

Sustaining Manufacturing Improvement

***A study of sustainability based on the
Engineering Employers Federation South
Manufacturing Advisory Service Programme***



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Employers Federation South Manufacturing Advisory
Service Programme*

***A study by the Operations and Technology
Management Group at London Business School as part
of the ESRC Advanced Institute of Management Research***

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Contents

1	EXECUTIVE SUMMARY	6
2	INTRODUCTION	8
3	SUSTAINABILITY	10
4	METHOD	12
5	THE MAS PROGRAMME DELIVERED BY EEF SOUTH	14
6	OUTCOMES IN THE COMPANIES STUDIED	16
7	FACTORS INFLUENCING OUTCOMES AND SUSTAINABILITY	18
8	KEY ISSUES AND OBSERVATIONS	20
	8.1 Short-term effectiveness	20
	8.2 Achieving sustainability	20
9	CONCLUSIONS	24
10	APPENDICES	26



1 Executive Summary

This research in this report is built on the argument that deployment and sustainability are key aspects of improving manufacturing businesses. The research is based on eight case studies of companies that have used the Manufacturing Advisory Service (MAS) Lean production programme or intervention, delivered by the EEF South. The report concludes that:

- 1** The EEF South MAS programme is a cost effective way of developing improvement in manufacturing companies.
- 2** The programme is well defined and the advisors capable and effective.
- 3** Although sustainability is often implicit and achieved, and much of the programme has been designed with sustainability in mind, its delivery and assessment are biased towards the short term.
- 4** This and similar programmes should have longer-term sustainability as one of the performance improvement objectives.
- 5** Such performance improvement objectives should be accompanied by targets and measures.
- 6** There are many factors that can lead to greater sustainability of improvements including:
 - Effective pre-preparation and diagnosis
 - Planned follow on activities
 - Treating such initiatives as business change programmes, not just education and training
 - Greater development of performance measures
 - A situational approach fitting the intervention to the context and alongside other change programmes
 - Addressing internal barriers and organisational issues.
- 7** The EEF South MAS should consider how it can support companies throughout their improvement journey and whether further, more advanced programmes and events could be developed.
- 8** There are dilemmas in the funding of the latter recommendation that needs discussion and addressing.



2 Introduction

The effective adoption of appropriate good practices can be an important factor in the competitiveness of organisations, in both private and public sectors. To address this, organisations including businesses, government, trade associations and consultants have endeavoured to help others adopt, implement and benefit from such practices. An important concern is how new practices can be introduced most effectively, particularly in SMEs. On the other hand there is a debate as to whether there is practice push, whether even 'best' practices are universally applicable, and whether many practices are just fads. This study focuses on the former, with a particular focus on sustainability of established practices.

There are many practices that are considered to have a positive impact on organisations, but there is also evidence that in many organisations these practices, although adopted, have not been sustained. Poor sustainability is probably higher than is commonly believed, as the impact of new practices is often reported soon after implementation. In the longer term their impact may decrease as well as be sustained or even improved. The issue of sustainability is important both to organisations trying to implement good practice, and to organisations seeking to deliver support for companies. In order to study sustainability, we have chosen as the subject a set of practices, and a process for delivering that set of practices, that has been shown to be effective in the short term – Lean manufacturing practices delivered by franchisees for the UK Manufacturing Advisory Service (MAS). The particular franchisee in the study was the EEF South.

The main question addressed in the study was:

- What factors lead to or inhibit long term sustainability and deployment of manufacturing improvements from the EEF South MAS interventions.

In doing this we also addressed two supporting questions:

- What are the strengths and weaknesses of the EEF South MAS programme
- What factors lead to or inhibit short term manufacturing improvements from the EEF South MAS interventions.



3 Sustainability

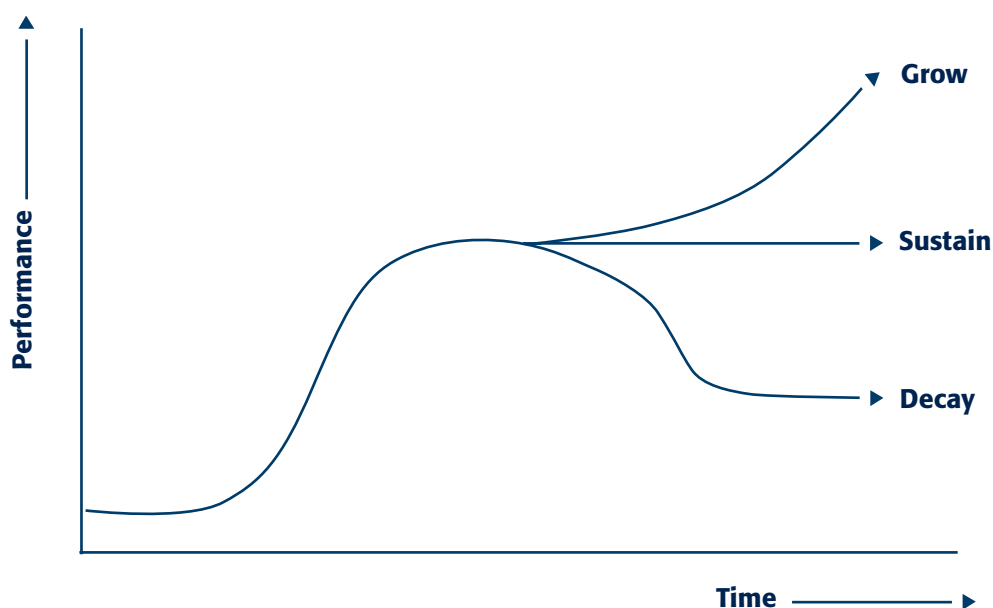
The pattern of successful adoption and implementation of new practices in firms typically goes through a number of stages¹. The first is **diagnosis**. Diagnosis may be conducted internally, sometimes through a process of benchmarking; or externally by consultants or other advisors. This process includes identifying problems and needs, potential solutions including, but not restricted to, the suitability of the practices for addressing these, prioritising actions and identification of sources of support. The next stage is **initial adoption**. The process includes internal communication, training, project management and performance measurement. Practices are often adopted in one part of the organisation, both to prove the practice, to learn about the organisation and culture changes that might be needed, to provide a base for developing expertise, to develop understanding of how the practices need adapting and for showcasing its effect. This stage also includes tailoring of the practices to the context and sometimes adaptation.

Following the initial success, the next stage is **deployment** across all relevant parts of the organisation. It is no coincidence that the major quality awards such as the EFQM and Baldrige awards require evidence of deployment. The final stage is **embedding**. A successful practice should not be a programme, but should become part of the way that people in the organisation work. Once embedded, practices require sustaining through training and reinforcement, and **review and improvement**. A practice is not static, but evolves over time and may have a useful life cycle after which it should be replaced. In this research we set out to address the areas of concern in the middle of this cycle.

- **Deployment** – the deployment of new practices across all relevant parts of the organisation.
- **Sustainability** – the continued and self-sustaining use of the practices.
- **Embeddedness** – the practices becoming part of the way that we work.

In particular we set out to see whether the performance gains from new practices were sustained and increased. The possible performance trajectories for a new practice improvement intervention are indicated in Figure 1.

Figure 1: The intervention and its outcome



¹ We draw on the work done by the 'next-generation diagnostics' team, led from the Cambridge University Institute for Manufacturing, with team members drawn from a number of institutions around the UK.



4 Method

The study was based on eight case studies of companies who had each been through a similar EEF South MAS programme to help them develop Lean production capability. Each of the cases was interviewed one year or more after their initial participation in the programme. To ensure the reliability of the research, in each case we interviewed the original MAS advisor and at least two different people in the organisation, normally one from senior management and one who was closely involved in the practice implementation. As well as interviews, a physical site visit was undertaken to see at first hand any changes that had taken place. In addition, two researchers, who subsequently compared notes so as to reduce bias and increase validity, conducted nearly all interviews. Finally available documentation, such as the MAS advisors' reports, was consulted where appropriate. The eight cases were drawn from seven companies and are outlined in Appendix 1. Two of the cases were interventions at different times in the same company (company D).

A research model was developed, based on the known literature on best practices and practice implementation. This is outlined in Appendix 2. Based on this model an interview protocol was developed (see Appendix 3).



5 The MAS Programme Delivered by EEF South

The Manufacturing Advisory Service is a DTI supported initiative to provide manufacturers with hands-on support and practical advice. In London, the MAS service is delivered by a partnership of EEF South, the regional Engineering Employer's Federation, PERA, and Business Link for London. It is supported by the London Development Agency. In the SEEDA region it is delivered by EEF South, in association with regional Business Links and other partners. They deliver hands on support which includes:

- A free on-site review from a local MAS specialist to analyse the needs of the business and offer practical advice
- Subsidised hands-on improvement programmes to implement best practice
- Access to benchmarking services
- Signposting to relevant information or services to support the business
- Access to subsidised training and training information.

Details of the MAS London offering are shown in Appendix 4.

The core of the programme is to deliver hands on support for change, based on the Lean manufacturing model. The programme is currently delivered through a carefully designed cluster programme involving typically six participating organisations. It follows on from initial meetings and diagnosis by a MAS specialist and involves the following main steps:

1 Directors' workshop

The objectives of this are to familiarise senior management with the concepts of Lean; to understand the programme, to gain commitment and to build relationships and trust of others in the programme.

2 Facilitator training

Each company nominates a facilitator who will lead the programme in the company. They then go through a thorough four-day programme to understand the principles and tools of Lean manufacturing, to build skills in analysing process and developing new and improved operations, and to build relationships with others in the cluster.

3 Planning session

Having identified the part of the organisation where the initial changes will be made (with the advisor/consultant) there is a planning session. This is to double-check the assumptions as well as to plan the activities.

4 Rapid Improvement Workshop

The Rapid Improvement Workshop (RIW) is the core of the programme. It is a four-day workshop where a particular part of the organisation is taken through the complete improvement process, where production is stopped and all the necessary changes are made during the four-day period. All analysis and management is done, not by the external facilitator, but by the facilitator so as to embed the skills needed. Often, a facilitator from another cluster company will attend. At the end of the RIW there is usually a celebration.

5 Cluster review

After all the workshops there is a review where the learning from the workshops is shared.

6 Best practice club

All participants can become members of a best practice club where further learning can be exchanged.

At the end of the programme, the companies should have the knowledge and skills to roll out the improvement process to other parts of the organisation.

Although this is the formal end of the programme, in many cases the involvement of the MAS specialist continues. In one of the cases investigated for this study, the initial programme hit major problems and the programme was restarted.

There is considerable tailoring of the content and process of the rapid improvement workshops to the company context. This is reflected in the diverse aims of the projects undertaken.

EEF South led interventions studied were conducted either as cluster programme interventions following the model mentioned above, or as company tailored programmes (concerning content, duration and pace) where the core activity was still the RIW supplemented with other training or improvement activities similar to those of the cluster programme.

Typical objectives of MAS projects studied, taken from project reports, include:

The project aim is to further disseminate Lean through the whole of the business. The program included training a team of Facilitators in Lean Manufacturing techniques and the implementation of these techniques, the identification of waste and the removal of non value-adding activities through the use of Lean principles obtained in the training. The main focus of the project was to develop eleven facilitators; this development would therefore ensure that ***** would continue implementing business improvements without the aid of third party advisors.

The overall aim of the project was to enable the team to continue implementing business improvements without the aid of third party advisors. The key objective of project (was) to enable the Team to approach improvement activities with Lean practice in mind and to organise the areas concerned in order to improve the flow of work with a view to eliminating waste, introducing 5S and effecting a reduction in lead time.

The project at ***** was to improve the flow of product and reduce non-value adding time and distance travelled by the welding operators. The process of construction was broken down to achieve a balance of individual process times and the layout was changed to achieve a more obvious product flow. 5S techniques were used to improve workplace organisation and a new crane was purchased to relieve an existing bottleneck.

6 Outcomes in the Companies Studied

For each of the companies we assessed the effectiveness of the outcome at three levels. First, the immediate outcome, second the medium term outcome and finally long term sustainability. We set out to use hard data on performance, but found that in nearly all the firms there was little or no performance data being collected. We therefore developed a simple ranking based on the advisors' original reports, the observations of two interviewers and data provided by the organisations. The ranking criteria were:

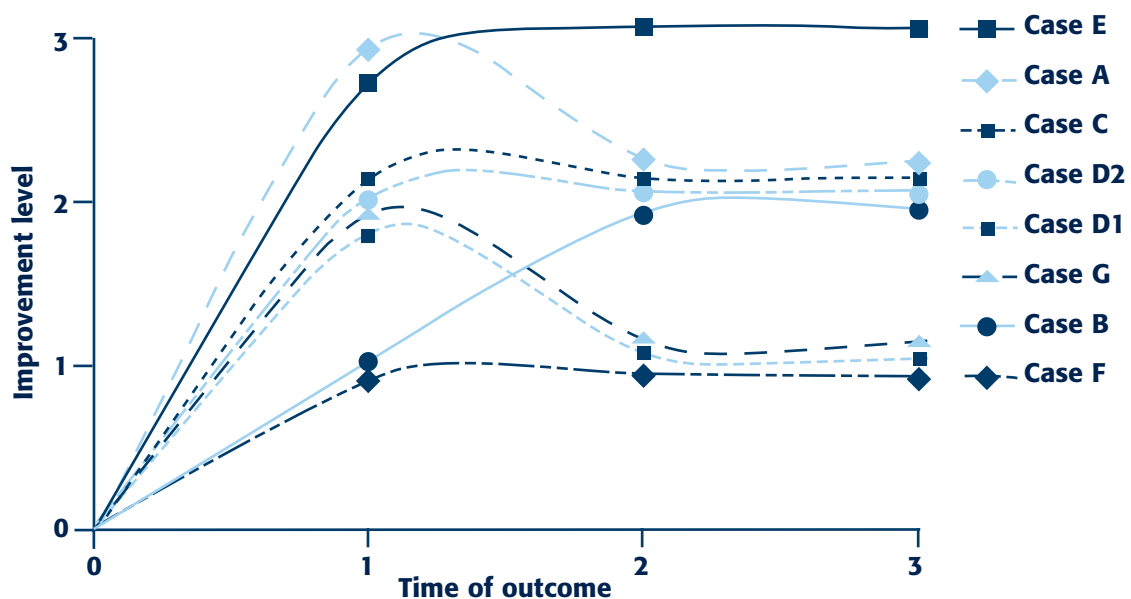
- * = Unsatisfactory performance; limited operational improvement over the pre-intervention level, little or no deployment of knowledge and Lean approaches across the organisation and little basis for sustained improvement.
- ** = Good improvement over the pre-intervention level; in medium term, some deployment across the organisation, with some of the skills, culture and knowledge in place for further deployment and improvement.
- *** = Excellent performance improvement; in the medium term deployment across the whole organisation in process, and the necessary skills, culture and knowledge in place for further deployment and improvement.

The results are summarised in Table 1 and represented graphically in Figure 2.

Table 1: Outcomes in the companies studied

Company	Immediate Outcome	Medium Term Outcome	Long Term Sustainability
E	***	***	***
A	***	**	**
C	**	**	**
D2	**	**	**
D1	**	*	*
G	**	*	*
B	*	**	**
F	*	*	*

Figure 2: Intervention outcomes over time



Of the seven companies studied (one company had two cases) only two, G and F did not end up with good long term outcomes. Two of the firms declined after an initial good or excellent start, and one improved sharply after a poor start. Five of the companies had demonstrated some degree of sustainability, whilst two had not. In the next section of the report we will analyse the factors that may be associated with supporting or hindering sustainability of practices and performance.

7 Factors Influencing Outcomes and Sustainability

We identified over 40 factors that influenced a good intervention in the cases studied – those that we felt were associated with both positive performance outcomes and sustainability. We categorised these into three main groups: factors associated with the intervention itself, factors deriving from the company context, and factors associated with the advisor or consultant.

The way that the intervention is planned and executed can have a positive impact on sustainability as well as the short-term impact. A detailed exposition of the observations in each of the cases is in Appendix 5.

The factors that we observed associated with the intervention are shown in Table 2.

Table 2: Factors associated with the intervention

Code	Description
A1	Involvement of key personnel (stakeholders)
A2	A priori planning for systematic roll-out
A3	A logical sequence of planned & connected events for top, middle management and employees
A4	Articulation and consensus of clear and realistic goals for intervention
A5	A positive engagement between external consultant & company personnel
A6	Consultant has a good rapport with company audience
A7	Appropriately tailored programme content
A8	Appropriately tailored intervention format (duration & pace)
A9	Spreading responsibilities & sharing workload amongst intervention participants
A10	Dedicating time & resources to the intervention
A11	Ensure that stakeholder groups remain committed during and beyond the intervention
A12	Milestones and checklists to support the consultant and intervention through phase changes
A13	Planned and organised intervention (clear project plan and organisation, time and resources and distributed responsibilities)
A14	Formal conclusion of intervention including planning for further activities
A15	Lack of measurement of improvements
A16	Positive marketing of the intervention (before, during and after)
A17	Being clustered with 'good' companies (genuine best practice)

Company context was a major influence on both the way in which the intervention was conducted and its short-term and longer-term outcomes. A detailed exposition of the observations in each of the cases is in Appendix 5. The factors that we observed associated with the company context are shown in Table 3.

Table 3: Factors associated with the company context

Code	Description
B1	High levels of motivation from upper & middle management, and shop-floor
B2	Committed involvement of upper & middle management, and shop-floor
B3	Openness to change on part of personnel
B4	High prior expectations regarding intervention outputs
B5	A commonly held sense of what can realistically be achieved
B6	A broader plan as to how intervention fits into companywide strategy
B7	Clear objectives for specific KPI improvements
B8	Coordination of intervention to fit with broader Lean effort
B9	Careful selection of company personnel involved (the right team of people)
B10	Honest & critical discussion between MAS consultant & company directors/personnel regarding areas of need and focus of intervention
B11	Management understanding of requirements for the Lean journey
B12	Key personnel stay within the company (before, during and after the intervention)
B13	Finding and supporting Lean champions
B14	Identifying and dealing with blockers
B15	Management of competition for resources from other company projects
B16	Other positive organisation factors (e.g. empowered workers, good communications, aligned reward/incentives, limited political battles etc.)

The advisor/consultant is critical to the success of a MAS intervention. The observations and feedback were very positive. There were a number of particular factors which were associated with both short and longer-term successful outcomes. A detailed exposition of the observations in each of the cases is in Appendix 5. The factors that we observed associated with the advisor/consultant are shown in Table 4.

Table 4: Factors associated with the advisor/consultant

Code	Description
C1	Broader business view of MAS consultant
C2	Appropriate 'reconnaissance' to ensure characteristics of a good intervention
C3	Increased depth of conceptual & implementation knowledge and skills
C4	Level of adaptability of consultant to provide a 'situational' approach (i.e. avoiding 'cookie-cutter' standard approach)
C5	Getting right balance of team of consultants/company personnel
C6	Awareness of specific political and cultural issues within the company
C7	Awareness of potential blockers and handling in an appropriate way
C8	Ability to think global – act local
C9	Discussion & consensus between consultant/key personnel regarding areas of need & potential outcomes
C10	Alignment of consultant performance goals/rewards with agreed & real improvements (i.e. Incentives towards company improvements rather than simply education and training)
C11	Sustained consultant-company contact (even if not requested)

8 Key Issues and Observations

In reviewing the data we sought to link the observed factors with successful and less successful outcomes. A summary of the analysis is shown in Appendix 6. From this analysis we identified a number of key issues and observation concerning both short term outcomes and longer term sustainability.

8.1 Short-term effectiveness

Our overall conclusion was that the EEF South MAS programme as designed and delivered is capable of making an effective short-term impact, and does so cost-effectively. The programme overall is well designed and the consultants/advisors capable and effective. The main scope for improvement probably lies in the pre-preparation aspects described later, and continual learning and improvement.

- The end of intervention assessments by the EEF South report short-term improvement and economic benefit for the majority of interventions. Our observations of performance impact at the individual organisations studied, as well as the feedback that we received from managers, were consistent with this. We conclude that the EEF South MAS programme is a cost-effective way of providing short-term economic benefits.
- The feedback that we received on the advisors themselves was also positive and often glowing. There was good evidence that the advisors/consultants had both the technical and the organisational skills to deliver the programme.
- Where there was limited short-term impact, this tended to be due to company specific factors, rather than the advisors or the programme. Cases with limited short-term impact were partially due to lack of a situational approach. It is possible that better pre-intervention diagnosis in order to inform a specific situational approach may have led to more improvement in at least one of the less-successful interventions.

8.2 Achieving sustainability

The EEF South MAS cluster programme is a very cost-effective way of delivering change in a company. However, a programme such as this will not lead to major economic benefit unless the changes are both deployed across the organisation and are sustained. As indicated earlier, we are positive about the EEF South MAS programme, both its process and what it delivers. However, from our analysis, we believe that there are a number of important factors and actions that can lead to greater sustainability, not just for this, but many similar programmes:

1 Designing the intervention for deployment and sustainability

Much of the EEF South MAS programme is notable for been designed with deployment and sustainability in mind; for example the focus on involving all from shop floor to senior management, as well as education and learning by doing. In particular making the company facilitator and shop floor team responsible for analysis, design and implementation of changes thus building of longer-term capabilities that can be transferred inside the organisation. Other such programmes can learn from the design of the MAS programme. However, we felt that often the delivery of the programme itself, the targets and measurement were often focused on delivery of shorter-term benefits.

2 The role of pre-preparation

Much of what leads to sustainability, as well as short-term impact, takes place during the pre-intervention stage. This includes the motivation and objectives of the senior management of the company, articulation of longer-term goals and the pre-planning for longer-term roll out and sustainability. Reconnaissance, diagnosis and preparation can be key to later success. The company sponsor and MAS specialist often prepare an intervention in collaboration. Information on the company situation provided by the company sponsor is in most situations the basis for preparation of the intervention. However in at least two cases, the consultant was not sufficiently informed about cultural and political issues potentially challenging the intervention outcome and later sustainability. During these interventions, problems surfaced which the MAS specialist was unable to do much about. Proper reconnaissance and diagnosis of the company situation (the manufacturing, cultural and political situation) is an important part of pre-preparation. It would be potentially beneficial to challenge the company sponsor in an honest and critical manner to reveal potential problems. Thereby critical issues could be dealt with beforehand and solutions planned into the delivery of a situational intervention able to deliver not only short term benefits, but also take the first steps towards more long term benefits.

3 Planning post-intervention activities

In most companies the RIW or intervention was finished with a celebration of the achievements made; this was done to reward the company participants and create more commitment for further initiatives. However MAS specialists often did not set up or become involved in planning further improvement activities. In three companies this was perhaps not needed as more Lean activities were already decided on before conducting the intervention and RIWs. However in four cases planning of further Lean activities happened immediately after the interventions were completed; in only one case were more initiatives not prepared for or conducted. Planning and organising further Lean activities can be critical for companies if to achieve not only short term, but also more long term outcomes of Lean interventions. By adding the planning of future activities, when closing the RIW or intervention, the EEF South or MAS can perhaps assist companies better in achieving more sustainable improvements.

4 Education vs. business change

It is possible to see interventions such as this in terms of education and training. However, one of the key differentiators of organisations with higher sustainability was treating the EEF South MAS programme as an enabler for business change as well as improvement in manufacturing. We see three parts to this:

- a) The company should set out with the objective of linking the improvement and change programme to planned longer-term business change.
- b) The advisor/consultant should see their role as preparing for business change as well as shorter term manufacturing improvement.
- c) The programme should explicitly see business change as an outcome, rather than just a programme of education and preparation for manufacturing change.

Clearly, business change cannot be achieved without success in achieving improvement in manufacturing in the short and medium term.

5 Measurement

We were surprised by the limited measurement taking place at most of the companies. In some, good and appropriate measures had been put in place, for example Overall Equipment Effectiveness (OEE) in some companies with high machine use. The lack of measurement is not just an impediment to assessing effectiveness, but it potentially limits deployment, sustainability and continuous improvement. In addition, there were no goals with appropriate measures for the MAS itself. We recommend that the MAS programme pays more attention to ensuring that key and appropriate metrics are put in place and that management use this for tracking the effectiveness and deployment of the programme.

6 Addressing internal barriers and organisation issues

As might be expected, some of the biggest barriers to both medium term impact and longer-term deployment and sustainability arise from internal barriers and issues concerning the organisation. For example at least four organisations reported that there were blockers – managers or a few employees who set out to block the implementation of changes, and in some cases managers had to be moved or removed. In other cases, lack of buy in by senior management led to lack of support and thus loss of momentum. On the other hand, although shop floor resistance has traditionally been seen as a problem, we did not find much evidence of this. This may in part be due to the bottom-up nature of the intervention, and in particular the involvement of people at the supervisor level.

7 A situational approach

Good or 'best' practices are not universal practices, and sustainability is most likely to come from ensuring that the approaches taken are both relevant to the business needs and fit the type of business of the organisation. We saw considerable tailoring of the programme content to the context by advisors/consultants. In a similar manner, intervention duration and pace were also tailored to the organisational, cultural and political situation of the companies.

8 Strengths and weaknesses of peer group support

Central to the cluster programme was bringing together companies going through a similar process. We heard mixed feedback about this aspect of the programme. Its value depended to some extent on the quality of the peer group. Where this included weak organisations, the value added was somewhat lower. In some cases, the complicating aspect of peer group quality may make using a situational approach more difficult.

9 Awareness of other ongoing projects – MAS projects are not always the most important for the company

Companies are continuously involved in different improvement projects that take place not only within manufacturing, but also other areas such as product development, sales and marketing, purchasing, logistics etc. A MAS intervention will typically compete with other projects for attention, time and resources. Thus it is important to clarify either links or potential conflicts with other ongoing projects otherwise outcomes can potentially be limited. It is also important to recognise that MAS interventions are not always the most important for a company. Not all companies are in a situation where improving manufacturing practices is the key to future survival. For example, in one of the companies studied, improvement of manufacturing practices was not sustained due decreasing sales and an increased management focus on markets, product development and more business-oriented issues. For this company, switching focus away from improving manufacturing practices was probably correct.

10 Recognition

We saw potential for greater recognition for those companies and individuals embarking on a Lean journey. As an additional service, the EEF South MAS could also offer certificates to companies and participants who have followed and completed MAS education and training events or had been successful in audits.

11 The limitations of a one-off intervention

The MAS programme as delivered by the EEF South is highly cost effective, but as we have indicated earlier, it does not always lead to longer-term sustainability. One of the key issues is whether further support is either necessary, or if not necessary, at least beneficial. On the one hand, in a number of cases ongoing support was provided. In all of these cases this was seen as contributing to deploying and embedding the new skills and practices. On the other hand, in one case the company deliberately chose not to have further involvement and was able to effectively make considerable longer-term gains. In most cases where there was on-going support, the organisations paid for this support. However, at least three companies had gained further government support and one of them stated that it would not have been able to progress without this financial support. Without this further support, this case would have ended up as a failure.

We conclude that the one-off intervention of the MAS programme does provide the companies with the basis for longer-term deployment and sustainability. However, ongoing support can enhance the likelihood of this happening. Whilst some companies can afford to pay for this, others cannot. There are thus some financial dilemmas:

12 Financial support dilemmas

For three companies, financial support did not seem to have mattered much in their decision about working with MAS. But four other companies claimed that available financial support was and is critical for their attempts to initiate Lean initiatives and, in fact, most of them have initiated follow up activities again subsidised by government or other sources. Given the possibility of getting financial support, there is perhaps a tendency for some companies to initiate the interventions in a trial-and-error manner without being aware of what they want or can get out of them and without preparing them carefully. Four companies seem to have approached the interventions to some extent in this manner. For two of these, the approach led to positive results and they have initiated later initiatives leading to further improvements (both again with financial support). However one company still claims an interest in redoing the process with another intervention if they can get financial support. This company is already involved in several other public sponsored initiatives where perhaps none will solve the fundamental business problems.

13 Develop a long term programme for SME companies

The MAS programme only launches companies into a programme of improvement. As the adoption of Lean manufacturing practices is a long journey for a company, it could perhaps be relevant for the EEF South MAS, the DTI or others to establish a series of connected events to support companies on the Lean journey. Those programmes could be offered to companies interested in not only a one-off Lean education and training event, but a more long term development of best manufacturing practices. The Lean programmes could be launched as level 1, 2, 3 etc., where companies and selected people could participate in a step by step manner. To support companies on their Lean journey, the EEF South or MAS could perhaps also offer Lean audits in the form of regular assessments of the level and outcome of Lean practices followed up with advice on how to proceed with further Lean initiatives. Audits and guidelines could be based on a Lean maturity model which companies could be recommended to follow in a situational manner.



9 Conclusions

The detailed study of eight cases of the EEF South MAS programme has led us to be positive about its design and delivery. However, we believe that there are a number of important lessons for the future both for this and other programmes.

1 Sustainability as an objective for change programmes

Although sustainability is often implicit and achieved, and much of the programme has been designed with sustainability in mind, its delivery and assessment is biased towards the short term. We strongly recommend that all such programmes, not just the EEF South MAS programme, should have sustainability as a key objective. In particular, the advisors/consultants should have longer-term sustainability as one of their performance objectives and measures. Having this as an objective leads to a number of implications for programme design.

2 Measurement

Sustainability is much more likely to be achieved if it is accompanied by appropriate measurement. Such measurement can be at a number of levels:

- For management – a limited number of metrics that help assess the success of change programmes. First, there should be key measures of the important operational outcomes such as quality, OEE, productivity. Second, there should be measures of deployment across the organisation
- For middle managers and shop-floor personnel. The tracking of targeted metrics to help demonstrate and visualise continued improvements over a prolonged period of time. A primary objective of such measures is to maintain interest, motivation and momentum for sustained shop floor effort
- For MAS advisors/consultants and MAS management. Metrics to objectively assess the longer-term sustainability of the programme, as well as the short-term impact already measured
- For DTI and similar bodies. Metrics to assess the longer-term sustainability of the programme.

3 Business change

Sustainability is more likely to be achieved if the programme is seen as bringing about business change as well as education and operational change. We recommend that this can be achieved at various places in the process. First, this should be part of the skills sought in the selection and training of MAS advisors/consultants. Second, making the business change component explicit at the earliest stages including diagnosis.



10 Appendices

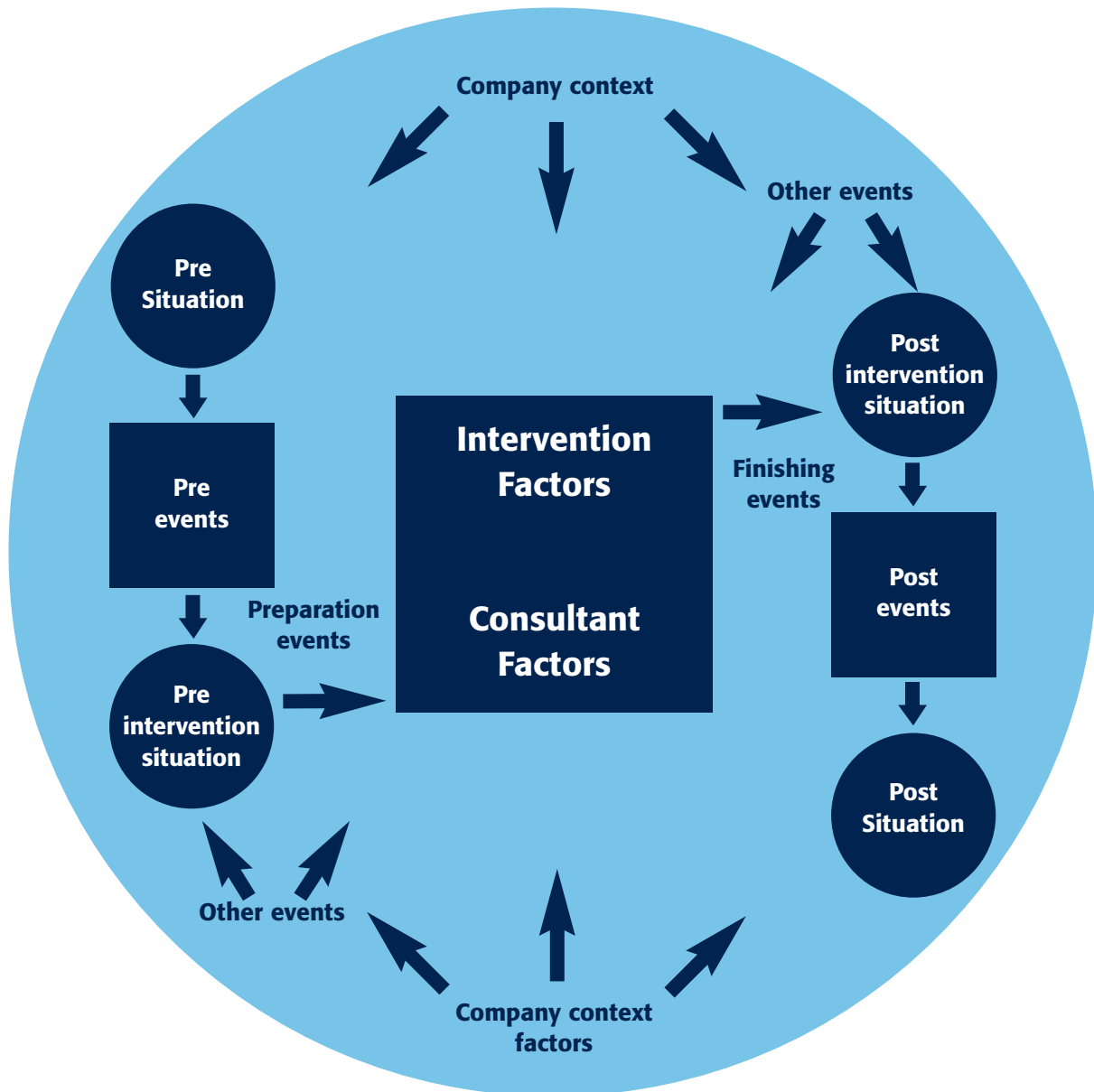
Appendix 1: The cases studied

Case	Size	Turnover	Ownership	Profitable	Industry	Type of Process	Lean Intervention
A	200	£20m	UK – Family owned	Yes	Fencing	One-of-a-kind/Batch, MTO/MTS	Spring 2004
B	40	£2.8m	Switzerland – Family owned – UK subsidiary	No	Blinds	One-of-a-kind (Some Batches), MTO	Summer 2004
C	90	£11m	UK – Mgt. group owned	Yes – recently	Printing	One-of-a-kind, Batch	Autumn 2004-Summer 2005
D	55	£4.7m	UK – Family owned	Yes – recently	Printing	Batch, MTO	D1: Autumn 2003 D2: Autumn 2004
E	17	£3.5m	Germany – Family owned – UK subsidiary	Yes	Industrial adhesive tapes	Batch, MTO	Summer 2005
F	35	£3m	UK – Management group owned	No	Automation equipment	One-of-a-kind, MTO	Autumn 2004-Spring 2005
G	20	£3m	UK – Family owned	No	Automation equipment	One-of-a-kind, MTO	Autumn 2003

Appendix 2: Research model

The detailed model used in the design of the research is shown in figure 3. The EEF South MAS programme can be considered as an intervention. The effectiveness of the intervention can first be influenced by the company context, the pre-intervention events and preparation. Important factors in the intervention itself will be its aim and scope, the social and technical, the project management and the facilitation. Important will be the behaviour and skills of the change agents. Finally, the finishing events can have an impact on the short term outcome.

Figure 3: The research model



The medium term and longer term outcomes will be influenced by the post-intervention activities associated with the practice implementation and deployment that take place within the organisation. In addition there are a wide range of events and activities in the rest of the organisation and in the market place that can have a strong influence on outcomes.

The literature base of this research model is available from the authors.

Appendix 3: Outline interview protocol for the study

- 1** Company introduction
- 2** Visit and plant tour
- 3** Company context
 - Internal and External context of the intervention
- 4** Pre events
- 5** Pre intervention situation
- 6** Intervention preparation events
- 7** Scope, aim, activities, participants, duration of the intervention
- 8** Dimensions and agendas of the interventions
 - Process, People, Project, Management and Facilitation issues
- 9** Behaviour, skills and competencies of change agents
- 10** Intervention finishing events
- 11** Immediate Post intervention situation
- 12** Immediate outcome of the intervention
 - Type and degree of outcome
- 13** Post events
- 14** Medium term (current) Post situation (i.e. at time of interview)
- 15** Medium term (current) outcome of the intervention (i.e. at time of interview)
- 16** Hard performance data (for retrospective within company comparison)
- 17** Final questions
 - What should have been done differently to make a better intervention?
 - What should have been done differently to increase outcomes and sustainability of Lean initiatives?

Appendix 4: London MAS services

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Hands-on Support

One of the key aims of the London MAS is to deliver tangible improvements to manufacturers through providing hands-on advice and support.

Manufacturing Advice Process (MAP)

Manufacturers can receive one day of free advice, and a further five days of heavily subsidised consultancy, delivered by MAS Manufacturing Specialists to help identify opportunities to significantly improve business performance.

We can:

- Diagnose key areas for improvement and develop an action plan
- Deliver training in identified areas for development
- Work with you over one whole day or two half days
- Organise follow-on consultancy, training and research
- Help you access the complete range of MAS services
- Refer you to specialists and centres of excellence.

The work is tailored to each company's needs and is results focused. Typical results:

- 83% Reduction in lead times
- 57% Improvement in productivity
- 67% Reduction in space requirements
- 38% Reduction in supply chain costs
- 54% Reduction in set up times
- 45% More capacity.

Source: MAS London website

Appendix 5

This appendix outlines some of the evidence and observations that support the more important conclusions outlined in tables 1-3. The numbers refer to the code in the tables.

A The Intervention

1 Involvement of key personnel stakeholders, from upper management to shop floor

In four companies powerful CEOs or managers (some of them company owners) sponsored, initiated and partially joined the interventions. These interventions also involved key middle managers and employees. In another company, the CEO initiated the intervention and the RIW, later improvement efforts largely fell to key middle management and shop floor personnel. Two of the interventions were conducted without clear commitment from anyone within the management group. Furthermore, critical middle managers and shop floor personnel were apparently ignored in one of these. In another, an important and influential management group member became more actively involved in the intervention, along with other critical personnel, whilst blockers were appropriately managed.

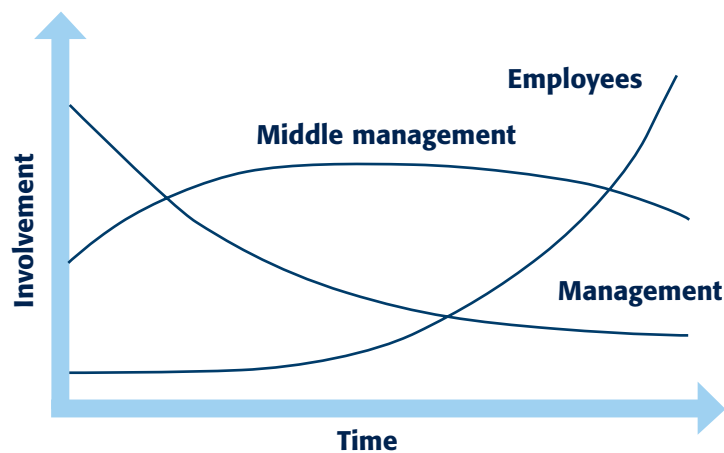
2 A priori planning for systematic roll-out

In three companies there were clear a priori plans for rolling-out Lean activities and other improvements before, during and after the intervention. In the others, such plans were lacking and post intervention follow-up initiatives, were initiated randomly or not at all.

3 A logical sequence of planned & connected events for top, middle management and employees

For example, in four companies there was a gradual and connected involvement of first top management, then middle management and finally employees in events related to the Lean intervention. The overall pattern of involvement in these companies followed the approximate trends shown in Figure 4 below:

Figure 4. Involvement of key stakeholders



In one company, the director responsible for Lean initiatives claimed he had underestimated the role of middle management in guiding shop floor personnel. A sequence of planned and connected intervention events was only partially present in two companies. In two other companies, intervention events for management, middle management and employees became isolated activities with limited exchange of people and information between events.

4 Articulation and consensus of clear and realistic goals for the intervention.

For example, one company had clear objectives regarding what the intervention was to contribute. Furthermore the scope and time of the intervention was chosen so it realistically fitted with other change projects being implemented within the company. Similarly, two other companies formulated realistic ambitions for the intervention. The other companies treated the interventions somewhat as experiments and were less clear about what they wanted to achieve. In two, management group consensus was missing about the benefits of the proposed projects.

5 & 6 A positive engagement and rapport between external consultant & company personnel

A positive relationship between the MAS specialist and company personnel was present in almost all companies. Nevertheless, in one company there was some misunderstanding over intentions, actions and personal opinions between MAS specialists and middle managers/shop floor participants. In particular personality clashes occurred with influential shop floor personnel resulting in breakdown in rapport and frustrations.

7 Appropriately tailored programme content

In most companies there was a tailoring of intervention scope and content so that improvement needs were satisfied. Two companies were run according to the 'standard' cluster programme model, but still involved careful selection of intervention scope and content. In five other cases, the company also conducted much needed interventions even if intervention scope in some cases could have been expanded. (The scope was expanded with extra training and HR activities in one). In one company a Lean office programme was run, where a Lean shop floor programme might have been more relevant.

8 Appropriately tailored intervention format (duration & pace)

Two company interventions were run according to the cluster programme model, which made the tailoring to company needs concerning duration and pace less easy. In four other cases, the intervention duration and pace was short and intense, to fit with the chosen intervention scopes and contents. Conversely, in one company, the scope and content (a lot of added training and education activities) required a longer duration and slower paced intervention. This intervention lasted more than 6 months, and apparently matched the company needs well. A similarly long intervention was conducted in another company, however here a more intense and paced intervention would possibly have been fruitful, given the changing company situation.

9 Spreading responsibilities & sharing workload amongst intervention participants

Most interventions seem to have been well prepared, planned and organised with clear assignments and responsibilities distributed to the participants during the intervention period. There was one possible exception to this where overall responsibility for the intervention outcome was unclear, as the company sponsor/manager could not drive the improvement initiatives himself. Thus a Lean or intervention 'champion' was missing.

10 Ensuring that stakeholder groups remain committed during and beyond the intervention

For example, in five companies all stakeholder groups remained (in general) committed to Lean improvements during and beyond the intervention. In these, the few resistant to change (blockers), especially amongst shop floor personnel were dealt with by senior and middle managers. In one company, commitment was lacking from key senior and middle managers – however in this company the intervention was repeated with a more influential management group member becoming actively involved and dealing with blockers within the company. In another company only one of three senior managers truly 'believed' in Lean initiatives, and lack of commitment spread to middle managers and shop floor people who were reluctant to join the improvement activities.

11 Milestones and checklists to support the consultant and intervention through phase changes

We did not observe specific milestones and checklists to support MAS specialists in keeping track of the progress of interventions. However the standard intervention model (the RIW and added training activities) with standard presentation materials etc., has supported the consultants when conducting the interventions. In all the cases studied, consultants seem to have relied more on their own experience with regard to monitoring and guiding the progress of specific interventions. However, to ensure positive intervention outcomes in varying contexts, this could perhaps be made more explicit in the future.

12 Planned and organised intervention (clear project plan and organisation, time and resources, and distributed responsibilities)

In most companies considerable time was spent on prior preparation, planning (activity, time and resources) and organising the interventions. This was often a joint effort between the MAS specialist and company sponsor. In some situations, there was the apparent danger of the MAS specialist being over-reliant upon (or not sufficiently critical of) proposals made by the company sponsor. Four companies seemed to be well prepared, planned and organised interventions with sufficient time and resources dedicated to the intervention, a clear intervention plan and key motivated people selected for the RIW team and additional initiatives. For example, in three of these production was stopped when conducting the RIW, and in the other employee personality profiles (Belbin tests) were used to establish the right team of people. (The MAS consultant claimed it to be one of the best teams he has experienced).

In one of these companies, the company facilitator made sure that the shop floor was tidy and painted before the intervention, so that they would be able to make as many important improvements as possible. For the other companies, planning and organising could have been done better. In one, production was running when conducting the RIW, and limited resources were dedicated to the RIW.

13 Formal conclusion of intervention including planning for further activities

Formal planning of further activities was not done as part of the interventions studied. However in three companies Lean activities had previously been planned to follow-up on the intervention. In four other cases several other activities were planned immediately after the intervention was completed. In contrast in one company, no further activities were planned.

14 Lack of measurement of improvements

Despite the calculations of RIW savings made by MAS specialists upon completing interventions, few companies actually measured improvements. As a result there were few hard, objective figures available regarding where, and by how much, improvements have been made. This was a significant concern in almost all companies studied, with key managers, personnel and MAS specialists stating that more before and after measurements should have been made. Two companies had begun measuring OEE on selected machines and equipment to be able to track improvements made through further Lean initiatives. One of these had also embarked on a KPI project for the whole company.

15 Positive marketing of the intervention (before, during and after)

Intervention sponsors and key personnel did some positive internal marketing of improvement initiatives in all companies. Nevertheless, it was done to varying degrees. Furthermore, three cases other influential personnel marketed the intervention negatively towards other people in the company. This could have been done for variety of political or 'hijacking' motives. On the positive side, two other companies reported to have used their Lean initiatives and collaboration with the EEF South in marketing for their clients (they purposefully invite them to the plant).

16 Being clustered with 'good' companies (genuine best practice)

Intervention sponsors and key personnel did some positive internal marketing of improvement initiatives in all companies. Nevertheless, it was done to varying degrees. Furthermore, three cases other influential personnel marketed the intervention negatively towards other people in the company. This could have been done for variety of political or 'hijacking' motives. On the positive side, two other companies reported to have used their Lean initiatives and collaboration with the EEF South in marketing for their clients (they purposefully invite them to the plant).

B. The Company Context

1 & 2 High levels of motivation and commitment from upper & middle management, and shop-floor

In no companies were all managers, middle managers and employees highly motivated and committed to implementing Lean practices and embarking on change. However in five companies most senior and middle managers, and also many employees, were motivated to implement Lean practices. As a result they formed a strong coalition committed to change from the outset, and attempted to ensure that needed initiatives were carried out successfully. In another company a 'change coalition' emerged across all organisation levels as the RIW and intervention proved the potential of Lean practices. In contrast, for two other companies only a few managers and employees were truly motivated or committed to change.

3 Openness to change on part of personnel

In many of the companies studied shop floor personnel accepted change, but stayed reluctant, waiting what was to come out of the interventions. However, in four companies personnel became enthused by the Lean concepts as the intervention progressed. In contrast, in four cases, many employees remained sceptical towards changes for some time. In one this was possibly due to lack of 'belief' in a key manager and his actions. In the other three the lack of consensus among managers became reflected in the attitudes of the employees. After the interventions two companies improved in these areas.

4 & 5 High prior expectations regarding intervention outputs and a commonly held sense of what can realistically be achieved

The key senior manager in one company clearly had very high expectations as to what the intervention should produce. These were tied to other projects within the company, resulting in a common belief that such achievements were necessary and possible. Key managers in two other companies also had relatively high, but realistic, expectations of the intervention. Four companies were less ambitious, whilst in two, there was some confusion as to what should, or could realistically, be achieved by the intervention.

6 A broader plan as to how the intervention fits into companywide strategy

Three companies already had manufacturing strategies (at least partially written) before initiating the interventions. The manufacturing strategies specified how to roll out relevant management and Lean practices (Lean, 5S, kanban, flow manufacturing, six-sigma etc.) to all areas of the companies in the coming years. The interventions were planned to fit within those broader programmes. Strategies or plans for overall company improvement existed only in a more vague manner or were lacking for the other companies.

7 Clear objectives for specific Key Performance Indicators (KPI) improvements

The three companies with clear manufacturing strategies tended to be more conscious than those having vague or lacking such strategies and plans about what KPI performance improvements to achieve in the coming years. However in general no companies had formulated clear objectives for KPI improvements to be achieved. Several companies claimed to be in a process of setting KPIs for the company and manufacturing; and establishing performance measurement systems and reward and bonus systems supporting those systems.

8 Coordination of intervention to fit with broader Lean effort

Three companies had plans for how the intervention fitted in to the overall effort of becoming Lean. In one there was a clear plan for rolling out Lean initiatives to different areas of the plant and company; the RIW was held for one those areas. For the other two similar plans also specified the exact management and Lean practices to be rolled out for the different areas. In one of these, a Lean shop floor programme (introduction to Lean, 5S, kanban, flow manufacturing etc.) was run in 2005. For 2006, a Lean office programme was planned, for 2007 ISO and in 2008 six sigma. For four other companies the broader Lean effort was decided on after the RIW was held when people had experienced the improvement potential of applying Lean principles to operations. In one company there was no real plan for a broader Lean effort in the years to come.

9 Careful selection of company personnel involved (the right team of people)

In five companies a careful selection of which people to involve in the intervention was made by the MAS specialist in collaboration with company sponsor/ facilitator. In one, a careful screening of employees' personalities (Belbin tests) was made to establish the right team of people. In the other companies, the facilitators and MAS specialists felt that the right teams of people were not brought together. This was particularly significant for one company, where the MAS specialist judged it as a very weak team.

10 Honest & critical discussion between MAS consultant & company directors/ personnel regarding areas of need and focus of intervention

The MAS specialists and company sponsors, on preparing, planning and organising the interventions before carrying them out, spent considerable time. In four companies, honest and critical discussions seem to have taken place between the MAS specialist and company sponsor who also have been well aware of business needs and critical cultural and political issues. However in the others, the company sponsors were either not aware of critical cultural or political issues (management conflicts, potential blockers etc.) or chose not to inform the MAS specialist about them.

11 Management understanding of requirements for the Lean journey

The programme in four companies reflected good management understanding of the time and resources needed to embark on the Lean journey. Lean initiatives were not only taken to obtain short-term improvements but also aimed at creating more long-term competitive operations. However in three, management attention to the Lean programme and related initiatives drifted a bit as time proceeded and other projects emerged. In three cases, management had become more aware of the potential and requirements for the Lean journey as they embarked on initiatives. In these companies an appropriate way of continuing and organising Lean initiatives has not been found yet, and the process is mainly driven by some 'enthusiasts' on a trial and error basis. In one company the management group failed to back up Lean initiatives, and the company sponsor fighting for them also lacked understanding of the personnel needs.

12 Key personnel stay within the company (before, during and after the intervention)

Most companies had been able to keep operations personnel in the company for a long period of time before, during and after the interventions. Key personnel familiar with business and manufacturing processes and Lean competencies are important to keep in the company for some time in order to implement management and Lean practices in a situational manner. One company had problems keeping shop floor people in the company (despite paying above normal salaries). In another it was recently hired employees that participated in the intervention, possibly resulting in the team lacking abilities to force changes through in the organisation. Finally one company had to lay-off people due to decreasing sales – though whether the loss of key personnel has influenced their ability to implement Lean practices is unclear.

13 Finding and supporting Lean champions

In several companies Lean champions were appointed or evolved as Lean initiatives were rolled out. In one company, MAS trained company facilitators who then took the lead after the RIW, but later lacked management support for making improvements. The company subsequently hired a young graduate to be responsible for Lean projects. In another company, the two company facilitators were not appointed as Lean champions but emerged through ‘force of character’ – though they claimed a lack of management backup to carry out the actual improvements. In another, the operations manager was appointed Lean champion and has taken responsibility for continuing the Lean implementation despite a big workload. In another company, a new operations manager was appointed as Lean champion after the two interventions, and was provided with two extra assistants to take care of daily operations while he focused more on improvement initiatives and overall management. In another company the management group, and especially two managers, have taken responsibility for Lean projects. In another company, an employee was also designated as Lean champion, but due to work pressure later resigned from further initiatives. Finally in one company, no Lean champion was found and the RIW company facilitator has not taken further initiatives.

14 Identifying and dealing with blockers

In most companies there were few people who obstructed Lean initiatives, sometimes called blockers. Usually they were identified and dealt with in a number of different ways. In one company, one shop floor employee refused to change his working procedures and he was allowed to work the way he wanted to. In another company, a production manager (along with some employees) stayed away from the RIW; he was later given another position in the company. Another company ran in to similar problems. After two separate interventions, it was clear that the production manager was not able to force changes through and that one middle manager and some employees were obstructing improvement efforts. The production manager was given another position in the company, a new one was appointed instead of him and the middle manager was fired. In another company the blockers were influential managers who saw no need for change. They were thus difficult to deal with for the company sponsor and especially the MAS specialist. Blockers amongst senior and middle management apparently tend to create more resistance to Lean initiatives than shop floor personnel.

15 Management of competition for resources from other company projects

In most companies other projects have been ongoing besides the Lean improvement projects. In two companies, other projects (e.g. an IT project) have partly taken attention, time and resources away from the Lean projects. In two others, product and market development projects critical for the survival of the companies have clearly pushed Lean initiatives behind in priority. In three companies, Lean initiatives did not lack attention, time and resources despite many other ongoing projects.

16 ‘Other’ positive organisation factors (e.g. empowered workers, good communications, aligned reward/ incentives, limited political battles etc.)

A number of organisational factors seem important for successful implementation of Lean initiatives. For example, lack of organisational stability, clear ownership of the company or consensus among key stakeholders of the company can create problems as seen in three cases that had fragmented or entrenched organisations compared to the other. In two companies the establishment of reward or bonus systems in support of Lean practices were mentioned as being critical for creating results in the future.

C. The Advisor/Consultant

1 Broader business view of MAS consultant

Despite being focused on the manufacturing area and the implementation of Lean practices, all of the companies studied appeared to benefit from having a MAS consultant with a general understanding of broader business challenges facing companies.

2 Appropriate ‘reconnaissance’ to ensure characteristics of a good intervention

In most companies the company sponsor or the company facilitators, in conjunction with the MAS specialists, did a thorough preparation of the intervention. However in two companies, the consultants could perhaps have done further reconnaissance of the companies’ manufacturing, cultural and political situation before rolling out intervention events.

3 Depth of conceptual & implementation knowledge and skills

A deep conceptual knowledge and implementation skills are important for a consultant or MAS specialist. For none of the companies such knowledge and skills have been lacking for the consultants.

4 Ability to provide a ‘situational’ approach (i.e. avoiding a ‘cookie-cutter’ standard approach)

When conducting the interventions, the MAS specialists have to a large degree relied on the standard intervention and RIW model, supported by standard EEF South materials for presentations, training etc. However for all companies, the intervention content, duration and pace was decided on in a situational manner, in response to different manufacturing, cultural and political situations of the companies. The tailoring of the interventions to company needs concerning content, duration and pace was necessary to create results, and in some cases the interventions could perhaps have been even more tailored.

5 Getting right balance of team of consultants/ company personnel

In most companies a good and balanced team of company facilitator and MAS specialists were brought together to conduct the interventions and initiate Lean initiatives. In one company there was some misunderstanding between the consultants and company facilitators about each other’s intentions and actions. In another company a more powerful company facilitator could have led to a more effective intervention.

6 Awareness of specific political and cultural issues within the company

In six companies, company the cultural and political situation needed special attention before, during or after the interventions. In all except one these, there were potential blockers of Lean improvements. In this company there was a lack of trust between the company sponsor, the key middle managers and the shop floor. In two companies the consultant was made aware of these issues before conducting the RIW and intervention by the company sponsor, However in three, this was not the case, and when problems later surfaced the consultant was surprised and partly unable to do anything about them. This illustrates how important it is for consultants to have a continuous awareness of potentially critical cultural and political issues in the company.

7 Awareness of potential blockers and handling in an appropriate way

As mentioned above, in five companies there were potential blockers for Lean improvements. In all most cases, the problems were handled either before, during or after the intervention. In two the consultants were made aware of these issues beforehand when preparing the intervention with the company sponsor. In another two the MAS specialists were not aware of the problems before the interventions and could perhaps have been more critical of the information provided the company sponsor. Identifying potential blockers and strategies for dealing with them often is a key issue to be aware of when conducting such interventions.

8 Sustained consultant-company contact (even if not requested)

All but one of the companies claimed an interesting in keeping a sustained contact with the MAS specialists after the intervention was completed. For three companies other Lean initiatives have been initiated since the first intervention where MAS specialists have participated, in some situations with and in others without outside financial support. In three others company sponsors also claim that they consider using the MAS specialists for further initiatives.

Appendix 6

Table 4: Intervention factors present/missing

Company	Intervention Factors Present	Intervention Factors Missing	ST	MT	LTS
A	A5, A6, A10, A7	A1, A4, A9, A11, A12, A15	***	**	**
B	A7	A1, A2, A4, A5, A6	*	**	**
C	A1, A5, A6, A16	A9, A10, A15	**	**	**
D I	A5, A6	A1, A2, A3, A11, A14, A15, A16	**	*	*
D II	A5, A6, A11, A14, A15	A1, A2	**	**	**
E	Almost all	A15 (A17)	***	***	***
F	A5, A6	A1, A3, A4, A8, A9, A10, A11, A13, A14, A15, A16	*	*	*
G	A5, A6	A1, A2, A3, A4, A15	**	*	*

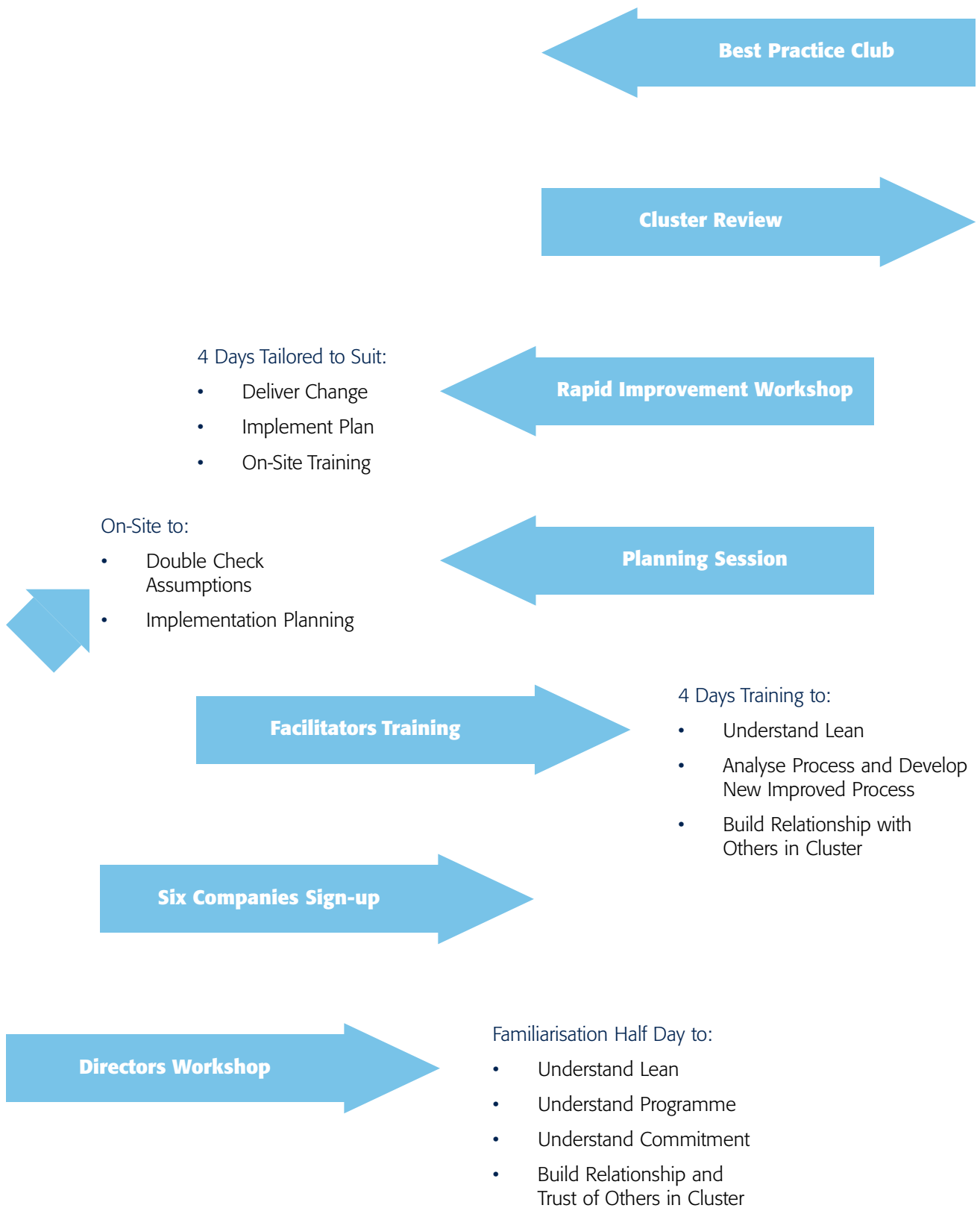
Table 5: Company factors present/missing

Company	Company Factors Present	Company Factors Missing	ST	MT	LTS
A	B6, B8	B3, B12, B13, B16	***	**	**
B	B3, B16	B4, B6, B7, B8, B11	*	**	**
C	B1, B4, B7, B9, B13	B15, B2, B3	**	**	**
D I	B12	B1, B2, B3, B5, B6, B7, B8, B9, B11, B13, B14	**	*	*
D II	B3, B5, B9, B10, B12, B13, B14, B16	B2, B6, B8	**	**	**
E	Almost all	–	***	***	***
F	B10, B12	B1-B16	*	*	*
G	B1	B2-B16	**	*	*

Table 6: Consultant factors present/missing

Company	Consultant Factors Present	Consultant Factors Missing	ST	MT	LTS
A	C9	C1, C7	***	**	**
B	–	C2, C4, C6, C8	*	**	**
C	C1, C9	–	**	**	**
D I	C1, C3, C5, C6, C9	C2, C4, C10	**	*	*
D II	C1, C2, C3, C5, C6, C7, C9	C4, C10	**	**	**
E	C1-C9	C10, C11	***	***	***
F	C1, C3, C5, C9	C2, C4, C6, C10	*	*	*
G	–	–	**	*	*

Appendix 7: The EEF South cluster programme



Notes



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