Competitiveness, Cost Reduction And Risk Avoidance At Source

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When we look at appliance manufacturing in the context of shorter model life cycles, it is clear that while modern manufacturers seek to deliver high quality end-user products – they must also find ways to recover the costs associated with product development and production against fewer sales per model type.

High Volume High Capital investment based strategies cease to be viable for cosmetic components and user interface modules, as these features in particular are subject to the most frequent design revisions. But as this paper explains, there are alternative ways to recoup development costs and retain added value in the production of components for appliances.

With a strong heritage in the development and deployment of injection moulding processes for the appliance manufacturing sector worldwide, leading international company Rosti Technical Plastics has successfully developed manufacturing strategies that can deliver high variety, without incurring the excessive overhead burdens associated with frequent model changes.

This paper explores modern development techniques that deliver robust, Right First Time, cost-optimised manufacturing. And by tackling these issues at the very start of the product development process – we will show how to build in competitiveness, reduce cost and avoid risk throughout the production process.

To maximise profitability out of shorter model life cycles, modern appliance manufacturers must reduce capital costs and the associated risks of under-recovery. To achieve this, manufacturing flexibility is essential – and a manufacturing partner must be well equipped to respond to these challenges.

A successful manufacturing strategy will deliver high variety without the excessive overhead burdens that arise from frequent, capacity-consuming changeovers. For example, if we consider the increasing popularity of “In Mould Labelling” (IML), Rosti is a leader in Appliance IML development (see International Appliance manufacturer 2007: ‘In mould labelling for the appliance industry’) precisely because the high quality values imparted by IML are created within the graphic and in mould application technique.

When the application technique is common to a model range, nearly all of the cost of model variety is contained within the foil printing process – which allows the manufacturer to leverage competitive cost, variety and added value.

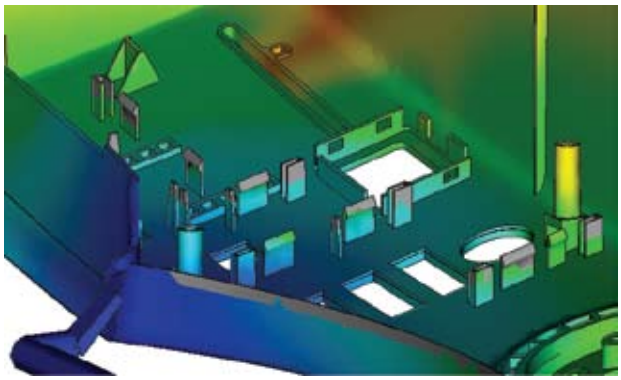
And it is this principle that places product development strategies under constant review at Rosti. Because we have to ask, how can the cost drivers within Product Creation, Product Development, Tooling Development and Process Optimisation be streamlined?

Identifying & measuring the cost of component development

Rosti’s approach has been to identify and measure the costs of component development across a broad spectrum of markets - from domestic appliances and business machines, to automotive and medical appliances - and to then categorise them.

In so doing, we have found that manufacturers often assume cost generators to be unavoidable and therefore integrated within fixed overheads.

Yet by applying new software tools and technology, it is



Example 1: Early-phase optimisation
The major functional and cosmetic component shown left has many thin sections that will generate recurring quality issues in production: issues that, with detailed analysis early in the process, can be corrected and optimised through design improvement and mould tool optimisation.

possible to reduce, or even remove entirely, some of these costs. Not only can we provide engineers with far greater certainty in terms of production outcome. This early-stage strategy also provides planners, product managers and CFOs with accurate, comprehensive insights into the actual – and avoidable – costs of product and process development.

Software technologies for improved performance

Rosti has established a toolbox of state-of-the-art product and process development software with a value of more than $430,000: a toolbox that is regarded as business critical to successfully filling the gap between conventional moulders and giant contract manufacturers – and living up to the term 'solution provider'.

Rosti's 'product creation' portfolio of business systems and engineering software, which includes Ansys Finite Element Analysis, Moldflow Part Adviser (MPA), Moldflow Plastics Insight (MPI) and Siemens NX, Pro/E, Catia and AutoCad design suites, was originally conceived to enable Rosti's engineering teams to integrate seamlessly with customer teams globally.

Early-phase optimisation

See **Example 1.** above. If this inherent design flaw is allowed to enter into production, it will lead to sub-standard moulding and could typically add 15% to cycle times due to higher material temperatures.

Compounded, costs will accumulate as follows:

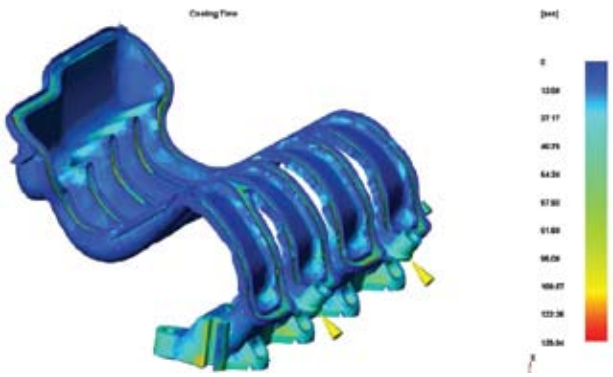
- Higher machine overheads to pay for lost productive capacity, which impacts depreciation and facility costs.
- Higher operating overheads to manage smaller processing windows, which will impact the cost of quality and add the cost of attending to critical machine (m/c) parameters.
- Higher total business overhead resulting from unnecessary capital investment and finance costs.

Yet a business that applies Design for Manufacture disciplines rigorously will, over time, generate typically 15% more output without additional investment. When this is combined with savings in direct expenses - a significant competitive advantage is created, and one that should be factored into the manufacturers technology road map.

This is a fundamental question for the major appliance brands. When addressing competitiveness and selecting manufacturing partners, OEMs should be querying whether their manufacturers have the resources to participate fully in the development process. Are they equipped and do they have the skills to optimise product at the product creation stage? Because if they do not, the brand is foregoing competitive advantage.

See **Example 2.** (shown over the page). While this is not an appliance component system, it is a very advanced 'Metal to Plastic' Conversion, which demonstrates an assembly that is under high stress in service and must be geometrically stable from the

Example 2:
The component shown to the right is an under bonnet automotive innovation that Rosti implemented in its Chinese facility during 2006. Despite its complex and challenging geometry, the part must be within exacting tolerances to ensure successful vibration welding of a mating component. Potential issues of uneven cooling within the tool were avoided, thus minimising warpage.



mould. This is a right first time achievement, made possible by extensive part and process analysis while the system was still in its concept development phase. Significant cost reductions have been achieved through:

- Component count reduction. Multi functions achieved with fewer components.

- Although a complex part, process analysis revealed an opportunity for multi-cavity tooling.

- Weight reduction was made possible through Finite Element Analysis (FEA) and wall thickness scanning, which also optimised the moulding cycle time.

When addressing systems development, another fundamental question for appliance brand manufacturers is whether their partners are capable of interfacing with product creation teams. Can they identify, through a technically robust process evaluation, the best solution to achieve credible results concurrent with concept generation? If they cannot, the brand is losing development leverage that could potentially affect model launches for many years.

But in themselves, clever solutions are not enough. They must also deliver a competitive total cost. A design that is not optimised will carry a lifetime burden of waste, which is unacceptable both from a commercial and an environmental viewpoint.

Material type, weight and volume, process selection, process energy, cycle time, process yield, all these factors and more can be optimised, to deliver meaningful savings and waste reduction.

Tool design: right first time for robust, optimised component delivery

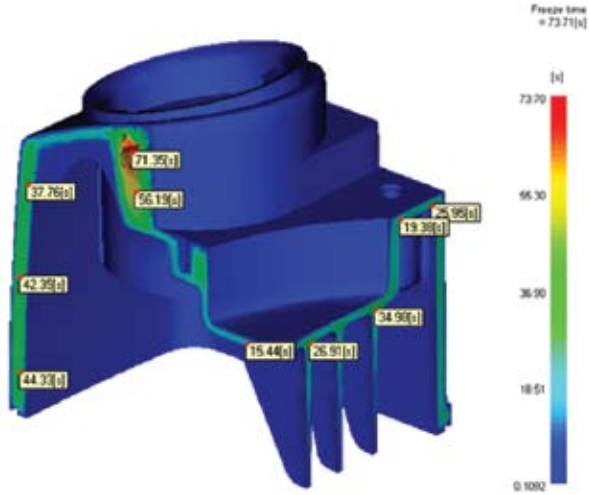
Injection mould tool design is a critical process, which must be managed with insights to the real processing issues likely to affect performance. But get it right first time, and substantial savings will be realised. Tool modifications to improve performance can be eliminated; tooling lead times are shortened and the process engineers can be confident that tool trials will quickly optimise the process for part qualification.

Example 3. overleaf illustrates the avoidance of cost and risk that a manufacturing partner can achieve:

- Component distortion could adversely affect the performance of the power train: an issue leading potentially to complex, costly engineering solutions and launch delays.

- For many moulders, material represents the major cost - in the range 45% to 60% - in a component. If the part is not optimised before the tooling phase, it can be uneconomic to correct after tool trialling. Thus the component, the product and its market price will carry a lifetime burden of material obsolescence.

- Concurrent engineering should deliver part weight reductions and detailed analyses will deliver savings. A 5% weight reduction of a material that



Example 3:
The image to the left shows 'freeze time' through the part thickness of a housing for an appliance motor and power train. In this example, analysis identified an excessively thick section which would add 54% to the injection moulding cycle as a result of prolonged heat dissipation time. Eliminating this problem produces significant cost reduction. Post moulding distortion will also be significantly reduced: a development factor with major implications for cost and lead time to product launch.

represents 50% of the part cost will reduce the total part cost by 2.7% when energy costs are also taken into account.

- The moulding cycle time advantage achieved by eliminating thick sections will further reduce labour and energy costs, delivering a total part cost saving of 5.1%.

A brand that consistently optimises its components - and therefore its processing costs - delivers a virtuous cycle of competitiveness. Total business overheads are optimised over time, adding further cost down leverage to the principle processing savings.

Example 4. over the page demonstrates the elimination of avoidable cost. Without early phase intervention, development costs would accumulate as follows:

- Because issues will arise after tool trialling, finding the root cause solution will be expensive in terms of time and tool modifications.

- Alternative process conditions to optimise performance may be tried. If the problem is marginal, the processor may deliver a working component - but the life cycle of the product will be hampered by a small process window, with all the associated cost implications of quality, m/c attention, sub optimal PPM performances and unnecessary management attention. If the problem is not marginal, then the whole investigation will waste time and money, both for the Brand and for the manufacturing partner.

- Alternative materials may offer a solution. However these are usually more expensive as they are formulated to achieve very specific performance parameters. This is often successful - but upgraded materials saddle the product with a lifetime burden of unnecessary cost.

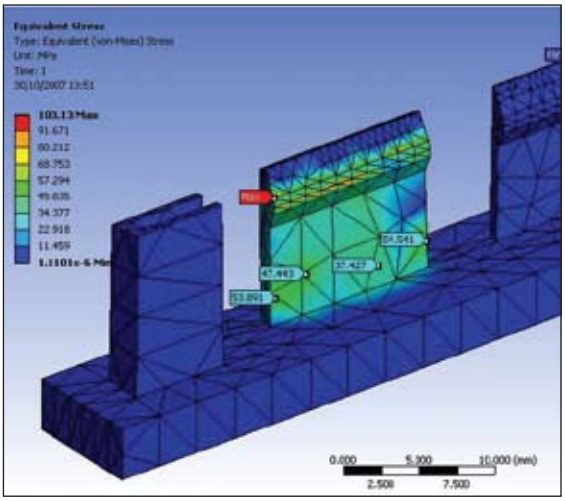
Experience has shown that the development cost drivers described above can represent 10% of the total tooling cost for a programme. These costs are usually unbudgeted, which leads to a 'who pays?' debate. The Brand owner must also absorb additional, unbudgeted development costs incurred in its own team. And importantly – planned launch dates are likely be missed by weeks or even months, which may have incalculable longer term market effects for the Brand.

Conclusions

Modern appliance manufacturing places new pressures on brand owners and their manufacturing partners. Knowledge of injection moulding must now be fused with a huge range of technical, analytical and economic competencies – and a global footprint to accommodate logistics and cost-down planning.

But how can a so-called 'solution provider' accumulate expertise

Example 4:
This image shows a customer's original design, which was found to exceed permissible stress limits during operation. By redesigning the problematic features - verifying the solution using further simulation prior to mould manufacture - the part now functions as desired and multiple assembly failures have been prevented.



and knowledge banks across such a breadth of activities for the benefit of all its manufacturing locations?

To address these issues requires a redrawing of the value chain – and a reassessment of the allocation of resources. With design identified as a 'close to customer' regional activity, Part & Process analysis is defined as a global activity, focused into one high competence centre: a confluence of knowledge from a multitude of disciplines.

A Manufacturing Partner that manages risk and development process rigorously (Project Management) will contribute leveraged gains well beyond those visible on the part cost sheet.

A Brand that consistently delivers innovative solutions for its customers, will generate long term loyalty and attract new opportunities.

About Mike Sullivan, MBA:

Following his early career in electro-mechanical products development and international technology transfer within Lucas TRW automotive, Mike Sullivan held General Management and Divisional Management roles within McKechnie Consumer Products and Marconi-Reltec Telecommunications.

Joining Rosti Technical Plastics in 2000, Mike has been responsible for integrating the company's R&D and International Technology Transfer functions, to advance the groups' global synergies. He has since filed several patents involving polymer surfaces, infomatics and mechatronics.

Mike studied at Manchester Business School UK, EADA Spain and Grand Canyon University USA, gaining his Masters degree at Staffordshire University UK. He currently lives in the UK.

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