Cost Management in Plastics Processing
Strategies, targets, techniques and tools
by
Dr. Robin Kent
Tangram Technology Ltd.
2002

Published by Rapra Technology Limited
Shawbury, Shrewsbury, Shropshire, SY4 4NR, UK.
Tel: +44 (0)1939 250383 Fax: +44 (0)1939 251118
http://www.rapra.net
# Contents

Preface ................................................................................................................................. 1

1 Cost management ........................................................................................................... 3  
  1.1 Financial and management accounting  4  
  1.2 Cost structures  6  
  1.3 Activity based costing  8  
  1.4 Activity based management  10  
  1.5 Product costing - 1  12  
  1.6 Product costing - 2  14  
  1.7 Old ideas and new ideas  16  
  1.8 Investment for cost management  18  
  1.9 Successful project management  20  
  1.10 The cost reduction process  22  
  Key Tips  24  

2 Design and development ......................................................................................... 25  
  2.1 Fundamentals  26  
  2.2 Total product management  28  
  2.3 PENTAMODE  30  
  2.4 The design and development process  32  
  2.5 Product design specification  34  
  2.6 Design for assembly and manufacture  36  
  2.7 Value engineering and analysis  38  
  Key Tips  40  

3 Materials ..................................................................................................................... 41  
  3.1 Reducing the raw materials cost  42  
  3.2 Purchasing  44  
  3.3 Materials content cost management  46  
  3.4 Materials usage cost management  48  
  3.5 Inventory  50  
  Key Tips  52  

4 Systems and people .................................................................................................. 53  
  4.1 Systems  54  
  4.2 People  56  
  Key Tips  58  

5 Production ................................................................................................................ 59  
  5.1 The basics  60  
  5.2 The business strategy  62  
  5.3 Production control systems  64  
  5.4 MRP/MRP II/ERP systems  66  
  5.5 JIT systems  68  
  5.6 Optimised production technology  70  
  5.7 Waste and non-value activities  72  
  5.8 Work cells  74  
  5.9 Machine size  76  
  5.10 Machine setting and operation  78  
  5.11 Machine maintenance and utilisation  80  
  5.12 Economic batch quantity and set-up time  82  
  5.13 Scheduling and batching  84  
  5.14 Supplier development and integration  86  
  5.15 Quality management and control  88  
  5.16 Quality costs / quality savings?  90  
  5.17 Performance measurements  92  
  5.18 Culture change  94  
  Key Tips  96
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overheads</td>
<td>97</td>
</tr>
<tr>
<td>6.1 Energy management</td>
<td>98</td>
</tr>
<tr>
<td>6.2 The site energy survey</td>
<td>100</td>
</tr>
<tr>
<td>6.3 Injection moulding</td>
<td>102</td>
</tr>
<tr>
<td>6.4 Extrusion</td>
<td>104</td>
</tr>
<tr>
<td>6.5 Blow moulding</td>
<td>106</td>
</tr>
<tr>
<td>6.6 Motors and drives</td>
<td>108</td>
</tr>
<tr>
<td>6.7 Compressed air</td>
<td>110</td>
</tr>
<tr>
<td>6.8 Buildings</td>
<td>112</td>
</tr>
<tr>
<td>6.9 Waste minimisation</td>
<td>114</td>
</tr>
<tr>
<td>6.10 The site waste survey</td>
<td>116</td>
</tr>
<tr>
<td>6.11 Assessing waste performance</td>
<td>118</td>
</tr>
<tr>
<td>6.12 Tools for waste minimisation</td>
<td>120</td>
</tr>
<tr>
<td>6.13 Managing waste minimisation</td>
<td>122</td>
</tr>
<tr>
<td>6.14 Environmental management systems</td>
<td>124</td>
</tr>
<tr>
<td>Key Tips</td>
<td>126</td>
</tr>
<tr>
<td>Tools for cost reduction</td>
<td>127</td>
</tr>
<tr>
<td>7.1 Cost management tools</td>
<td>128</td>
</tr>
<tr>
<td>7.2 Pareto principle</td>
<td>130</td>
</tr>
<tr>
<td>7.3 Cause and effect diagrams</td>
<td>132</td>
</tr>
<tr>
<td>7.4 Scatter diagrams</td>
<td>134</td>
</tr>
<tr>
<td>7.5 Flow charts</td>
<td>136</td>
</tr>
<tr>
<td>7.6 Histograms</td>
<td>138</td>
</tr>
<tr>
<td>7.7 Process capability studies</td>
<td>140</td>
</tr>
<tr>
<td>7.8 Statistical process control - Control charts</td>
<td>142</td>
</tr>
<tr>
<td>7.9 Mind mapping</td>
<td>144</td>
</tr>
<tr>
<td>7.10 Other tools</td>
<td>146</td>
</tr>
</tbody>
</table>

Postscript ................................................................. 148

Abbreviations and acronyms ........................................... 149
EBQ - the hidden cost
Whenever short runs are discussed in plastics processing there is an automatic tendency to assume that they are impossible because of the Economic Batch Quantity (EBQ) for processing. This whole concept of EBQ is driven by the need to amortise and recover the production lost due to the time taken to set-up the process. Set-up times drive the whole concept of EBQ and this then drives another set of assumptions that build cost into the process.

EBQ results in:

• Higher than necessary inventories of finished goods - ‘We have got to produce 10,000 to make it worthwhile setting up’. This is despite the fact that the customer order is only for 100 and 10,000 is 10 months’ stock. This ties up cash, increases storage space required, requires movements and labour to carry them out, increases the possibility of redundant or damaged stock, reduces flexibility of response (‘We can’t change the product design/material/colour because we have 20,000 in stock to get rid of first’).

• Money tied up in raw materials - ‘We need the large amounts of raw materials so that we can produce the minimum runs’.

• Planning difficulties - long runs of low sales items take up more machine time than they need to (and always when there are capacity problems).

The effort of most processors has been put into reducing the machine cycle time and increasing the output rate whilst ignoring the changeover time from one product to another. This has led to the Economic Batch Quantity (EBQ) concept and has resulted in small batches appearing to be uneconomical to run.

Reducing the set-up time reduces the EBQ and the ideal of a set-up time reduction plan is to move towards SMED (Single Minute Exchange of Dies) or OTED (One Touch Exchange of Dies). These remove set-up times entirely and make EBQ concepts redundant. Large batches no longer appear on the shop floor, lead times disappear, work in progress disappears, customer response is improved and variety can be increased. Making daily and selling daily becomes the norm rather than a dream.

Reducing set up times allows the introduction of variety as a competitive edge and a manufacturing advantage. What would the warehouse be like if you really could ‘make daily and sell daily’? What would it do the cash flow, storage needs and ability to sell higher value-added products?

Reducing set-up times (which is rarely concentrated on) can give the equivalent of a huge increases in process speed (which is almost always concentrated on). This is all achieved without detriment to the quality of the product which is almost always a by-product of increasing output speed.

Smarter not faster
In many cases set-up time reduction can be achieved simply by changing the working method and 80% of the benefits can be achieved simply by working smarter rather than faster.

During one of our trials with set-up time reduction we wanted a benchmark on the current times to prove improvements. We set up a chalkboard and started to note the times. No sooner had we started than the setters started a competition to improve the set-up (they didn’t tell us).

Before we started the formal process the set-up time had been halved from eight hours to under 4 hours.

When asked how they had done it they replied: ‘It was easy - but we never knew you cared so we never made an effort!’

The EBQ concept is driven by the set-up time and then drives a range of undesirable consequences.

MRP systems tend to accept EBQ and consider it in the timings, JIT forces set-up time reductions to drive down the transfer batch size and to attempt to achieve one-piece flow.

Chapter 5 - Production
Reducing the set-up time
Set-up time reduction works by accepting that some operations can happen while the machine is running (external set-up operations) and others require the machine to be stopped and access to the machine (internal set-up operations). The aim is to carry out all the external actions before the machine has finished the current run, stop the machine, carry out the internal actions and start the machine again. This greatly reduces the down time from good product to good product.

The sequence for further reduction of the set-up time (without large investment) is:

**Step 1:** Establish a ‘set-up time reduction team’ from the shop floor. One of the best methods of ‘capturing’ the current method is to video the operation. Watch the video with the team to see all the times where people and machines are doing nothing. This exercise will generate copious suggestions for improvement. Analyse the existing set-up times. Try putting these on a chalkboard to show the employees what is important. There will be an immediate improvement.

**Step 2:** Divide the total time set-up time into internal and external set-up operations and reduce these. This is done as follows:
- **Internal set-up operations - Improve by:**
  - Quick-change tooling/connections.
  - Standard base plates.
  - Combining handed tooling.
  - Parallel operations.
  - Set-up sheets for all variables.
- **External set-up operations - Improve these by:**
  - Pre-setting of tooling. Provide tool kits for each tooling set.
  - Standardise on all screws, bolts and fixtures to be used in tooling
  - Pre-kit all gauges and inspection equipment.
  - Provide tool kits beside the machine for all operations.
  - Make all special equipment available.
  - Use standard base plates and connectors.

**Step 3:** Convert internal operations to external operations.
**Step 4:** Reduce internal and external operations further through experience.
**Step 5:** Start again.

Display the results
Establish high standards and targets regularly, visibly display the results and regularly audit these to encourage improvement.

Variety is the key
The ability to rapidly produce a low cost, high variety product range to meet the customer demand will distinguish a company. Low set-up times are the key to this and are a key measurement in the drive to continuously improve productivity performance.

The set-up time reduction process
The basic outline of the set-up time reduction process. The process is not a once-and-for-all process but continues as part of the continuous improvement programme.

The morals are:
- Involve the workforce, they know more than you.
- Measure and you will improve.