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## **Implementing collaborative improvement – top-down, bottom-up or both?**

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**Abstract:** The research presented in this article was aimed at increasing the current understanding of the process of developing Collaborative Improvement (CoI) in Extended Manufacturing Enterprises (EME). Based on action research in three EMEs involving a total of 13 companies from five European countries, the study identifies three different implementation approaches.

The bottom-up learning-by-doing approach starts at a practical level, with simple improvement activities, and aims at gradually developing a wide range of CoI knowledge, skills and initiatives. The top-down directive approach starts with aligning the partners' CoI objectives and an assessment of their collaboration and CoI maturity in order to provide a common platform before actually starting improvement activities. The laissez-faire approach builds on shared goals/vision, meetings on equal terms and joint work, in a non-directive and non-facilitated way, though. The article demonstrates how and why the different approaches have different effects on the development of collaborative improvement.

**Keywords:** collaborative improvement; strategic supplier; action learning; action research.

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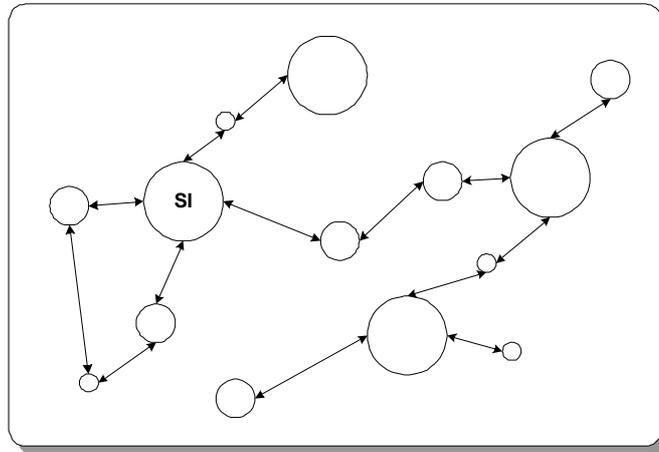
## 1 Introduction

The network theory of firms has developed since the early 1980s from the idea that firms depend on other entities (suppliers, customers) for the resources and competencies needed to develop, produce and deliver their products and services. While some generic definitions of network are based on the presence of relationships between persons, groups or bodies (*e.g.*, Aldrich and Dubini, 1989), more specific definitions distinguish networks as sources of long-term relationships between actors (*e.g.*, Thorelli, 1986) and, more specifically, an intermediate organisational form between market and hierarchy (Thorelli, 1986; Grandori, 1989; Miles and Snow, 1992).

One network structure is the Extended Manufacturing Enterprise (EME) (see Figure 1). There are many definitions of an EME; *e.g.*, Busby and Fan (1993), Childe (1998), Stock *et al.* (2000), Petersen and Szegheo (1999), and Frohlich and Westbrook (2001). Common elements in these definitions are:

- a *network* of industrial firms
- strong orientation towards *collaboration*, based on formal and informal links
- achieving *joint* competitive advantage for, and sharing the returns among, the partners
- one *dominant partner*, who views its suppliers as legally independent but functionally integrated into the dominant organisation.

**Figure 1** An Extended Manufacturing Enterprise (EME)



Source: Inspired by O'Neill and Sackett (1994)

Companies have learned to take inter-firm relationships much more seriously, according to Douma (1997), because of a number of global developments, including the internationalisation of markets, increasingly complex technologies and the increasing speed with which innovations occur. One effect of these developments has been a restructuring of roles, responsibilities and altered organisational structures to align inter-firm relationships with the market demands (Rich and Hines, 1997). Another effect

is that the battlefield of competition has increasingly moved from the level of individual firms to that of supply networks. Consequently, practices at the firm level are gradually finding their way to the network level. This article focuses on one of these practices, Continuous Improvement (CI) or, viewed in an interfirm setting, Collaborative Improvement (CoI). EMEs represent one of the closest forms of collaboration between firms and, thus, are a suitable setting for collaborative improvement. This study focuses on the adoption and development over time of CoI in EMEs.

Owing to functional, geographical and time separations between partners involved, EMEs cannot rely on traditional organisational and managerial mechanisms supporting continuous improvement, while the Information and Communication Technology (ICT) needed to bridge these barriers is in its infancy. Even with suitable ICT support, learning to improve collaboratively is a non-trivial, protracted process. Active collaboration between the firms is needed to create and maximise the synergy between the capabilities of the firms involved, while allowing each partner to realise its own strategic goals. This requires a well-developed capacity to learn, not only at the levels of individuals or firms, but also at the interorganisational level. However, there are few clear theories and tools to support interorganisational learning in EMEs.

The EU-funded CO-IMPROVE project addressed this need. Focusing on the learning required to enhance collaborative improvement of EME performance, the objective of the project was to develop:

- A business model, supported by:
- A software system, to facilitate collaboration between, and joint learning by, dispersed partners, as well as:
- Implementation guidelines building on an action learning approach and supporting the situational design, implementation and ongoing development of collaborative improvement, using the business model and the software system.

The business model essentially describes what a CoI environment might look like, what may be enablers and barriers to achieving such an environment, what possibilities there are of creating the enablers and of overcoming the barriers. Furthermore, the model proposes and describes tools that are available for the partners to manage and monitor key aspects of the development process. We have defined collaborative improvement as “a purposeful inter-company interactive process that focuses on continuous incremental innovation aimed at improving the performance of the companies within a supply network” (*e.g.*, Cagliano *et al.*, 2002). The portal-based software system aims to enable and enhance the capture, storage, retrieval, transfer and dissemination of knowledge generated as part of ongoing collaborative efforts to improve the performance of the EMEs.

Within an EME, three possible levels of collaboration can be distinguished:

#### 1 EME level

The entire extended manufacturing enterprise is the natural platform for collaborative improvement, and the ultimate goal is to develop and spread knowledge, improvement and innovation amongst all the firms in the EME.

2 Dyadic level

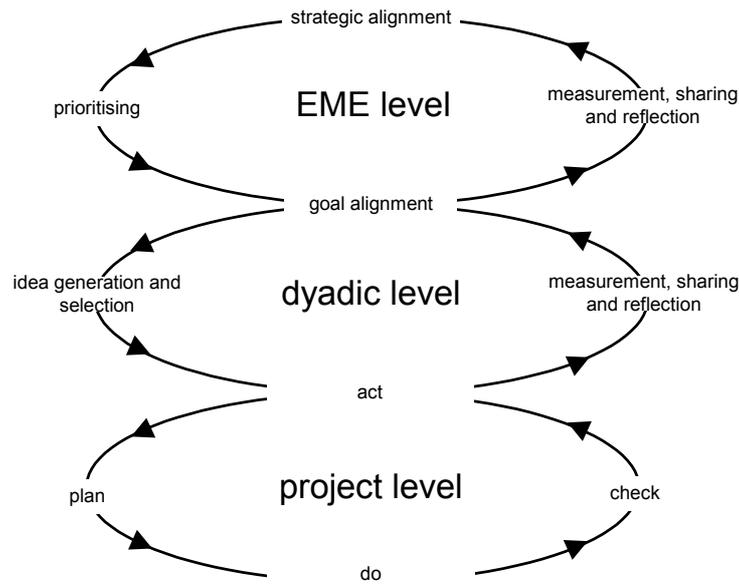
An EME consists of many firm-to-firm relationships. Each firm generally dedicates many people to a relationship, generally coming from different functions, such as sales, purchasing, design, planning, production, quality and logistics.

3 Project level

This level corresponds to specific projects, including improvement activities, put in place within a dyad, a set of dyads or, possibly, even the whole EME. The time horizon of the projects is shorter than that of the dyad and the EME. Their scope is also much narrower, as each project is focused on a specific goal. Generally, only a limited number of people from each firm are involved in a project.

Within each of the three levels, collaborative improvement takes place through a cyclical sequence of steps or phases, which repeat over time (see Figure 2). For more information on the Business Model and other CO-IMPROVE products, see [www.i2s.gr/coimprove/co-improve.html](http://www.i2s.gr/coimprove/co-improve.html).

**Figure 2** The CO-IMPROVE collaborative improvement business model



**2 Research question**

To our best knowledge and understanding, there are no contributions addressing the implementation of CoI. Moreover, there are very few contributions to literature addressing the implementation of CI. This article focuses on the empirical evidence from three EMEs that adopted different approaches to initiate CoI: top-down directed, bottom-up learning by doing, and laissez faire. The research question addressed is: *Do the different approaches yield different results and, if so, why?*

### **3 Methodology**

The central methodology in the project was action research (by university teams working closely with three EMEs) of action learning processes (by the EMEs). The interventions by action researchers were based on the business model and aimed at facilitating the EMEs in learning to improve collaboratively. In the following a description of action learning is presented, and action learning also represents the theory used for discussing the paper.

#### *3.1 Action learning approach*

Action learning is an approach to the development of people in organisations, which takes the task as the vehicle for learning. It reverses the traditional learning process where one learns something first and then applies it. In action learning, the starting point is the action. It is based on two principles:

- 1 “There can be no learning without action and no (sober and deliberate) action without learning.” (Revans, 1998)
- 2 “Those unable to change themselves cannot change what goes on around them.” (Revans, 1998)

One way of conceptualising action learning is through Revans’s (1998) learning formula,  $L = P + Q$ . L stands for learning, P for programmed learning (current knowledge in use, already known, what is in books, *etc.*) and Q for questioning insight. More precisely, action learning is:

- A process of inquiry into the issue under consideration – its history, manifestation, what has prevented it from being resolved, what has previously been attempted.
- Science in progress through rigorous exploration of the resolution of the issue through action and reflection.
- Group interaction, which enables individual critical reflection and, ultimately, learning. This is the essence of action learning.

While the practice of action learning is demonstrated through many different approaches, two core elements are consistently in evidence:

- 1 Participants work on real problems that do not appear to have clear solutions.
- 2 Participants meet on equal terms to report to each other and to discuss their problem and progress (Marsick and O’Neil, 1999).

The implementation of action learning has four elements – the person, the group, the problem, and action on the problem in the organisation and learning from that (Pedler, 1996). Action learning is essentially built around a structure whereby participants meet in a group, discuss and reflect on the progress of the particular project(s) on which they are working and then follow up on the learning from that meeting in the day-to-day enactment of attempted solutions to the problem.

Marquardt's (1999) six components of action learning provide a useful characterisation of the structure of action learning:

- 1 a problem – whereby complex organisational issues, which touch on different parts of the organisation and which are not amenable to expert solutions, are selected and worked on
- 2 the group – comprises a typical number of six to eight members who care about the problem, know something about it and have the power to implement solutions
- 3 the questioning and reflective process
- 4 the commitment to taking action
- 5 the commitment to learning
- 6 the facilitator.

We used action-learning theory as the general approach to help the EMEs develop collaborative improvement capability. However, the way in which they actually implemented the process was quite different. The remainder of this article describes and analyses the three approaches and draws lessons for theory and practice.

#### 4 Empirical field

The three EMEs each comprised one system integrator and three or four suppliers. A System Integrator (SI) is defined as a company that integrates components provided by a number of suppliers. The three SIs are located in Denmark, Italy and The Netherlands, and their suppliers in Denmark (the Danish EME), Italy and Austria (the Italian EME), and The Netherlands and Germany (the Dutch EME). In addition, two software vendors (Sweden, Greece) and four universities (Denmark, Italy, Ireland and The Netherlands) were involved. The EMEs are active in the following businesses (Table 1).

**Table 1** The three EMEs

	<i>SI</i>	<i>Supplier 1</i>	<i>Supplier 2</i>	<i>Supplier 3</i>	<i>Supplier 4</i>
Denmark	mobile hydraulics	metal parts	metal parts	foundry products	
Italy	aircraft	composite parts	metal parts	metal parts	metal parts
The Netherlands	electro hydraulics	plastic moulding	fine-mechanical parts	cylinder tubes	

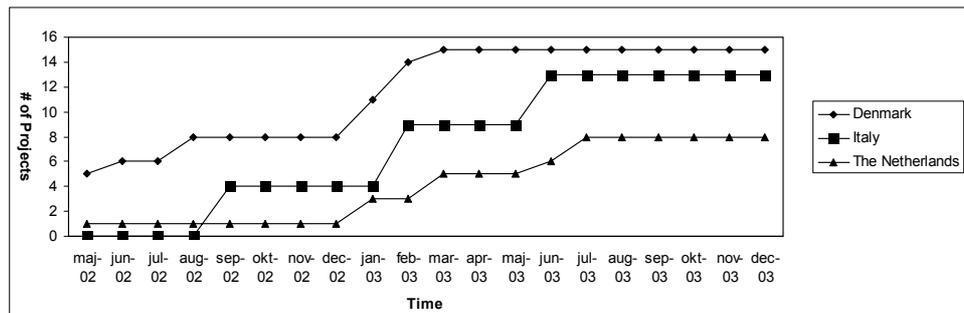
Figure 3 shows the accumulated number of improvement projects started in each EME. As can be seen from the figure, in all three cases there has been observed a stagnation in the initiation of new projects followed by a considerable increase due to interventions made by researchers. (See Middel *et al.* (2003) for further information on these projects.)

The three SIs were selected based on two criteria:

- 1 Active in the assembly industry
- 2 Eager to develop at least part of their supplier network, that is, the suppliers they regarded as strategic suppliers, into an EME as defined earlier in this article.

The latter had to include a genuine interest in developing improvement capability in close collaboration with their strategic suppliers. The SIs were asked to identify and involve three or four of these suppliers in the project.

**Figure 3** Accumulative number of improvement projects started in the three EMEs



#### 4.1 The Danish EME

##### 4.1.1 Philosophy

The Danish EME was characterised by a bottom-up and learning-by-doing approach:

- Bottom-up – starting on the practical/operational dyadic level, gradually moving towards developing a joint strategy and supradynamic collaboration, and from doing to doing and understanding.
- Learning by doing – initial focus on improvement projects within areas that were familiar to the participants (quality and delivery), slowly but steadily advancing to greater impact, involving more resources and a longer time perspective.

The philosophy behind this approach was that practitioners need practical experience with CoI to create joint strategies and understand, for them, a new and partly unexplored concept. As both the practitioners and researchers were inexperienced with CoI (and the need for data access for the researchers), the Danish EME chose to incorporate intensive facilitation by the researchers at the beginning of the CoI process. Quick wins were sought in the first improvement cycles to create and maintain momentum.

##### 4.1.2 Structure

The two main elements of the Danish implementation approach were a cycle of workshops and the work between the workshops. During the first eight months, these workshops were characterised by:

- frequency – monthly workshops
- focus – planning, working with and presenting (in plenum), improvement projects
- team members – five supplier and four SI representatives, an experienced continuous improvement consultant, two senior researchers and two PhD researchers; attendance close to 100%
- facilitation – researchers facilitated the workshops and decided the theme.

In between the workshops, the PhD students facilitated the improvement projects initiated at the meetings. They attempted to maintain momentum by following up on deadlines, encouraging face-to-face interaction between the SI and the suppliers, and engaging in joint meetings between, and individual meetings with the partners. In some cases, operationalising the improvement projects required the involvement of experts from the partner companies, *e.g.*, quality engineering or IT experts. Between the bi-weekly meetings, intensive use was made of phone calls and e-mail.

Eight CoI projects were initiated during the first eight months (see Figure 3). The objective of these projects was to achieve improvements in areas such as quality, delivery and information sharing. One project was aimed at rolling out the SIs' version of Total Productive Maintenance into the EME.

#### 4.1.3 *Change of approach*

After four months, the EME stopped initiating new projects (see Figure 3), and the effort put into projects, started during the first period, diminished, too. This was mainly due to:

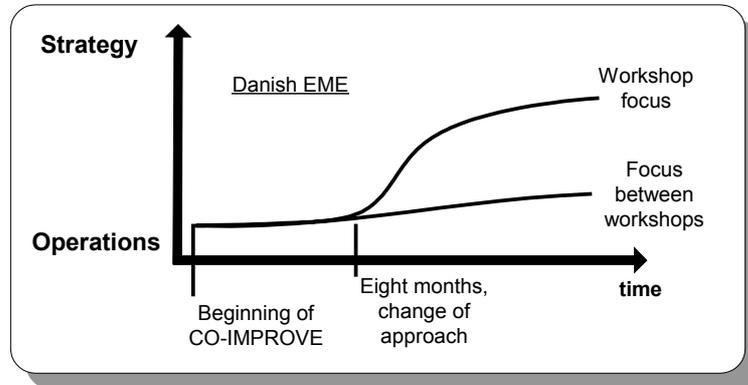
- Lack of project management and continuous improvement skills.
- Lack of a joint vision, needed to move beyond the results already achieved, no visibly increasing impact of improvement projects conducted, no further spreading into the partner companies' organisations.

To foster the development of CoI, the companies identified lack of skills and joint vision as needing attention. Eight months into the process a decision was made to change the workshops in terms of:

- Frequency – bi-monthly workshops. The 'new style' of the first workshops was focused on developing a joint vision and teaching some basic project-management skills
- Focus – strategy, building up competencies, learning, reflection; improvement projects: planning new projects, and learning from completed and ongoing projects at the workshops
- Team members – the same, but the team became a steering committee; attendance still close to 100%
- Facilitation – researchers facilitated the workshops; the steering committee picked the themes.

The objectives of these changes were to achieve more frequent communication between the partners, to launch and conduct improvement projects with larger impact and to get a longer-term, more strategic perspective in the projects (see Figure 4). However, even though a large number of new improvement projects were initiated (see Figure 3), the focus and impact of these projects changed very slowly, despite extensive researcher facilitation after the change of approach.

**Figure 4** The change of focus in the course of time: Danish EME



## 4.2 The Italian EME

### 4.2.1 Philosophy

The Italian EME chose a top-down and directive approach:

- Top-down – initial focus on assessment and goal alignment, which drove the selection of improvement projects
- Directive – due to the lack of previous experience and to the novelty of the approach, the process was guided by facilitators in terms of methodology and sequence of steps.

The philosophy behind this approach was to provide structure and direction to the process through the researchers and the SI and so to guide activities by providing methods and tools. The SI had no desire to impose any decisions upon the suppliers. The reason the SI adopted this approach was that the company and the suppliers involved lacked knowledge and experience of CoI. So they believed it was best to provide direction (strategy), structure, methods and tools, so as to create a context within which CoI activities could be started.

### 4.2.2 Structure

As with the Danish EME, the CoI implementation process evolved around regular workshops. The workshops during the first five months were characterised by:

- frequency – monthly workshops
- focus – assessment, learning and planning, improvement projects
- team members – four senior researchers, one PhD student, two Master's degree students, six suppliers and six SI representatives; attendance close to 100%
- facilitation – researchers facilitated the workshops, which were prepared together with the SI representatives.

Between the workshops, the Master's degree students tried to teach the representatives of the EME partners some basic collaboration techniques and to train them in the use of assessment tools. However, this seemed difficult for the participants to grasp. As Figure 3 shows, no improvement projects were initiated during the first five months, in spite of the facilitators' efforts not only during, but also between, the workshops.

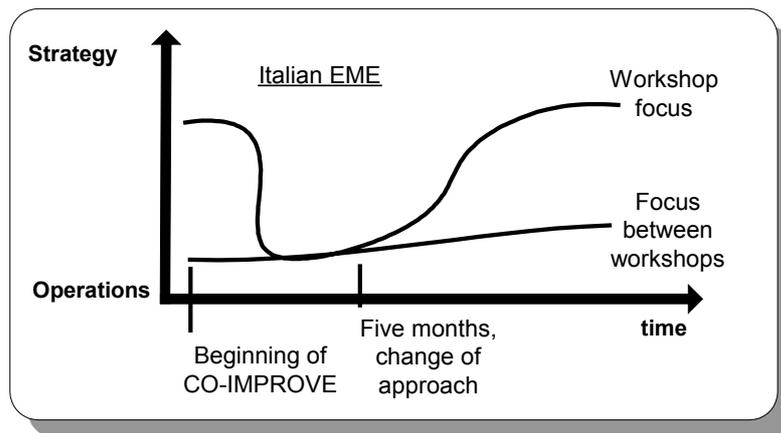
#### 4.2.3 Change of approach

To overcome this impasse, the EME decided to change the focus, from creating a suitable context to doing things. To facilitate the new approach, the workshops were changed as follows:

- frequency – two workshops every three months on average
- focus – planning, executing, evaluating, reflecting on and presenting (in plenum) improvement projects
- team members – six SI representatives were added to the team; attendance was high but varying since some members were involved only temporarily for specific improvement projects
- facilitation – researchers facilitated the workshops, but the participants were more proactive.

Between workshops, employees tried to work with improvement projects. This proved difficult for them. Nevertheless, the improvement projects eventually commenced. The Master's degree students attempted to maintain momentum by following up on deadlines, providing training in software tools and observing the interaction between the partners. In some cases, experts from within the organisations, *e.g.*, engineering or IT experts, were involved. Between the workshops, contact between the practitioners was sporadic and defined by the needs of the projects. Figure 5 shows the effects of the new approach.

**Figure 5** The change of focus in the course of time: the Italian EME



### 4.3 *The Dutch EME*

#### 4.3.1 *Philosophy*

The Dutch initially chose a laissez-faire approach, that is, a non-directed and non-facilitated approach. The philosophy was that successful collaboration and improvement in a network of companies requires shared goals and vision, trust and commitment but, most of all, should be self-initiated. CoI initiatives should be initiated and selected by the whole group, based on immediate practical problems or improvement opportunities. The Dutch EME thought a laissez-faire approach would be the best way for the partners to discover and become aware of the concept and the possible benefits of CoI.

#### 4.3.2 *Structure*

Eight months before the start of the process a workshop was held, aimed at explaining the concept and benefits of CoI and assessing the current maturity with regard to collaboration and CoI. In addition, the Dutch discussed the experiences, wishes and requirements related to CoI initiatives of each of the companies involved. During the first six months of the CoI implementation process, several workshops were held. However, only one improvement project was started. During that period, the workshops were characterised by:

- frequency – bi-monthly workshops
- focus – assessment tools; initiating, selecting and planning improvement projects
- team members – one senior researcher, one PhD student, and three supplier and three SI representatives;
- facilitation – researchers facilitated the workshops and decided the theme.
- The only activity started during the first months concerned a quality improvement project.

#### 4.3.3 *Change of approach*

The low number of improvement projects was mainly due to:

- low frequency of workshops (bi-monthly) and, thus, no momentum
- no sense of urgency
- no direction from the SI, which the suppliers were used to and expected.

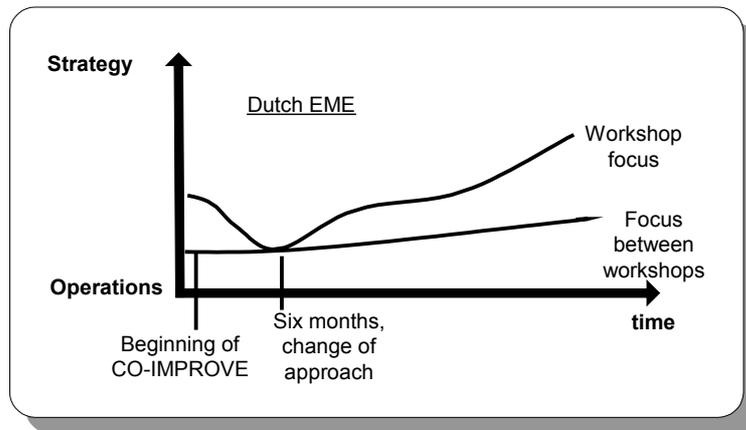
To create momentum and speed up or, rather, really start up the CoI process, these issues needed to be addressed. Following intervention by the CO-IMPROVE project manager, the SI realised it needed to become more directive. Consequently, after six months, the EME changed its strategy. As a result of this change in strategy several aspects of the workshops were changed:

- frequency – monthly workshops

- focus – strong focus on choosing, working with and reflecting upon improvement projects and eventually diffusing learning between and into the companies
- team members – one representative of the SI less, but more active participation of others in improvement projects between the workshops
- facilitation – by the researcher, with a more active and directive role for the SI.

The effects of the change of approach are shown in Figure 6.

**Figure 6** The change of focus in the course of time: the Dutch EME



## 5 Discussion

### 5.1 Initial approach

The empirical evidence indicates that before commencing the implementation of CoI, firms need to consider how to approach the process. The main advantage of the bottom-up learning-by-doing approach selected in the Danish case is its focus on practical improvement projects and results. This creates enthusiasm and engagement among the participants from the beginning of the process. The disadvantage became obvious eight months into the process, when the EME experienced a stagnation of projects and motivation dropped. The main cause identified was the practitioners' lack of skills, such as continuous improvement and project-management skills. Another main cause was the lack of a joint vision, so they changed the approach accordingly. The strengths of the Italian approach, top-down and directive, are knowledge and skills development, assessment of collaboration and CoI maturity level, and identification of improvement areas. Five months into the process, however, the difficulty of translating these strengths into practical improvement projects became apparent, since hardly any improvement projects were initiated. The Dutch identified the lack of direction as a major disadvantage and only when the SI started to take action in a more directive manner did the results start to show.

Marsick and O’Neil (1999) and Revans (1998) claim that action learning cannot occur without action, inquiry and reflection amongst the participants. In Denmark, the focus was primarily on action as well as questioning insight (Q) obtained from action. With little focus on programmed learning (P) through, for example, assessing collaboration and CoI maturity, or acquiring project management and improvement skills, the improvement results and the number of new improvement projects initiated dropped after some months. After adjusting for this, the process received new energy and new improvement projects were initiated. The Italian and Dutch approaches focused on programmed learning, by identifying and increasing existing knowledge of collaboration and CoI, but had little or no action to reflect upon and learn from. When the focus was directed towards action and improvement projects, Q-learning started to occur. The learning took place without the difficulties experienced in the first phase of the Danish case, and the reason was the foundation of P that was created before starting the actual action.

Further evidence suggests that, around half a year into the process, all three EMEs actively considered the benefits and drawbacks of each of the approaches outlined in this article. However, with hindsight, a combination of the three approaches might have been considered. In effect, all three EMEs changed strategy after some time, which rejuvenated the CoI implementation process in all cases. This seems to suggest that it is useful to evaluate and consider a change of approach at a suitable stage of the process. Using Revans’ (1998) terminology and formula, all cases experienced an imbalance in their learning modes, and a change of approach was needed to adjust P and Q to create more effective L.

## 5.2 Workshops

According to Revans (1998), the structure of CoI in an action learning perspective must be built upon a group-based structure. In addition, Marquardt (1999) and Pedler (1996) identify facilitation as an important factor in keeping the actors focused on learning. Empirical evidence confirms the need for facilitation to kick-start the process, and frequent interaction to maintain momentum. Part of the *laissez-faire* approach corresponds to Marsick and O’Neil’s (1999) recommendation to create a setup in which the group meets on equal terms. The Danish and Italian cases developed the workshops in this direction (meeting on equal terms) but started out with the researchers and/or the SI being in the lead. Initially, this caused difficulties, as most suppliers regarded the relationship with the SI as power based (Nielsen *et al.*, 2004). To experience real learning, Revans (1998) and Marquardt (1999) emphasise the importance of the partners’ commitment to learning and taking action, and their willingness to adapt to what goes on around them. The empirical evidence demonstrates difficulties, especially with the latter, but when the willingness is apparent to and acknowledged by all partners the process appears to mature quickly.

The three case studies, combined with action-learning theory, suggest that the workshops should be characterised by:

- building up knowledge of CoI and improvement and project-management skills to get CoI going
- assessing the CoI maturity level and potential areas for performance improvement

- developing a joint vision
- creating a learning environment in which participants can and do share knowledge
- facilitating the translation of all activities into concrete improvement projects.

The initial focus should be on commencing improvement cycles and creating results, while at the same time the development of skills and knowledge should not be neglected. After about half a year, participants are likely to develop some basic CoI skills and implement them in their daily work life. The focus of the workshops can gradually move from actual improvement projects to the development of skills and a learning environment.

### 5.3 *Between meetings*

Another important category of interaction took place *between* the workshops. The facilitation of improvement activities appeared very important, as CoI was new to the participants. In the Danish case intensive researcher facilitation from the beginning of the process ensured immediate results (see Figure 3), whereas the Italians and Dutch had difficulties, which were, at least partly, due to the much lower facilitation provided to those EMEs. The facilitators need not be experienced or experts but they should be able and prepared to take action, keep participants to deadlines and make sure that momentum is achieved and maintained. Furthermore, empirical evidence tells us that facilitation is very important in creating a learning environment in which questioning and reflection occur. Over time, external facilitation becomes less important, that is, provided that the industrial partners develop the skills and capacity required to continue, without assistance from outside facilitators.

## 6 Conclusion

The objective of this article was to describe different approaches towards collaborative improvement, identify if the different approaches yield different results and, if so, explain why. Three system integrators with three to four suppliers each provided the empirical setting. Three approaches were identified through the three cases:

- 1 Bottom-up learning by doing – moving from the practical level to concept and strategy, learning from experience
- 2 Top-down directed – focus on assessment and goal alignment that develops the foundation for improvement projects
- 3 Laissez faire – a non-directed approach, with equal attention being paid to concept building and experience from practice.

The strength of the bottom-up approach is that it produces immediate improvement results. Its potential weakness is that it may run out of momentum after a while, because of a lack of joint vision, and poor project-management and inadequate continuous improvement skills. The strengths of the top-down approach are that it provides the fundament of theoretical knowledge, goal alignment and an assessment of the partners' and the EMEs' strengths. Its potential weakness lies in the difficulty of translating

knowledge and vision into action. The laissez-faire approach may help create a shared vision and goals, genuine collaboration and learning. However, if there is not enough commitment (will, time, resources) and/or trust, this approach does not even begin to work.

The analysis presented in this article also shows that a combination of the three approaches may be the best way to implement CoI, if not from the beginning then early in the process. A successful implementation process requires understanding and direction (provided by the top-down approach), activity and learning (supported by the bottom-up approach) and a genuine willingness to collaborate based on trust and commitment (key values underpinning the laissez-faire approach).

There are three areas for further research: firstly, will a combination of the three approaches produce the most effective implementation of CoI and should such a combination apply from the beginning? The study was performed in three EMEs, with SIs and with three to five suppliers in West European countries, all active in specific segments of the assembly industry (cars, aircraft and agriculture). Do the results presented here apply to SIs and suppliers in other economic areas (*e.g.*, Eastern Europe and Asia), in other assembly industries (*e.g.*, electronics, white-good) and for other processes, in particular (semi)process (*e.g.*, food, pharmaceutical, chemical) industries? Finally, the study has focused on dyads, not networks, in the initial implementation of CoI. Further research is needed to identify successful approaches to get from the level of dyads to that of networks, and to determine if the approaches described and analysed in this study hold for later phases of collaborative improvement.

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