every use case will be different, we need to provide them better and highly flexible tools for a wide variety of solutions.
We also believe that we should carry the flag for human centred, subject oriented, empowerment of the worker and therefore may also try and shape a SO-PC-Pro product demonstrator based on these tools addressing the specific needs of future workers in the FOTF.

The consortium partners are convinced that the central concepts of the project remain as relevant today as when they were first proposed.
Fortunately the marketing survey needed to justify our efforts has already been conducted in the form of the visionary direction of Industry 4.0.

4.2.1 Review of Industry 4.0 in relation to SO-PC-Pro

When we look at the proposed vision of I4.0 we can set out general goals for the application of all kinds of sensors and support data analytics.

- To make divergent systems work together reliably and efficiently
- Embedding technologies in production systems; in ever smaller partial systems
- Transform mechatronic into cyber physical through widespread information systems creating a system of systems

"In contrast to the early concepts of automation, human beings are not to be "optimized out" of the production processes, but rather to be given an increasingly important role: The CPPSs are to supply them with compressed information suitably derived from the complex interrelationships and communicated in a personalized manner as the basis for their intervention in the process. In this way, not only a new form of cooperation between machines and parts of machines, but also one of cooperation between machines and human beings arises."- from THE GERMAN STANDARDIZATION ROADMAP INDUSTRIE 4.0

"The semi-finished products and parts involved in the manufacturing process are to possess "artificial intelligence", or at least information on themselves and suitable means of communication, and therefore themselves constitute cyber-physical systems. These "smart products" are to be embedded in the process as a whole and in extreme cases control not only their own logistical path through production, but rather the entire production workflow that concerns them." From THE GERMAN STANDARDIZATION ROADMAP INDUSTRIE 4.0

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I4.0 will apply sensors to all types of data flow
- Machine to Machine
- Human Machine
- System wide
- Internet of Things
- End to End

Internet of Things/Services/people will be a key aspect where sensors must provide the glue and data analytics the fibre, that together reinforces worker empowerment and assured high quality productivity of innovative products. Using the Internet of Things and Services in manufacturing, the Internet of Things and Services makes it possible to create networks incorporating the entire manufacturing process that convert factories into a smart environment.
Cyber-Physical Production Systems comprise smart machines, warehousing systems and production facilities that have been developed digitally and feature end-to-end ICT-based integration, from inbound logistics to production, marketing, outbound logistics and service. This not only allows production to be configured more flexibly but also taps into the opportunities offered by much more differentiated management and control processes.

Data flows (sensor + analytics) will couple elements spread across the organisation through their role in Horizontal integration.
Similarly data flows will couple key stakeholders within and out organizations through a Vertical integration of processes.
When the data flows can become embedded into the smallest detail (e.g. in design) through to the smallest detail in production (e.g. delivery timeliness) I4.0 will have achieved the goal of End to end engineering.

To achieve this the sensors must communicate efficiently with SMART networks and the data analytics will need to operate at a high level in order to deal with the millions of inputs and outputs making the analytics close to the field of Artificial Intelligence.

In the TC Contact use case, we tried to improve the accuracy and ease with which Management could better estimate delivery lead times and to realize where a job was placed in the work flow. One could think of this as the Horizontal goal.
Knowing instantly the status of assets (location, completion, and quality) allows multiple departments in an organization to interoperate better since information is timely, accurate and comparable.
It would seem that the power of asset management through sensors is the fact that the sensors expose information which otherwise would remain buried.
Once exposed the data must be converted or associated intelligently with some high level semantic feature. The simplest action is then to monitor the features and compare scenarios, for example seasonal variations, the receipt of different size/volumes of orders, and then compare the data and determine satisfactory answers that explain why there are or are not differences in the newly observed information.

In addition (at TC Contact) we tried to improve the work flow from order receipt all the way through production and quality to the final product. In this respect we aimed to move in the direction of the End to End goal. Finally we tried to use a combination of modeling of

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processes, with tracking, with energy sensing and with new human machine interfaces which starts in the direction of Cyber Physical.

Extrapolating from our experience, the end to end goal is difficult to realize because in general different departments have different goals. For example a product design department may like the idea of adding a feature to a product to improve its appeal. The change may impact the production departments for various reasons, for example difficulties in achieving quality levels of reliability.
End to End goals need end to end metrics that tie directly to a chain of work flow.
For this reason the use of energy along a workflow could provide the types of metrics we need to establish if end to end improvements have been made.
Broader productivity goals can be imagined by management. For example, the power consumption used by every value adding step from start to end may be tracked and monitored over several months. The power consumption of each step could be analyzed and intelligently associated with the highest cost factor that is implicit in that step. This cost could be the cost of running a machine, or the use of a precious material or the cost of labor. Once the relevant cost of the end to end flow can be measured over several operations and alternative scenarios, it may be possible to apply a cost minimization process. The cost needn't be financial and could be for example a human factor such as stress.

Creating the sensors and cyber physical platform has its own engineering challenges, however the benefits to productivity will always rely heavily on what one chooses to improve and if a simple CPP can be set up which together with intelligent analytics can derive the information which we can first compare and then propose optimization methods.

"Better, not cheaper" as an opportunity and benchmark for industrial change… This socio-technical approach argues that adopting an even more extreme version of the Taylorist approach to work organization based on frequent repetition of highly standardized and monotonous tasks is hardly the most promising way to go about implementing the Industry 4.0 initiative in partnership with employees in a way that allows new efficiency gains to be achieved. The fact that smart factories will be configured as highly complex, dynamic and flexible systems means that they will need employees who are empowered to act as decision-makers and controllers. "

"Smart assistance systems release workers from having to perform routine tasks, enabling them to focus on creative, value-added activities. In view of the impending shortage of skilled workers, this will allow older workers to extend their working lives and remain productive for longer. Flexible work organization will enable workers to combine their work, private lives and continuing professional development more effectively, promoting a better work-life balance. "

"Implementation of a socio-technical approach to work organization will offer workers the opportunity to enjoy greater responsibility and enhance their personal development. For this to be possible, it will be necessary to deploy participative work design and lifelong learning measures and to launch model reference projects. "

Technology and automation in today's factories seem to be being applied mainly to reduce costs, primarily labor costs and increase high availability production levels.

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Take for example the recent news that manufacturing giant Foxconn replaces '60,000 factory workers with robots', http://www.bbc.com/news/technology-36376966 .

So the factory of the future that I4.0 is talking about is a different place, where Taylorist methods are not to be used.
Instead, workers will use automation as an adjunct to their work but only in so far as it helps them creatively or to achieve decision making and control.
So how can we imagine sensors and intelligent data analytics contributing to this way of thinking?

From our experience in SO-PC-PRO there are possibly two ways. Disengagement and Re-engagement.

4.2.2 How to empower the worker benefiting all stakeholders

In order to move from the current management systems and worker involvement we see today in most factories and towards the I4.0 vision, we need to empower workers and management in such a way that we can unlock the locking of horns that exists between management and workers. We need to introduce a means to create new and safe spaces where the two can work together with full trust and 100% overlapping objectives.
Disengagement could be supported by a Cyber Physical System designed to provide a very high level of transparency to every process in the organization. One could think of the CPS as an organization wide referee keeping an eye of everything so that everyone plays fair.
Play fair policies are implemented in some organizations today. For example a public list of male and female salaries allows everyone to know if there are significant gender biases in the organization's pay policies. Similarly some organizations promote staff on the basis of hard evidence; attendance at seminars, hours worked, absenteeism, age, health, contributions etc.
It should be possible to extrapolate from these approaches and allow empower workers and management by providing intelligent data analytics that can support the reward systems.
An example could be that location sensors could (in combination with other process flow data) establish which workers have the highest operational time (and experience) on a particular type of problem set or which workers have made the most relevant suggestions or which workers always tend to fill in for others away on sick leave and so on.
In the same way that people concerned about their health fitness may use the objective reference of a wearable activity monitor (e.g fitbit), the CPS could act as a real time constantly updated multi-dimensional reference for the progress of a worker in the company; a very high resolution, high definition, high accuracy CV which could be standardized for interoperable use across different organizations.

The disengagement process empowers workers who want to improve themselves by investing their time and effort towards a goal that is also an organization goal. However this investment must be backed up by the organization's assurance that this investment will be rewarded fairly. Fair play and fair return on investing into an organization breaks down the impression of exploitation and empowers the worker to contribute as if they are a shareholder.
It does not force any worker to strive for improvement nor reduce anyone's normal standing in the organization. For example if a worker does the job he was hired for and then he does the absolute minimum amount of work in-line with what he was contracted to do, then within "fair play" this (zero level investment) should be considered acceptable and not a negative.

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Thus workers who like to arrive at 9AM and leave promptly at 5PM cannot be labeled as disinterested workers. A CPS refereeing system would work in this case 100% on the side of the worker. In this way workers will not feel forced to stay at work just because they think the boss will "mark them down" for bad behavior.
On the other hand workers who like, can and want to do more can do so secure in the fact that the CPS refereeing system is logging their contributions and investment.

Industry 4.0's vision is of a factory of the future where the worker
- Has very flexible work hours
- May not even work at the factory but cyber virtually
- Will use assistive devices to perform repetitive physical jobs
- Will primarily perform decision making and control
- Will innovate
- Will require lifelong learning
- Will be integrated in a team but also contribute independently

This type of worker sounds like someone who successfully applied the benefits of disengagement in that they have reached a level of wide competence and self-confidence and can work toe to toe with management but on the worker's own terms.
This worker is organized and self-controlling enough to work from home and dedicated to continue to improve and innovate. The worker is still willing to "get the hands dirty" with active work but has learned how to do so using the latest assistive devices.

Re-engagement could be seen as the next step in sensor and data analytical integration in factories of the future. Once the worker has learned and earned the self-empowered status, they can re-engage in the industry as a fully-fledged stakeholder. While such a stakeholder may make greater returns (salary), probably they would also suffer consequences of failure and risk.

Additive manufacturing technologies (3D- printing in different materials) is a technology that will highly likely be extremely important as a design tool and assistive tool in this future scenario.
Likewise other massively innovative telepresence oriented sensor and data analytical technologies will be required to support this vision.
These workers will need to overlap several disciplines (mechanical, physics, electrical, sales and marketing etc.) in order that their relevance to the organization is maximized.

4.2.3 Concrete Exploitable Ideas

Industry 4.0 is a grand vision; Multi dimensional it is extremely hard to achieve in practice
But we believe SO-PC-Pro can deliver aspects of the industry 4.0 vision through a set of components.

- A range of flexible sensor components that can be rapidly interconnected and programmed to perform diverse functions.
- A communication infrastructure with a high degree of scaling, merging the IOT with Cloud services.
- A layer based on S-BPM and with an added module for deep learning and inference engines in support of analytics.

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Specifically to look at worker empowerment in future factories subject to high levels of automation using a set of building blocks.

SO-PC-Pro's "Building blocks"

- S-BPM integrating
- Sensors, Actuators
- Modelling people's and work role activities
- Inferring information from the above
- Worker information feedback
- Processing the feedback within a framework
- Delivering change through participation

4.2.4 Inverting the responsibility of empowerment; valorising the worker.

There is a heavy investment in IT today in order to empower the company. ERP systems are installed in order to apply a fine grain analysis of the usage of resources and human work. Optimising and removing waste is key. Management clearly address their responsibility of empowering the company with IT that delivers higher productivity at higher quality and efficiency.
As automation becomes more and more pervasive, low skilled workers are being removed/replaced by robotics of one sort or another. Even artificial intelligence and sensors will remove other skilled jobs.

Yet many still believe we have a responsibility to empower the worker and output optimisation simultaneously. Is this possible? We may ask ourselves who is it that is responsible for empowering the worker? Is it society? Is it management's role? Is it Government's role?

One way of looking at this question is to ask Why don't workers use IT themselves, to empower their position in the workplace? One answer is that no IT exists specifically that a worker can use (purchase or obtain on an OPEN SOURCE basis)to self-empower. But what would be the centre of this empowerment?

If it were possible to commoditise a workers value, wouldn't this empower the worker since he or she could trade their skills more effectively and flexibly. A worker with high worth would be able to make destiny choices by selecting more easily for whom and where and under what conditions they could work.

In an environment where workers trade their skills and exchange their contribution for salary, then management would aim to attract the best commodity it could afford and would concentrate on improving the workplace providing better infrastructures.

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Today many workers tend to always think of themselves as employees and not as suppliers of work. Life-long learning and a conversion of low to high skilled workforce will eventually result.
A highly skilled innovative worker will be a highly sort after commodity.
Companies that use automation 99% will lose profit margins as their competitive advantage wanes since others can simply copy their machine investment strategy.
Sustainable long term competitive advantage will be where there is change and where highly skilled innovative workers can bring their solutions.
We believe that we can use the tools of SO-PC-Pro to generate an IT solution that can clearly and objectively define the skill set and value of a worker to any organisation by looking at a great deal of sensor data and message interactions between the worker and colleagues.

The idea is that IT automatically generates a digital version of a Curriculum Vitae that the worker can use to promote themselves as suppliers of skilled services.

Using the Industry 4.0 framework we can talk about a worker who demonstrates good Vertically Integration in the organisation. Such a worker would be recorded by the SO-PC-Pro system as having subject oriented roles from various OEM component suppliers, through the organisation and onto B2B clients further up in the supply chain. Thus his location, message interactions, platform interactions will record a level of activity that would substantiate the depth and breadth of this VI experience.

Likewise for Horizontal Integration, a worker will be conducting meetings with a variety of departments at different levels; quality, health and safety, design, production, human resources and so on. Day to day physical location and messaging contact between shop floor , managers at all levels and across departments reflects the horizontal feature.

End to End Design could for example look at the multidisciplinary role with substantiated contact with engineering designers and scientists, product designers, patent authors, legal and so on.

Life Long Learning would not only cover what courses were attended but how this was put into action post course. How what was learned contributed to innovations or better decision making.

Importantly the Depth and Breadth of the CV would be determined through a combination of subject orientation modelling and substantiation through location tracking, messages documenting interactions, human to machine and even relevant impact; machine to machine communications.

As an analogy one can see how sensors are used in sports during a tennis match or football game. Here the technology automatically can create a live account of the sport persons key stats; number of aces, drop shots, aggressive second serves, distance run, etc..

Subject Oriented Modelling provides us the framework by which a live CV can be built. Any worker should be able to model what they do and who they come in contact with. They can define which machines they work with and the related processes, who they message and talk to, which meetings or courses they attend etc.

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At the same time the SO-PC-Pro sensor system and messaging systems can keep track of a wide range of locations, times, interfaces, results etc.. that substantiate and even grow the SO model.
For example in the TC Contact case one can Model the user & work context and correlate these with Sensors in Production (Human Machine, Machine Machine)
In the FIMAP use case we could see worker company interactions and the active participation and eventually results, we can see their impact on the organisation.
Similarly depending on the work role, e.g. high stress jobs, sensors can ensure he physical health and capture Human Machine stress events (Physiology).

From the overall modelling and substantiating statistical data using style sheet like techniques a meaning full human readable CV could be built.

This would provide a CV with live and Objective Data, that could be both human and machine readable.
It could be made to fit Standardised CV formats and could even roll out Industry Wide

A worker, with the live CV is empowered in that the CV valorises his/her work in a manner that captures each and every day's skilled contribution. It overcomes biases such as gender or race.

4.2.5 Technology Action Plan

The technology available as a result of the SO-PC-Pro project needs to be enhanced in order to provide a flexible tool set for the consultants to use.
Therefore we will need as a team (JKU, MET, MAS, FBK) to convert the existing background and foreground and deliver 3 essential components

- A range of flexible sensor components that can be rapidly interconnected and programmed to perform diverse functions.
- A communication infrastructure with a high degree of scaling, merging the IOT with Cloud services.
- A layer based on S-BPM (providing extremely easy to define subject oriented modelling) and with added modules for employee messaging (similar to social media but intra-employee) and for deep learning/inference engines in support of analytics.

The flexible sensor components will be developed by MAS. These components will comprise

- a processor chip,
- plug on sensors (energy, location, motion, temperature etc..)
- plug on NFC, RFID, Bluetooth, Wifi,
- power source (varying from energy harvesting to long term battery)

MAS will also address the communication infrastructure and IOT protocol adherence.

JKU will develop a more intuitive, easy and probably touch graphical based way for users to define subject oriented modelling of their or their employees work or machine roles.

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FBK will develop the module for employee messaging based on a very simple version of Facebook for example, to implement an intra-employee messaging medium that is linked to standard office products.

MET will develop a new module not considered in the SO-PC-Pro project. This module will use tools such as WEKA to perform data mining and deep learning on sensor data and message passing so as to provide rapid means to extract semantic data associating the SO models and sensor and messaging data.

The team will address realistic and pragmatic needs by using the wide experience of the consultants (CEN, C&A, AXXIS, BYE). At a first level they will be allowed to use the tools to solve hypothetical problems. Then after adaptation they will be asked to use the tools to develop the Live CV as a general human centred worker empowerment tool.

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4.2.6 Partner Interactions and Dependencies

The partner dependencies is best summarised by looking at the three main overlaps.

Sensor Tool Overlap

JKU, MET, FBK and MAS

Data from the sensors and data from the social media messaging must be combined appropriately with the SO models. For example if my role is to conduct training in the company and I hold the courses in the training room every Thursday morning, then location sensing should substantiate this. Similarly if I as is my role I am messaging students to provide essays back by the end of the week, the messaging system should substantiate this. If a machine on the shop floor is part of the training then students who come in location of the machine should have their models substantiated. This JKU, MAS, MET and FBK must define how substantiation of models is linked to sensor and message passing and how this linkage can be made in a generic formulation to cover most likely scenarios.

Semantic Extraction

JKU, MET, FBK and MAS

Semantic extraction occurs at two levels. At the lowest level, sensor data or message data needs to be data mined to look for patterns on the basis of supervised or unsupervised learning. Physiological sensing for example requires supervised training to train classifiers to look for stress or poor health or dangerous circumstances. Meanwhile unsupervised learning may simply be a form of cluster analysis where one can classify workers into for example those who eat in the canteen versus outside the company or bring sandwiches.
At the next level one requires that data related to substantiation can be used alongside the low level semantics to again provide training for supervised and unsupervised learning. Therefore we may want to determine relationships between machine maintenance costs and training received by machine operators, or the active participation in quality circles.

Visualisation

All Partners

Appropriate methods to display information of what is going on in a company as determined by the SO modelling and substantiation as well as inference semantics is required and all partners need to contribute. Thus consultants will refine the visualisation methods to describe a workers roles and then all the extracted aspects of the role in relation to a wide range of objective statistics.

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4.2.7 Risks and Mitigation

We focus on the two main risks; the consortium and the technology.

The consortium has pledged to keep working together after the SO-PC-Pro project ends. However the collaboration may not continue as partners are distracted by other opportunities or they may face hard times. Keeping the consortium together will be a difficult task unless something is attracting them to continue.
To mitigate this risk, we will implement two strategies. First we will create an agreement which clearly shows what each partner will get from the successful outcome (e.g. money, shares, access) and what they will be required to do (specific tasks). Secondly we will aim to obtain collaboration funding as soon as possible to cover all collaborative efforts. Finally we rely strongly on the kudos received by each partner as publications of our on-going collaboration is presented in the media and academic conferences to promote partner continued involvement.

The technology challenges are not small however they are all achievable provided sufficient manpower is available and the objective is aligned with each partners long term goals. Therefore to mitigate this risk, we will first align all partner goals with the technologies so that our work forms a natural part of each partners medium to long term evolution. Second we will aim to attract funding to support the technical development costs.

4.2.8 IP handling

The primary IP coming from this collaboration is know-how and solutions embedded in software and hardware and modules. Therefore we will not aim to apply for patents or similar. Instead we will aim to deliver advanced solutions which thanks to the basic philosophies we are building on, are rather advanced on the market and thus providing us a time to build market share. However a collaboration agreement will have defined the contributions and the return on this investment when the tools and services produced go on sale.

4.2.9 Business Action Plan

The business action plan depends heavily on identifying the best sources of development funding. We consider two possible opportunities; Horizon 2020 Factories of the Future Calls and investment from external investors.

Horizon 2020

Within H2020 we have identified some possible opportunities. € 85 million has been earmarked for the following topics in the now open 2017 Call:

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FoF-06-2017: New product functionalities through advanced surface manufacturing processes for mass production

FoF-07-2017: Integration of unconventional technologies for multi-material processing into manufacturing systems

FoF-08-2017: In-line measurement and control for micro-/nano-enabled high-volume manufacturing for enhanced reliability

FoF-09-2017: Novel design and predictive maintenance technologies for increased operating life of production systems

FoF-10-2017: New technologies and life cycle management for reconfigurable and reusable customised products

€ 33 million for the following topic:

FoF-12-2017: ICT Innovation for Manufacturing SMEs (I4MS)

Currently the choice of Calls is very limited and the only call that we might be able to target is FoF-09-2017. We could propose to use the tool set with sensors to implement the objectives.

Investment Capital

Metasonic was recently acquired and therefore given that they would be developing a software product which would not exclusively belong to Metasonic, we need to ensure Metasonic owners are agreeable to the consortium obtaining funds. Moreover any external investment would have to come from a non-software sector.
With little to show for now in terms of specific products or services, it would be difficult to convince investors.
Therefore our strategy here is to leverage the sensor side of the developments and look for investors in new forms of I4.0 sensors, that are backed up by middleware and back end applications.
Therefore we will wait until the sensor developments are more mature; funded by MAS.
Then we will look for investment capital to boost the hardware with software.
Examples would be telecom operators who are moving into the I4.0 arena.
http://m2m.telekom.com/telekom-m2m/insights/industrial-internet/?mlid=2337.14.1186970.9f4053c214338196dd574b8b75187782...0.1478183332.1.1480775332

Seeking investment capital will require a detailed Marketing Plan, with clear arguments for the Return on Investment and Commercialisation Approaches.
Since the investment may come from infrastructure providers looking beyond our own objectives such as worker empowerment, we must also decide if the software will in fact be delivered as OPEN Source on OPEN standards access.

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