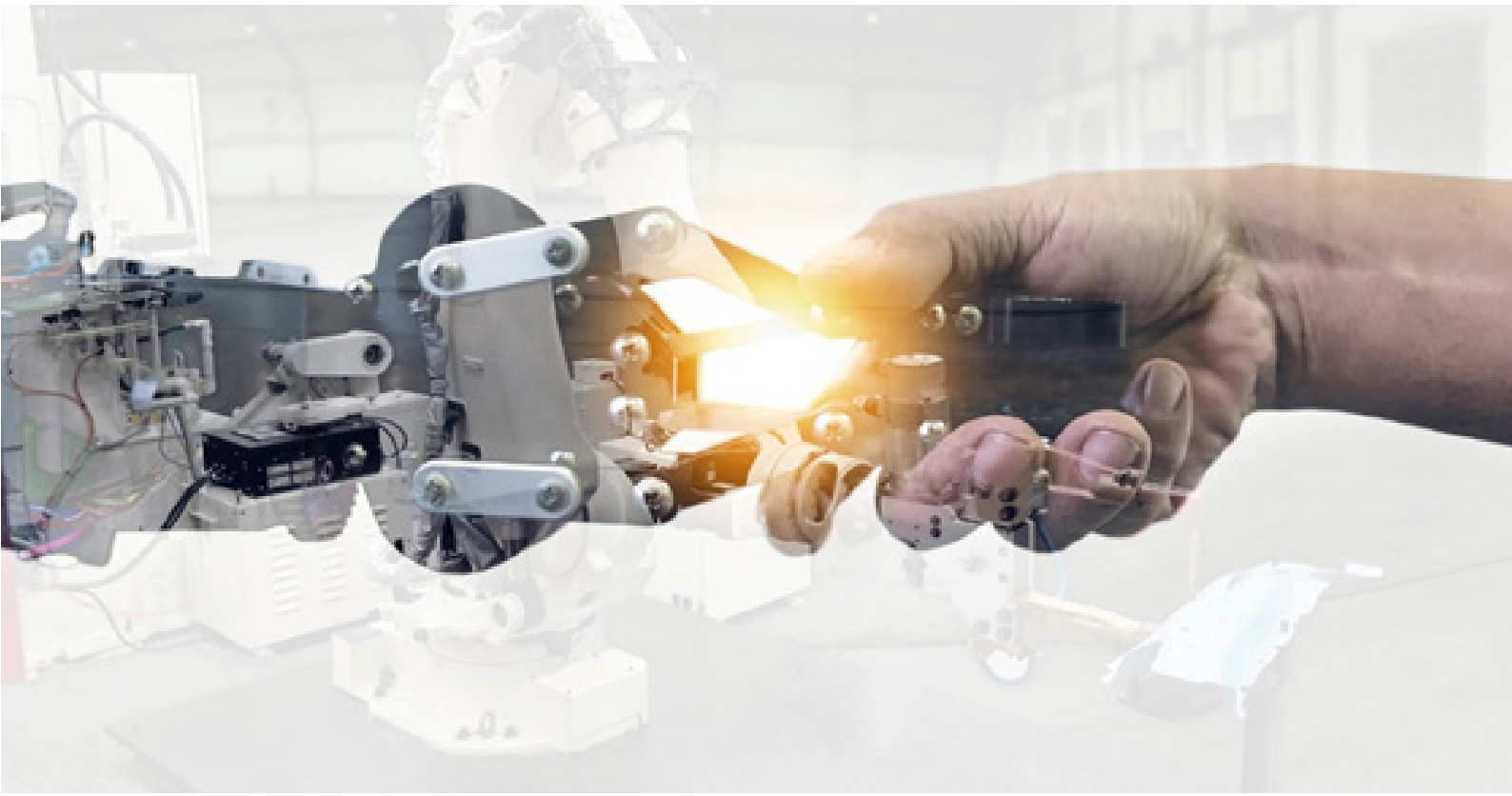
New business models and strategy development

Work Package 3

Best practice report - January 2019



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Introduction

The Interreg North Sea Region (NSR) project "Growing into Industry 4.0 – Accelerate growth in manufacturing SME's" - GrowIn 4.0 - aims to build strong competences and tools in the participating regions for the benefit of manufacturing small and medium-sized enterprises (SME's). The overall objective is to raise the level of innovation and to create more growth within manufacturing SME's who are heading for Industry 4.0.

The project is working within the following three work packages:

3. New business models and strategy development
4. Better use of technology and development of products
5. Training, education and recruitment of Industry 4.0 qualified staff

In each of these work packages all partner regions have gathered best practices (methods, tools and concepts) with focus on Industry 4.0 and described these in a common template. The intention is to make smart combinations of existing best practices in order to create new tools and methods, which will be tested in partner regions. The main target is to develop Industry 4.0 tools to assist manufacturing SMEs on their way towards digitization.

In total 27best practices have been described. This report content an introduction to WP3 and the collection of tools gathered and described in this work package. Two other best practices reports have been made for work package 4 and 5.

Introduction to WP3

This report deals with sharing of the practices that potentially would benefit a strategic transformation of business, with a special emphasis to the move towards Industry 4.0.

According to Geissbauer, Vedso, and Schrauf (2016), the following three aspects of digitization form the heart of an Industry 4.0 approach:

The full digitization of a company's operations:

- Integration of Information technology with operational technology (vertical integration)
- Integration of supply network - linking the suppliers, partners, and distributors in the value chain and transferring data among them seamlessly (horizontal integration.)

The redesign of products: to be embedded with custom-designed software, so that they become responsive and interactive, tracking their own activity and its results, along with the activity of other products around them.

Closer interaction with customers: enabled by these new processes, products and services. Industry 4.0 makes the value chain more responsive, allowing industrial manufacturers to reach end customers more directly and tailor their business models accordingly.

In WP3, the gathered best practices and tools include:

Awareness/readiness assessment tools
The awareness and readiness assessment tools developed by PwC and the WMG are the main tools looked at by the WP3. The tools are designed to provide companies with an understanding of their position with regards to Industry 4.0 and assess their readiness level. The PwC on-line tool looks at a set of dimensions from digital business models, digitisation of products and services, digital vertical and horizontal integration, data analytics, through to compliance and security. The WMG tool has similar approach and looks at the readiness of companies to Industry 4.0 through products and services digitisation, operations digitisation, organisational alignment, supply chain integration, business model and legal considerations. (More details of these tools are attached.)

Benefit Realisation tool
This tool is aimed at helping firms identify the benefits, the dis-benefits and business challenges they might anticipate from adoption of new technology. Phase one comprises group work involving key actors (managers as well as those actually working in processes) examining the features of any given technology (what it actually does) and linking specific features (enablers such as data collection, performing tasks more quickly, eliminating some human tasks) to identifiable benefits. These changes are then linked, through structured discussion, to potential costs (activities which may not be done so well) and the requirements for other actions (training,

task restructuring, organisational re-structuring). The relationships between technology enablers, business changes, benefits and organisational objectives are mapped visually to foster any further discussion. Once the benefits are identified they should be quantified as far as possible and then plans put in place to measure and track them over time. This begins by establishing existing process 'base-lines', designing forms of measurement (directly or through 'proxies') and then tracking how these acrrue over time. Establishing baselines is a task in its own right – it is basically a form of time and motion study. (More details attached)

Return on Investment (ROI) or monetising tool
One of the biggest problems facing change projects is that they require a commitment of resources – time, staff and money. Change is also risk – careers may be at stake along with the viability of the firm. It may, therefore, be important to generate reliable data on the financial benefits of a technology adoption.

The ROI Methodology is a step-by-step credible process that meets the need to show the value used by organizations. The methodology is a simple to use and proven process that will generate a balanced set of data that is realistic and accurate – particularly from the perspective of sponsors and key stakeholders. To allocate funds to programs, projects and improvement initiatives that deliver the highest value, a method is needed that credibly proves or "shows" the value. The 10 steps of the Phillips ROI Methodology intend to do that. (More details are attached).

New Business Models in Manufacturing Tool
This is based on a project concerning new busness models in manufacturing companies that were running in 2014, 2015 and 2016. The project targets small and medium sized manufacturing companies with growth potential and could be adapted to the transformation towards Industry 4.0. The project was coordinated by VIA University College in Denmark and involves counselling by consultants to help SMEs rethink their business models. The process includes three phases: Initial counselling, base camp and strategic workshop. Transforming to Industry 4.0 could thus be considered as the strategy and the process adapted to the objectives of GrowIn 4.0.

The team of WP3 have chosen to adopt the good practices, adapt them to SMEs requirements and develop four tools: Awareness tool (from PwC and WMG tools), Benefit realisation tool, monetising tool, and Benefits Tracking and Management tool. The Business Models in Manufacturing tool is proposed to be integrated to the monetising tool.

Selection criterias

a) What makes a Good Practice interesting?

A Good Practice should be:
Simple –user-friendly, easy to understand, with potential to be implemented without large scale changes,
General – theme wide enough that different realities can find aspects of interest; not too specific but easily adaptable,
Applicable – to put into practice.

b) Selection Criteria to identify suitable Good Practice:

The Good Practice examples selected and proposed by a partner should respect the following criteria:

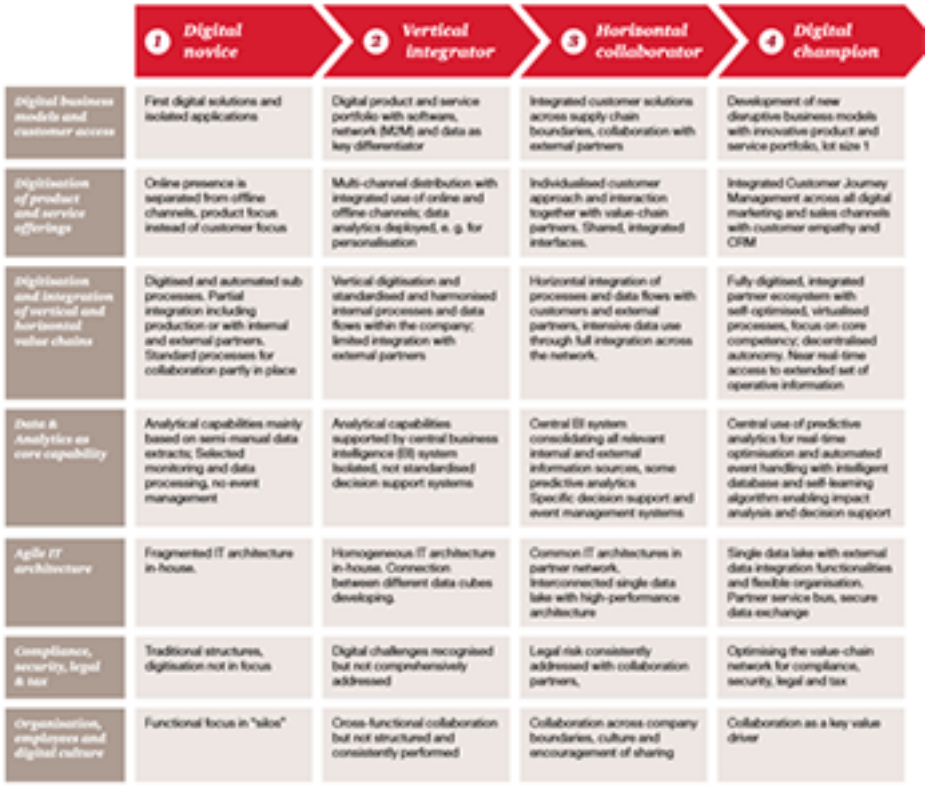
1. **Availability of results** (meaning: initiatives already completed / at an advanced stage, which show concrete results – both qualitative and quantitative)
2. **Transferability** (meaning: tools with potential to be replicated in another geographical area, available in English)
3. **Level of Innovation** (meaning: new in the context of I4.0)
4. **Long-term durability** (meaning: financial sustainability – i.e. affordable, payback/cost reduction; stakeholder/user participation, etc.).

Annex: Register of tools found by WP3

Descriptions for all tools can be found on the following pages.

Self Assessement

Title of practice	Self Assessment (by PwC)
Detailed description	(Around 3.000 characters) Please provide information on the practice itself in particular: This Self-Assessment tool is designed to provide companies with an understanding of their position with regards to Industry 4.0 by measuring their actual against their target maturity along seven dimensions, thereby identifying needs for action as well as classifying the current maturity level. The maturity level will enable companies to benchmark their position against competitors in their sector.



	1 Digital novice	2 Vertical integrator	3 Horizontal collaborator	4 Digital champion
Digital business models and customer access	First digital solutions and isolated applications	Digital product and service portfolio with software, network (M2M) and data as key differentiator	Integrated customer solutions across supply chain boundaries, collaboration with external partners	Development of new disruptive business models with innovative product and service portfolio, lot size 1
Digitisation of product and service offerings	Online presence is separated from offline channels, product focus instead of customer focus	Multi-channel distribution with integrated use of online and offline channels; data analytics deployed, e. g. for personalisation	Individualised customer approach and interaction together with value-chain partners. Shared, integrated interfaces.	Integrated Customer Journey Management across all digital marketing and sales channels with customer empathy and CRM
Digitisation and integration of vertical and horizontal value chains	Digitised and automated sub processes. Partial integration including production or with internal and external partners. Standard processes for collaboration partly in place	Vertical digitisation and standardised and harmonised internal processes and data flows within the company; limited integration with external partners	Horizontal integration of processes and data flows with customers and external partners, intensive data use through full integration across the network.	Fully digitised, integrated partner ecosystem with self-optimised, virtualised processes, focus on core competency; decentralised autonomy. Near real-time access to extended set of operative information
Data & Analytics as core capability	Analytical capabilities mainly based on semi-manual data extracts; Selected monitoring and data processing, no event management	Analytical capabilities supported by central business intelligence (BI) system isolated, not standardised decision support systems	Central BI system consolidating all relevant internal and external information sources, some predictive analytics. Specific decision support and event management systems	Central use of predictive analytics for real-time optimisation and automated event handling with intelligent database and self-learning algorithm enabling impact analysis and decision support
Agile IT architecture	Fragmented IT architecture in-house.	Homogeneous IT architecture in-house. Connection between different data cubes developing.	Common IT architectures in partner network. Interconnected single data lake with high-performance architecture	Single data lake with external data integration functionalities and flexible organisation. Partner service bus, secure data exchange
Compliance, security, legal & tax	Traditional structures, digitisation not in focus	Digital challenges recognised but not comprehensively addressed	Legal risk consistently addressed with collaboration partners,	Optimising the value-chain network for compliance, security, legal and tax
Organisation, employees and digital culture	Functional focus in "silos"	Cross-functional collaboration but not structured and consistently performed	Collaboration across company boundaries, culture and encouragement of sharing	Collaboration as a key value driver

Industry 4.0 Development dimensions
(Source: PWC, www.pwc.com/indutry40)

Digital Novice:
At this maturity level, some initial digitisation has been achieved in department as well as in products and services but the activities are not well co-ordinated and geared for the future. The portfolio is typically dominated by physical products and there is limited integration within the vertical and horizontal value chains. Digital risks are not systematically recorded and compliance is not guaranteed in all areas.

	Vertical Integrator: Companies at this maturity level have already given their product and service portfolio digital functions. The operative processes and some administrative processes are digitised. For example, data from product development is available for physical production, logistics and systems in the company. The functions of online an online presence are used. **Horizontal Collaborator:** Here collaborators integrate their value chains with customers and partners. The product and service portfolio is connected with external value chain partners to the extent that customers are offered end-to-end solutions across several steps of the value chain. Innovative concepts optimise customer communication, and customer information is saved and analysed for optimal communication. Digital risks are managed with standardised and efficient method and compliance is maintained for all functions at the company. **Digital Champion:** The digital champion has connected its operational and administrative processes on global scale and will also have virtualised the processes in the main areas. It focusses on the key areas and works with global network of partners. The key administrative processes ae digitised and globally optimised according to cost and control criteria. The self-assessment tool is developed by PwC and is available online on https://i40-self-assessment.pwc.fi . The assessment could be followed by identifying the needs for action for the company and benchmarking the company against others in their sector.
Area of I4.0	*Could be the level of I4.0/digitization the practice is focusing on.* This self-assessment is mainly for Industry4.0.
Evidence of success (results achieved)	*Why is this practice considered as good? Please provide factual evidence that demonstrates its success or failure (e.g. measurable outputs/results).* The PwC's Global Industry 4.0 Survey is one of the biggest worldwide survey of its kind, with over 2,000 participants from nine major industrial sectors and 26 countries. The study explored the benefits of digitising company's horizontal and vertical value chains, as well as building digital product & service portfolio. Based on the findings and their experience working with first movers, they've crafted a blueprint for success to help companies secure their position in tomorrow's complex industrial ecosystems. The self-assessment tool is developed based on the survey and experience.
Difficulties encountered/ lessons learned	*Please specify any difficulties encountered/lessons learned during the implementation of the practice.* The tool is mainly aimed at larger industries. It may have to be adapted to cater SMEs as well. The internal mechanisms of how the assessment is done will also need more scrutiny before using it for SMEs.

Potential for learning or transfer	*Please explain why you consider this practice (or some aspects of this practice) as being potentially interesting for other regions to learn from. This can be done e.g. through information on key success factors for a transfer or on, factors that can hamper a transfer. Information on transfer(s) that already took place can also be provided.* This tool is based on studies from a wide range of sectors an d global regions. If adapted properly, it can be used by all the regions involved.
Target group	*Specify the target group of the practice at if possible the level of I4.0/digitization.* It is mainly targeting big industries of nine sectors but has the potential to adapt to SMEs. It has a direct application to I4.0.
Nature	*Please explain whether the practice is a tool for SMEs to use themselves, a method used by ex. consultants, a program having a broader objective etc.* The assessment tool is developed by PwC but the assessment can be done online. It may require consultation with PwC to have a fuller use of the tool.
Proposal for modifications/sustainability	*Please describe if there is suggestions of how to make the practice even better, and how the practice can evolve, need orientation, is integrated into the ecosystem/Smart specialization strategy and is supported by the community.* The main area to look at is how the dimensions could be adapted to specific SMEs and simplified for effective use by SMEs.
Resources needed	*If applicable - please specify the amount of funding/financial resources used and/or the human resources required to set up and to run the practice.* The online assessment tool could be free but we may need to discuss with PwC on how we could adapt the tool for SMEs' use. It can take up to 5 days for a good output.
Further information	*Link to where further information on the good practice can be found.* Industry 4.0 - Enabling Digital Operations, Self Assessment, Available at https://i40-self-assessment.pwc.fi/i40/landing/ (accessed on 27/3/2018). PWC, Industry 4.0: Building the digital entreprise, available at https://www.pwc.com/gx/en/industries/industry-4.0.html (Accessed on 28/3/2018). On the latter website, a specific country could be selected for a better regional view.
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Assesment tool WMG

Title of practice	Assessment tool by WMG - The University of Warnwick
Detailed description	This collection of Self-Assessment tools is designed to provide companies with an understanding of their position with regards to implementation of their strategic choices on I4.0 – these series of assessments look at deployment level of strategic choice, operational readiness, readiness of supply chain operations, competences needed for HR and IT preparations The maturity levels for each table enable companies to benchmark their position against competitors in their sector and identify their current state vs future state sources: ▪ Industry 4.0 readiness asessment tool WMG available at https://warwick.ac.uk/fac/sci/wmg/research/scip ▪ Holistic approach for human resource management in Industry 4.0 Hecklau, Galeitzke, Flachs and Kohl Procedia CIRP 54 (2016) 1 – 6 Available online at https://www.sciencedirect.com/ 6th CLF - 6th CIRP Conference on Learning Factories ▪ SPECIAL REPORT HARNESSING IOT IN THE ENTERPRISE (2017) CBS interactive available at https://www.techrepublic.com/resource-library/whitepapers/special-report-harnessing-iot-in-the-enterprise-free-pdf/

Readiness level	Level 1 Beginner	Level 2 Intermediate	Level 3 Experienced	Level 4 Expert
Degree of strategy implementation	Industry 4 is recognised at departmental level but is not integrated into the strategy	Industry 4 is included in the business strategy	Industry 4 strategy has been communicated to the business and is widely understood	Industry 4 strategy has been implemented across the business
Measurement	KPIs are not focused around Industry 4	Structured set of business metrics exist, with some measurement of Industry 4 drivers	Industry 4 metrics ae widely understood in the business and used in monthly reporting	Business metrics and personal development plans are focused around Industry 4 objectives
Investments	Initial Industry 4 investments in one business area	Industry 4 investments in more advanced business areas	Industry 4 investments in multiple business areas	Industry 4 investments across the entire business
People capabilities	Employees have little or no experience with digital technologies	Technology focused areas of the business have employees with some digital skills	Developed digital and data analysis skills across most areas of the business, e.g. production	Leading edge digital and analytics skills across the business
Collaboration	The business operates in functional silos	There is limited interaction between departments, e.g. S&OP process	Departments are open to cross functional collaboration	Departments are open to cross company collaboration to drive improvements
Leadership	Leadership team do not recognise the value of Industry 4 investments	Leadership team are investigating potential Industry 4 benefits	Leadership team recognise the financial benefits to be obtained through Industry 4 and are developing plans to invest	Widespread support for Industry 4 within both the leadership team and across the wider business
Finance	No sizeable Industry 4 investment	No ongoing review of cost/benefit analysis for Industry 4 investment	Annual cost/benefit analysis of Industry 4 investment	Quarterly cost/benefit analysis of Industry 4 investment

Manufacturing and Operations readiness assessment table

Automation	new machines can be controlled through automation	system infrastructures can be controlled through automation	system infrastructures can be controlled through automation	Machines and systems can be controlled completely through automation
Machine and operation system integration (M2M)	Machines and systems have no M2M capability	Machines and systems are to some extent interoperable	Machines and systems are partially integrated	Machines and systems are fully integrated
Equipment readiness for Industry 4	Significant overhaul required to meet Industry 4 model	Some machines and systems can be upgraded	Machines already meet some of the requirements and can be upgraded where required	Machines and systems already meet all future requirements
Autonomously guided workpieces	Autonomously guided workpieces are not in use	Autonomously guided workpieces are not in use, but there are pilots underway	Autonomously guided workpieces used in selected areas	Autonomously guided workpieces are widely adopted
Self-optimising processes	Self-optimisation processes are not in use	Self-optimising processes are not in use, but there are pilots in more advanced areas of the business	Self-optimising processes are used in selected areas	Self-optimising processes are widely used
Digital modelling	No digital modelling	Some processes use digital modelling	Most processes use digital modelling	Complete digital modelling used for all relevant processes
Operations data collection	Data is collected manually when required, e.g. sampling for quality control	Required data is collected digitally in certain areas	Comprehensive digital data collection in multiple areas	Comprehensive automated digital data collection across the entire process
Operations data usage	Data is only used for quality and regulatory purposes	Some data is used to control processes	Some data is used to control and optimise processes, e.g. predictive maintenance	All data is used not only to optimise processes, but also for decision making
Cloud solution usage	Cloud solutions not in use	Initial solutions planned for cloud-based software, data storage and data analysis	Pilot solutions implemented in some areas of the business	Multiple solutions implemented across the business
IT and data security	IT security solutions are planned	IT security solutions have been partially implemented	Comprehensive IT security solutions have been implemented with plans developed to close any gaps	IT security solutions have been implemented for all relevant areas and are reviewed frequently to ensure compliance

Supply Chain readiness assessment table

Readiness level	Level 1 Beginner	Level 2 Intermediate	Level 3 Experienced	Level 4 Expert
Inventory control using real-time data management	Inventory levels are understood	Computer database is used which is manually updated with inventory levels	Computer database used with smart devices updating inventory levels	Real-time database which is updated by smart devices
Supply chain integration	Ad hoc reactive communication with suppliers and customers	Basic communication and data sharing where required with suppliers and customers	Data transfer between key strategic suppliers/ customers (e.g. customer inventory levels)	Fully integrated systems with suppliers/customers for appropriate processes (e.g. real-time integrated planning
Supply chain visibility	No integration with suppliers or customers	Site location, capacity, inventory and operations are visible between first tier suppliers and customers	Site location, capacity, inventory and operations are visible throughout supply chain	Site location, capacity, inventory and operations are visible in real-time throughout supply chain and used for monitoring and optimisation
Supply chain flexibility	Slow response to market changes	Moderate response to market changes and general customer requirements shifts	Moderate response to changes in market environment and individual customer requirements	Immediate response to changes in market environment and individual customer requirements
Lead times	Long materials lead time resulting in high inventory levels	Improvements have been identified to reduce lead times for some materials	Some improvements have been implemented to reduce lead times on key materials	Differentiated stocking policies and lead times to meet make-to-order efficiently

All of the above 3 tables are from source 1

HR competence readiness assessment

Required competencies for employees in I4.0	Work Context
State-of-the-art knowledge and technical skills	Increasing job responsibility - technical knowledge is increasingly important - Technical skills are needed to switch from operational to more strategic tasks.
Process understanding	Higher process complexity demands a broader and deeper process understanding.
Media skills	Increasing virtual work requires employees to be able to use smart media.

	Coding skills	Growth of digitized processes creates a higher need for employees with coding skills.
	Understanding IT security	Virtual work on servers or platforms obligates employees to be aware of cyber security.
	Creativity	Need for more innovative products, as well as for internal improvements, requires creativity.
	Entrepreneurial thinking	Every employee with more responsible and strategic tasks has to act as an entrepreneur.
	Problem solving	Employees must be able to identify sources of errors and be able to improve processes.
	Conflict solving	A higher service-orientation increases customer relationships; conflicts need to be solved.
	Decision making	Since employees will own higher process responsibility, they have to make their own decisions.
	Analytical skills	Structuring and examining large amounts of data and complex processes becomes mandatory.
	Research skills	Need to be able to use reliable sources for continuous learning in changing environments.
	Efficiency orientation	Complex problems need to be solved more efficiently, e.g. analyzing growing amounts of data.
	Language skills and Intercultural skills	Understanding different cultures, especially divergent work habits, when working globally - Being able to understand and communicate with global partners and customers.
	Communication and Networking skills	Service-orientation demands good listening and presentation skills, increasing virtual work requires virtual communication skills - highly globalized and intertwined value chain requires knowledge networks.
	Ability to work in a team	Growing team work and shared work on platforms needs ability to follow team rules.
	Ability to compromise and collaborate	Entities along a value chain develop to equal partners; every project needs to create win-win situations, especially in businesses with increasing project work.
	Ability to transfer knowledge	Companies need to retain knowledge within the company - explicit and tacit knowledge needs to be exchanged.
	Leadership skills	More responsible tasks and flattened hierarchies make every employee a leader.
	Flexibility	Increasing virtual work makes employees time and place independent; work-task rotation further requires employees to be flexible with their job responsibilities - Accepting change, especially work related change due to work-task rotation or reorientation.
	Motivation to learn	More frequent work related change makes it mandatory for employees to be willing to learn.

	Ability to work under pressure	Employees involved in innovation processes need to cope with increased pressure, due to shorter product life cycles and reduced time-to-markets.
	Compliance	Stricter rules for IT security, working with machine, or working hours.
		Source 2 **IT Readiness Checklist** **Do you have an I4.0 Team?** *Team must cross boundaries and engage the resources of all disciplines* **Are IT/I4.0 partnerships in place?** **Do you have the I4.0 skillsets in the organisation?** **Do you have an I4.0 sandbox?** *There's a lot we don't know about IoT. How will it change business operations? Will it work in every case we.* **Do you have a strategic roadmap for I4.0 ?** **How well-positioned is your IT infrastructure for I4.0 ?** **Do you have strong I4.0 vendor partnerships?** **Do you have an I4.0 policy development and compliance function?** **Have you thought through IoT security?** **Is your management on-board with I4.0 ?** **Do you have a method in place for defining and measuring the ROI of your I4.0 projects?** *Source 3*
Area of I4.0	*Could be the level of I4.0/digitization the practice is focusing on* These self-assessments are mainly for 14.0.	
Evidence of success (results achieved)	Why is this practice considered as good? Please provide factual evidence that demonstrates its success or failure (e.g. measurable outputs/results). ▪ Source 1 WMG is based on a survey with 53 responses from 22 countries carried out by WMG and created by WMG, Pinsent and Mason and Crimson and Co , both management consultants ▪ Source 2 is an article from the Fraunhoffer institute ▪ Source 3 is a report from IoT specialists	

Difficulties encountered/ lessons learned	*Please specify any difficulties encountered/lessons learned during the implementation of the practice.* All assessments are mainly aimed at larger industries and may have to be adapted to cater for SMEs as well. The internal mechanisms of how the assessment is done will also need more scrutiny before using it for SMEs.
Potential for learning or transfer	*Please explain why you consider this practice (or some aspects of this practice) as being potentially interesting for other regions to learn from. This can be done e.g. through information on key success factors for a transfer or on, factors that can hamper a transfer. Information on transfer(s) that already took place can also be provided.* The assessments are based on studies from a wide range of sectors and global regions. If adapted properly, they can be used by all the regions involved.
Target group	*Specify the target group of the practice at if possible the level of I4.0/digitization.* They are mainly targeting larger industries but have the potential to adapt to SMEs. They have direct application to I4.0.
Nature	*Please explain whether the practice is a tool for SMEs to use themselves, a method used by ex. consultants, a program having a broader objective etc.* The assessments are based on reports and articles and would need facilitation to complete.
Proposal for modifications/sustainability	*Please describe if there is suggestions of how to make the practice even better, and how the practice can evolve, need orientation, is integrated into the ecosystem/Smart specialization strategy and is supported by the community.* The main areas to look at are how the dimensions could be adapted to specific SMEs and simplified for effective use by SMEs.
Resources needed	I*f applicable - please specify the amount of funding/financial resources used and/ or the human resources required to set up and to run the practice.* The assessments can be adapted – sources should be referenced.
Further information	14.0 readiness asessment tool WMG available at Warwick.ac.uk/scip Holistic approach for human resource management in Industry 4.0 Hecklau, Galeitzke, Flachs and Kohl Procedia CIRP 54 (2016) 1 – 6 Available online at https://www.sciencedirect.com/ 6th CLF - 6th CIRP Conference on Learning Factories SPECIAL REPORT HARNESSING IOT IN THE ENTERPRISE (2017) CBS interactive available at https://www.techrepublic.com/resource-library/whitepapers/special-report-harnessing-iot-in-the-enterprise-free-pdf
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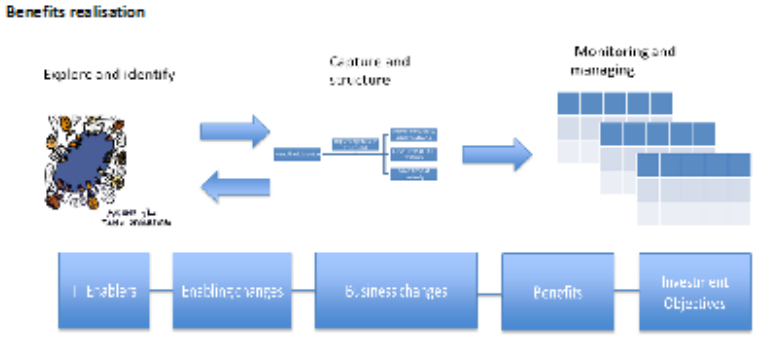
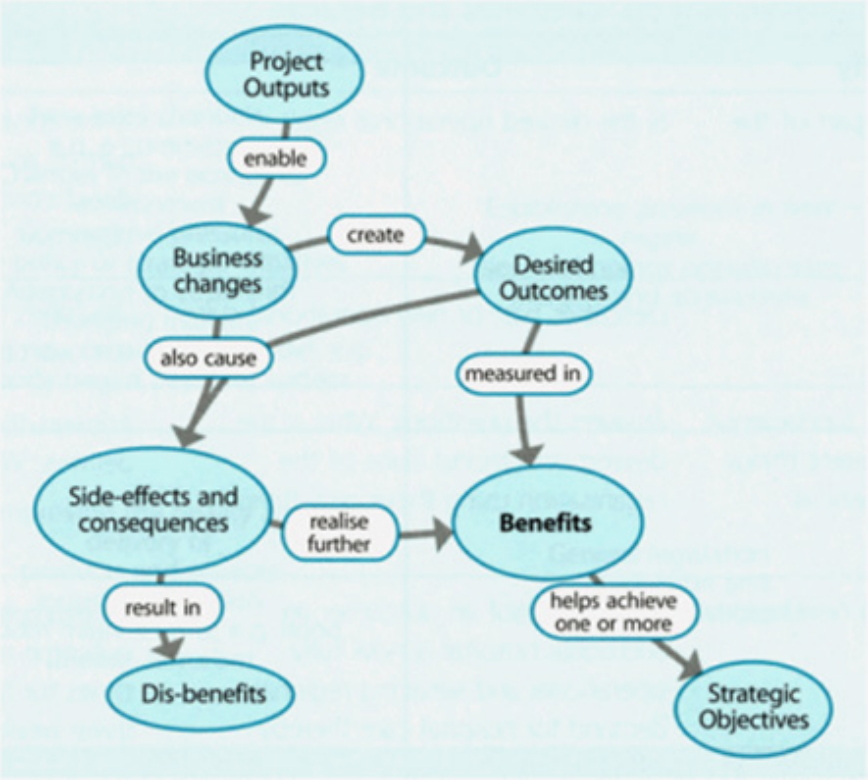
Benefit Realisation

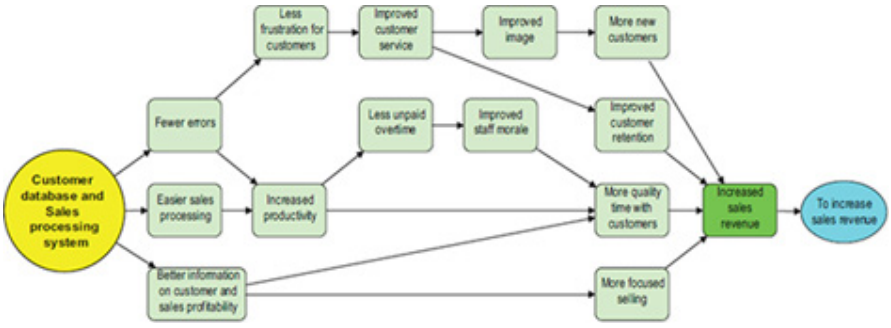
Title of practice	Benefits realization management
Detailed description	*Please provide information on the practice itself in particular:* Benefits realisation is aimed at helping firms identify what benefits and dis-benefits and business challenges they might anticipate from the adoption of a new technology. As the process is followed it highlights what organisational changes are needed to gain the (potential) benefits from the technology (e.g. efficiency, better quality products) and shows how these link to organisational strategy. Phase one comprises group work involving key actors (managers as well as those actually working in processes) examining the features of any given technology (what it actually does) and linking specific features (enablers such as data collection, performing tasks more quickly, eliminating some human tasks) to identifiable benefits. These changes are then linked, through structured discussion, to potential costs (activities which may not be done so well) and the requirements for other actions (training, task restructuring, organisational re-structuring). The relationships between technology enablers, business changes, benefits and organisational objectives are mapped visually to foster and further discussion.  Benefits realization tools provide a rigorous and standardized means of comparing the actions, impacts and objectives of differing activities (Serra and Kunc, 2014; Buchanan and Evans, 2007; Matharu and Green, 2015).

Benefits realisation thinking (mapped)

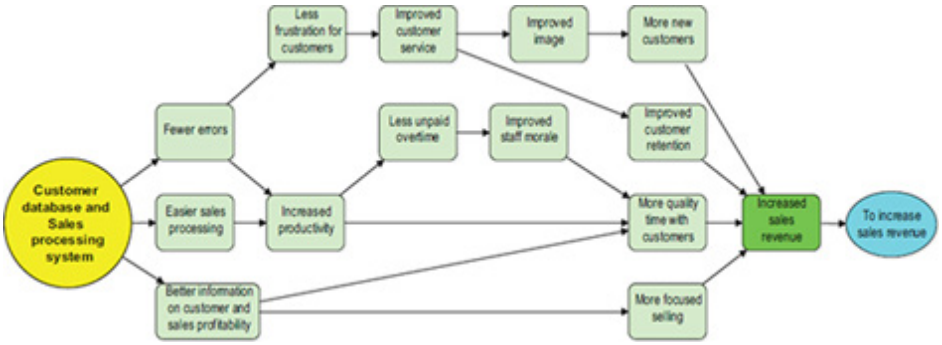


Example maps

1. Unstructured emergent



2. More structured



Once the benefits are identified they should be quantified as far as possible and then plans put in place to measure and track them over time. This begins by establishing existing process 'base-lines', designing forms of measurement (directly or through 'proxies') and then tracking how these acrrue over time. Establishing baselines is a task in its own right – it is basically a form of time and motion study.

Measure	Baseline value	Start Period	End Period	Target Value	Period 1	Period 2	Period 3	Period 4
No. of errors per 100 sales	7.5	1	3	2.5				
No. of written complaints per week	9	2	4	2				
No. of phone complaints per week		2	4	5				
Customer service rating (%)	55	3	8	80				
No. of sales processed pp per day	8.5	2	4	12				
Value of sales processes pp per day	£480	2	4	£750				
Total overtime worked per week (hr)	55	2	4	15				
Staff morale rating (%)	68	3	6	80				
Time spent with customers (hr/wk)	450	3	6	1000				
No. of new customers per period	3	4	7	10				
No. of lost customers per period	5	4	7	2				
Lead conversion rate (%)	28	4	8	40				
Sales revenue	£300,000	4	9	£1m				

Period = 3 months

Some thought should be given as to how the tools used to measure improvement will be embedded in the organisation. Who will collect the data, where will it be reported and how will it be used – ideally it should be embedded in existing performance reviews (reported in key meetings, used in personal targets).

Using tools like benefits realization builds confidence in the 'investment' and can be started before the investment is made. As a process it also builds skills and directs management to problems and solutions. It leaves staff better informed and able to make better decisions in the future. It encourages rigorous and thoughtful decision-making around technology adoption and implementations.

For our purposes the key objective will be getting firms to identify actual business benefits from Industry 4.0 technologies and identifying precisely how they will exploit them (new businesses processes). For example, having more data on a process does not add value if that data is not exploited.

Area of I4.0	The focus is very much on technology implementation but this can feed-back into future investment decisions. It is primarily aimed at IT systems adoption.
Evidence of success (results achieved)	N/A but the tool is recommended by the UK Office of Government Commerce (now BIS)
Difficulties encountered/ lessons learned	Not following the process in an orderly manner. Needs clear understanding of the process. For example, enablers and benefits are often confused. Requires time in workshops, writing up results, creating benefits maps.
Potential for learning or transfer	The tool is designed for IT implementation in the US (lack of gains from IT being the problem solved) but it is certainly adaptable to gaining the benefits from Industry 4.0 and encouraging adoption by building confidence in the benefits. Public organisations using these tools will also develop insights regarding how benefits are best gained and these lessons will be transferrable between firms.
Target group	The level of the firm (it is an implementation tool) and public support agencies (they can support implementation work and their own learning)
Nature	The process should be run by public agencies in their support of firms. As noted above it requires workshops to be run, maps to be created, base-lines to be established.
Proposal for modifications/sustainability	We need to provide detailed instructions on how to apply the tool. However, this material is publically available. This perhaps more about developing the skills to use it.
Resources needed	One or more workshops involving firm staff. Support in writing up results. E.g. Two half day worshops, 2 interviews / meetings with senior managers (two researchers/consultants). 4-8 Full Time Equivellant days writing up results, creating maps.
Further information	There are plenty of resources on line.
Contact details	
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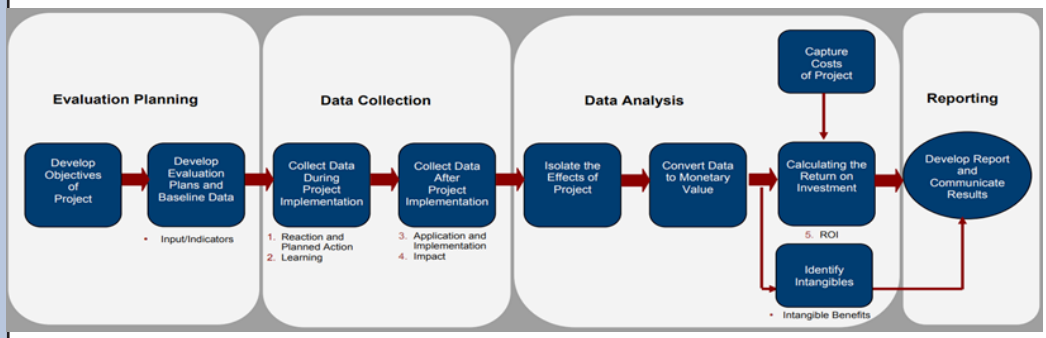
Philips ROI Methodology

Title of practice	Phillips ROI Methodology (by ROI Institute Canada)
Detailed description	*Please provide information on the practice itself In particular:* The Phillips ROI Methodology is a step-by-step credible process that meets the need to show the value used by organizations all over the world. The methodology is a simple to use and proven process that will generate a balanced set of data that is believable, realistic and accurate – particularly from the perspective of sponsors and key stakeholders. To allocate funds to programs, projects and improvement initiatives that deliver the highest value, a method is needed that credibly proves or "shows" the value. The 10 steps of the Phillips ROI Methodology are shown in the figure below:  *Phillips ROI Methodology Model (Courtesy of ROI Institute, https://roiinstitutecanada.com/wp-content/uploads/2014/02/Application-Guide.pdf)* **Phase 1 – Evaluation Planning** **Step 1: Develop Objectives of Project** Evaluation begins with the objectives of the program, project, or solution. The objectives must go beyond typical learning objectives and include up to five levels of data: ▪ **Reaction objectives** describe desired immediate reaction to the program, highlighting issues that are important to the success of the program. ▪ **Learning objectives** communicate expectations for obtaining new information, skills and knowledge. ▪ **Application objectives** describe intermediate outcomes, including use of skills and knowledge, on-the-job. ▪ **Impact objectives** describe consequences of applying skills or implementing the project and are expressed as specific measures of output, quality, cost, time and intangibles. ▪ **ROI objectives** set the acceptable level of monetary benefits versus costs of the program and expressed as an ROI percentage. **Step 2: Develop Evaluation Plans and Baseline Data** Planning begins as soon as it is decided that an impact/ROI study should be conducted and typically involves key stakeholders. All important decisions for the study are made early through evaluation planning. This step involves completing three documents: data collection plan, ROI analysis plan, and evaluation project plan.

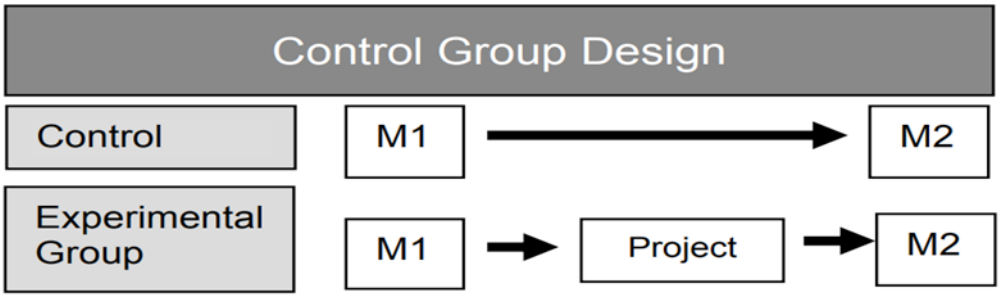
Phase 2 – Data Collection

Step 3: Collect Data During Implementation
Two types of data are collected during a project's implementation: (1) Reaction and (2) Learning.

Step 4: Collect Data After Project Implementation
Two types of data are collected after a project is implemented: (3) Application and (4) Impact.

Objectives	Data Collection Methods	Discussion Points
Reaction Data	▪ **Feedback questionnaires** – simple, straightforward and easy to tabulate ▪ **Action plans** – measure intent to use with planned actions ▪ **Interviews** – sometimes used when the project is in its first offering to help capture detail ▪ **Focus groups** – used when it is important for participants to hear the input of others	▪ Project Design (objectives, duration, location) ▪ Project Implementation (delivery method, environment) ▪ Project Value (relevant, practical, important to success)
Learning Data	▪ **Surveys and questionnaires**—determine the extent to which participants have acquired skills, knowledge, and information ▪ **Facilitation assessments**—ratings from facilitators or project leaders based on observations during the project ▪ **Written tests and exercises**—measure changes in knowledge and skills ▪ **Skill practices**—help assess the degree of applied learning and acquisition of problem-solving skills ▪ **Performance demonstrations**—provide direct evaluation of the ability to apply knowledge and skills ▪ **Simulations**—enable assessment of skills and knowledge acquisition ▪ **Team assessments**—assess the extent of skills and knowledge acquisition ▪ **Skill/confidence building** exercises—an interactive approach to capturing skill and knowledge levels	Readiness, Awareness, knowledge, competency, capacity

	Application & Impact Data	▪ **Surveys**—taken to determine how extensively the participants have used various aspects of the project ▪ **Questionnaires**—usually more detailed than surveys and can be used to uncover a wide variety of data in open-ended and forced-response options ▪ **Observation**—captures actual skill application and use. Observations are particularly useful in customer service projects and are effective when the observer is either invisible or transparent ▪ **Interviews**—conducted to determine how extensively the project is used ▪ **Focus groups**—conducted to determine the extent to which the project is used ▪ **Action plans**—developed by participants during the project and are implemented after the project is completed. Follow-up on action plans provides evidence of application and business impact success ▪ **Performance contracts**—developed by the participant, the participant's supervisor, and the facilitator who all agree on performance outcomes ▪ **Performance monitoring**—useful where various performance records and operational data are monitored for changes	Revenue, efficiency, customer satisfaction, productivity, downtime, employee engagement
	Phase 3 – Data Analysis **Step 5: Isolate the Effects of Project** One of the most critical steps in the process is to isolate the effects of the project. While this is sometimes difficult it is necessary for credibility of the study. Without this step, there is no proof that the project is connected to a business measure. **Control groups** are used to isolate the project's impact. With this strategy, one group participates in a project, while another similar group (the control group) does not. Their performance is monitored in a parallel time frame.		



Isolating the project's impact (Courtesy of ROI Institute, https://roiinstitutecanada.com/wp-content/uploads/2014/02/Application-Guide.pdf)

Step 6: Convert Data to Monetary Value

To calculate the ROI, improvement in business measures must be converted to money.

This step develops a monetary benefit for one or more impact measures linked to the project. It usually follows the step to isolate the impact of the project. To calculate the monetary value:

1. Identify the unit of improvement, e.g. one first aid treatment
2. Determine the value of each unit (V), e.g. $300, a standard value
3. Determine the unit performance change (Δ), e.g. 6 incidents per month (experimental vs. control)
4. Determine the annual performance level change (ΔP), 6x12=72
5. Calculate the annual improvement value (V times ΔP), e.g. $300x72=$21,600

   Several techniques are available to determine the value of a measure:
   - Participant's wages plus employee benefits
   - Historical costs
   - Internal/external experts
   - External databases
   - Soft measures are sometimes linked mathematically to other measures (customer satisfaction which is hard to value is usually linked to revenue which is easy to value)
   - Participants
   - Supervisors and managers

Step 7: Identify Intangibles

Intangible benefits are project benefits that we choose not to convert to money. They are measures that cannot be converted to money credibly with minimal resources. Intangible data should be collected in some way, even if participants must indicate the degree to which the project has influenced intangible measures. Intangible benefits are usually reported in a table in the complete report. Typical intangibles include but are not limited to image, job satisfaction, organizational commitment, teamwork, customer service, complaints, networking, partnership, brand awareness, communications etc.

Please indicate the extent to which the project has influenced the following measures:

Intangible Measure	Not Applicable	No Influence	Some Influence	Moderate Influence	Significant Influence	Very Significant Influence
Image	❑	❑	❑	❑	❑	❑
Teamwork	❑	❑	❑	❑	❑	❑
Brand	❑	❑	❑	❑	❑	❑
Engagement	❑	❑	❑	❑	❑	❑
Stress	❑	❑	❑	❑	❑	❑
Customer Satisfaction	❑	❑	❑	❑	❑	❑
Communications	❑	❑	❑	❑	❑	❑
Job Satisfaction	❑	❑	❑	❑	❑	❑

Identifying intangible benefits (Courtesy of ROI Institute, https://roiinstitutecanada.com/wp-content/uploads/2014/02/Application-Guide.pdf)

Step 8: Costs

When impact studies are conducted, the total costs of the project are needed for the ROI calculation. The costs must be fully loaded, i.e., must include all direct and indirect costs.

Typical cost categories are:

- **Initial needs assessment and analysis**—possibly prorated over the expected life of the project
- **Project design and development**—possibly prorated over the expected life of the project
- **Software or equipment**—purchase allocated in some convenient way
- **Project or program materials**—cost of all materials provided to each participant or consumed in the project
- **Facilitator/coach/coordinator**—includes preparation time as well as delivery time
- **Salaries plus benefits**—of the participants for the time they are involved in the project
- **Administrative and overhead costs**—allocated in some convenient way
- **Evaluation**—the costs of the impact or ROI study

Step 9: Calculate ROI

Return on Investment (ROI) is a financial metric, representing the ultimate measure of project success. ROI is calculated using the project benefits and costs. The return on investment calculation considers the net benefits divided by project costs. The net benefits are the project benefits minus the costs. In formula form, the ROI becomes:

$$\text{ROI (\%)} = \frac{\text{Net Project Benefits}}{\text{Project Costs}} \times 100$$

The payback period compares total investment (cost) to monetary benefits to calculate the number of years (or percent of a year) needed to pay back the investment. The calculation is:

	$$PP = \frac{\text{Project Costs}}{\text{Project Benefits}}$$ **Phase 4 – Reporting** **Step 10: Develop Report and Communicate Results** Reporting the results of the study is an important final step in the ROI Methodology. Properly identifying the audience and providing appropriate information is essential. By default, four audiences are always essential: 1. The participants directly involved in the project who provide data to the evaluators. 2. The immediate managers of the participants who need evidence of the success of the project. 3. The sponsors of the project who need to understand the project's value to the organization. 4. The staff team members who need to understand how the study was developed.
Area of I4.0	*Could be the level of I4.0/digitization the practice is focusing on.* The tool can be utilized to identify the needs of an SME and can be implemented to conduct ROI studies for I4.0 with some modifications.
Evidence of success (results achieved)	*Why is this practice considered as good? Please provide factual evidence that demonstrates its success or failure (e.g. measurable outputs/results).* ROI Methodology™ provides a comprehensive understanding of the various requirements of a business and can be easily implemented by following the 10 steps. Its effectiveness is evidenced based on the following metrics: ▪ More than 4,000 organizations have implemented the ROI Methodology ▪ More than 7,000 professionals have attended ROI Certification Workshops ▪ More than 30,000 professionals have participated in two-day ROI workshops ▪ International and Local ROI Networks ▪ Over 50 books translated into 38 languages
Difficulties encountered/ lessons learned	*Please specify any difficulties encountered/lessons learned during the implementation of the practice.* It is a time consuming activity that requires understanding and identification of the monetary benefits to a company. The tool will require bespoke modifications to work with different SMEs based on their goals.
Potential for learning or transfer	*Please explain why you consider this practice (or some aspects of this practice) as being potentially interesting for other regions to learn from. This can be done e.g. through information on key success factors for a transfer or on, factors that can hamper a transfer. Information on transfer(s) that already took place can also be provided.* Developed by Jack Phillips, this methodology is a critical tool for measuring and evaluating programs. The company that developed the methodology has been providing services to organizations for the better part of two and a half decades and has successfully implemented it in 18 different applications in more than 60 countries. It can be used in all regions after a few modifications.

Target group	*Specify the target group of the practice at if possible the level of I4.0/digitization.* The tool can target many different sectors including information technology and management industries. It can target large industries as well as SMEs. It can be used to conduct I4.0 related ROI studies for SMEs with some modifications.
Nature	*Please explain whether the practice is a tool for SMEs to use themselves, a method used by ex. consultants, a program having a broader objective etc.* The tool has a broader objective and is effectively a step-by-step guide for developing/conducting ROI impact studies for programs, projects, and solutions in different areas including information technology, communications, marketing, knowledge/resource management, organization consulting, leadership, quality, lean engineering.
Proposal for modifications/sustainability	*Please describe if there is suggestions of how to make the practice even better, and how the practice can evolve, need orientation, is integrated into the ecosystem/Smart specialization strategy and is supported by the community.* ROI implementation requires comprehensive evaluation of the collected data. In case of SMEs, the major issue will be the availability of useful data that can be collected to achieve specific goals and targets. Therefore, some of the steps identified above will need to be modified to work with a limited amount of data.
Resources needed	*If applicable - please specify the amount of funding/financial resources used and/or the human resources required to set up and to run the practice.* The ROI Institute™, founded in 1992, is a service-driven organization which strives to assist professionals in improving their programs and processes through the use of the ROI Methodology™. The company runs workshops to help organizations understand their needs and how they can be met in a mindful manner.
Further information	*Link to where further information on the good practice can be found* Further explanation for the different steps employed in the ROI Methodology has been given here: The ROI Methodology in 10 easy steps, Available at https://roiinstitutecanada.com/wp-content/uploads/2014/02/Application-Guide.pdf (Accessed on 01/06/2018). ROI Institute Canada, Available at https://roiinstitutecanada.com/roi-methodology/ (Accessed on 04/06/2018).
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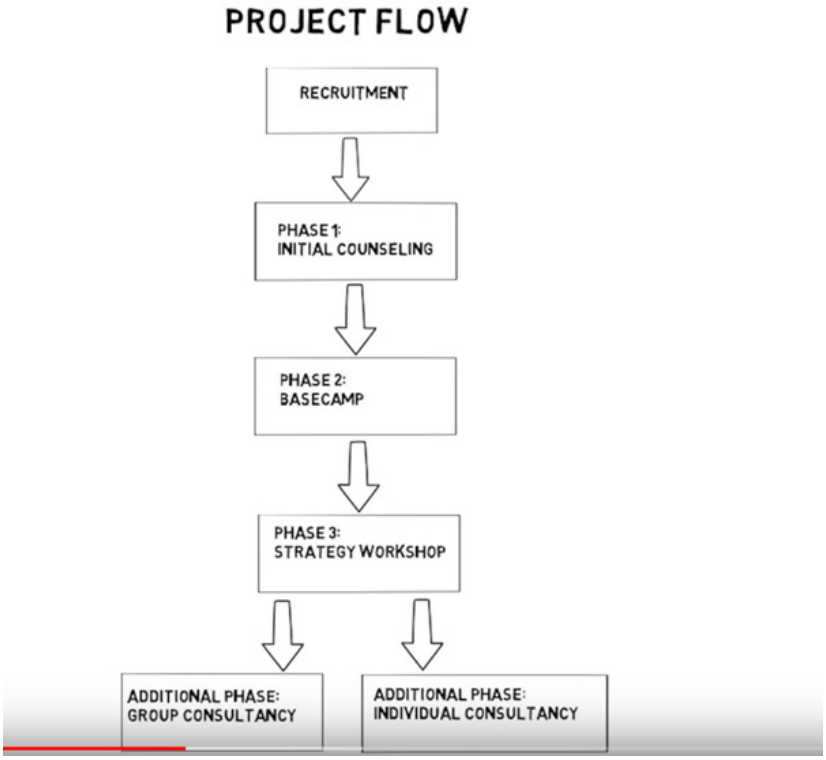
New Business Models in Manufacturing

Title of practice	New Business Models in Manufacturing (VIA University College)
Detailed description	A project concerning new business models in manufacturing companies, which was running in 2014, 2015 and 2016. The project is a good example on how to activate SMFs with a positive outcome for the companies. The process can be considered in Growin 4.0. The project was called New Business Models in Manufacturing. The project was targeting small and medium-sized manufacturing companies with growth potential. By joining the project, companies receive counseling from private consultants to rethink their business models and ensure their continuous growth. The counseling will usually focus on topics such as production optimization, LEAN manufacturing, customer relations and sales, organizational development and new concept and product development. The project recruits manufacturing companies primarily through regional business advisors and local business councils. Afterwards, the company takes part in the project's first phase, called initial counseling. This is a 1-2 hour meeting with the aim of clarifying the company's growth ambitions, growth potential as well as any barriers to growth. Phase 2 in the project is called Base Camp and is a 1-hour dialogue session. During the session, the company meets a panel of experts from higher educational institutions and business associations. The experts are 3 independent specialists who is chosen from a pool of specialists. The experts were prepared on beforehand, with key figures from the company. The group of experts are chosen from a pool of people and the groups are compound of experts with different background. In this way the groups are able to cover and understand as many of the company's issues as possible. During the meeting with the company, the experts ask in to the company's situation and detect the root causes. Based on this the experts suggest and match the company with a relevant private consultant, who together with the company's management will develop the company's growth strategy. It is mainly phase one and this second phase which can be used in the Growin 4.0 project. Phase 3 is a strategy workshop with the selected private consultant. The aim of the workshop is to plan the company's growth strategy and discuss tools for its implementation. In order to implement the strategy suggestions outlined in Phase 3, the company can continue with group consultancy together with 4 to 10 other companies. This is however optional for the company. The group is organized around a relevant topic within business development and the group meetings focus on sharing experiences on how the strategy implementation is progressing. Another option for the company is to continue with individual consultancy. The focus of the meetings with the private consultant is implementing the company's growth strategy. The project has involved more than 160 manufacturing companies in Denmark.

	The project is coordinated by VIA University College Denmark and is financed by The European Regional Development Fund and Central Denmark Region. The process can be summarized in the following diagram:  *For further information see the video on https://www.youtube.com/watch?v=Nd-v5wtaEnyU*
Area of I4.0	The practice is focusing on identifying the areas of importance in the strategy implementation and can be adopted for choice of the digital strategy of a company.
Evidence of success (results achieved)	Analyses among the participating companies showed a high degree of satisfaction see file: fif-tilfredshedsmaalinger.pdf
Difficulties encountered/ lessons learned	The difficulties was to see through the companies own perception of their issues and convince them of the root cause of their problems. This had to be done at the initial counselling.
Potential for learning or transfer	It was a practice which served as an eye opener for the companies and it gave the companies the possibilities to have some totally independent people to look on the company's situation.
Target group	The target group is all companies who have recognized that they have a digital issue.

Nature	The practice is not a tool for companies to use on their own. The practice need to have some independent knowledge resources from universities or similar and there have to be some consultants in different business areas connected to project.
Proposal for modifications/sustainability	
Resources needed	
Further information	For further information see the video on https://www.youtube.com/watch?v=Nd-v5wtaEnyU
Contact details	
Name	Rickard Lindquist
Organisation	VIA University College
Email	rl@via.dk

Who is involved?

Anglia Ruskin University

ALLIANZ FÜR DIE REGION

midt Central Denmark Region

OMC

Ostfalia Hochschule für angewandte Wissenschaften

SNN

SPK

FLANDERS MAKE

VIA University College

Hanzehogeschool Groningen University of Applied Sciences

TWI

VÆKSTHUS MIDTJYLLAND

Kamer van Koophandel Oost-Vlaanderen

Interreg North Sea Region GrowIn 4.0

European Regional Development Fund

EUROPEAN UNION

More information: https://northsearegion.eu/growin4/