



# Industrial Alchemy for Chemists

**The chemical industry is rightly proud of its technical expertise. It is innovative, resourceful and smart. It has, however, been a bit hesitant in adopting many modern manufacturing techniques that have been proven to serve other industries well. If the chemical industry is to continue to thrive, Paul Beaumont of WCI Consulting argues the time has come to speed up learning from other sectors and not simply rely on its own inventiveness.**

Recently I was meeting with the senior manufacturing personnel at the flagship site of a top-fifty chemical company. There were twelve of us in the room and, between us, we mustered eleven PhDs. It goes without saying that all of the doctorates were in chemistry and that I was the odd man out! The focus of the discussion was on trying to select the most suitable plant for the company's first six sigma project. At least that was what I thought! I was rudely awakened from this when the senior technical expert seated on my right interrupted the conversation by placing his hand on my arm and asked, with the utmost sincerity, if it would help if he explained to me the detailed chemistry of the process!

Well, of course it wouldn't! For one thing, I wouldn't understand his explanation (my chemistry education having petered out well below PhD level) and, for another, we were supposed to be discussing plants and products, not molecules and atoms.

This little incident illustrates both the strength and the weakness of this endlessly fascinating and important industry. The mind boggles at the ability that some people have to grasp all of the detail between the extremes of massive, complex production plants at one level, and covalent bonding and atomic interactions at the other. Amazing! What's more this expertise isn't just limited to the technical functions: very often many of the most senior executives and managers throughout the company will also be highly qualified chemists, even though their day jobs may rely little on these qualifications. But, there's only so much expertise that the human mind can master. Sometimes I wonder if part of the trouble with the chemical industry is that it has within it too many people who know so much about the technical minutiae that it becomes difficult for them to see the wood for the trees. Not that I would ever dream of telling them that, you understand!

Before I explain exactly what I mean by that provocative statement, let's reflect a little on the nature of the industry. For a start, it's big. We're talking over €1,500bn of annual sales, with serious players in Asia, Europe, the USA and LATAM. It's complex, capital intensive, increasingly regulated and, in many cases, subject to the vagaries of the global economic cycle. It's also a little unfit. That is to say, if there was a competition to find the leanest, nimblest, most adaptive and responsive industry on the planet, the chemical industry would probably not win. Actually, it might find itself coming a long way down the field, puffing and panting behind a host of far healthier performers.



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# Industrial Alchemy for Chemists

How is that, especially given the above-average IQ of so many of its employees? Great chemical processes, but not such great business processes; it has too much inventory for one thing. Its plants are not always reliable, or clean, or well-maintained. It also has a rather old-fashioned attitude to quality. In many ways it looks just like the automotive industry used to look before Toyota decided that there might just be a better way to make cars. Not that the chemical industry has shown itself to be particularly adept at copying ideas from the car industry. We are talking about subtle chemistry remember, not snap-together mechanical cars!

But you know, it's not all that long ago that you could walk around a car plant and see poor standards of housekeeping, or find that the line was stopped because of a breakdown or a shortage, in spite of the ugly piles of inventory. If you wandered into the purchasing department you would overhear buyers agreeing Acceptable Quality Levels (AQLs) with their suppliers. This meant that if a supplier had an AQL of 98% on a part they would actually be allowed to supply two in every one hundred out of specification. Imagine that! Those days are long gone and, nowadays world-class automotive plants purr with elegant efficiency; the lines don't break down; the workplace is spotless and beautifully ordered; and the suppliers, naturally, provide exactly what's required, at exactly the right moment, to exactly the right quality.

There are some chemical plants that fit this description too, but perhaps not many. For those that don't, the floor is covered in powder because, well, they make powder. You couldn't expect anything else, could you? Of course there is some downtime because chemical plants are complex beasts, are they not? As for quality, well of course you have to blend the product because it just isn't possible to make it right first time. From a high level, the acceptance that blending is an unavoidable part of a process looks suspiciously like AQL thinking: people know it's not ideal, but they just can't get away from using it. And as for supplier quality, there is often a very lenient attitude that accepts that the quality of raw material will be variable and that the receiving plant will have to use its own process expertise to compensate for the supplier's inability to provide consistent products to exacting standards.

Well, maybe it is time to stop being quite so smart and to take a few short cuts. Why not keep the really clever thinking for the fundamental chemistry and the product and plant design, but copy some of the more straightforward ideas from other industries who have had to learn the hard way? Here are a few that could make a real difference:

- **Total Productive Maintenance:** The application of smart techniques that ensure the plant is always available when needed, runs at the necessary rate, produces the right level of quality and is flexible enough to meet changing customer requirements at minimum cost. In one chronically performing agrochemical plant WCI worked with the client to embed TPM and as a consequence doubled output in three years and transformed the operation into an award-winning site.



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# Industrial Alchemy for Chemists

- **Six Sigma:** If ever there was a methodology designed for the chemical sector it is this one! With its emphasis on statistics, experiments, structure and control six sigma methodologies offer process engineers the chance to become the organisational heroes they have hitherto only dreamt about. If you have a manufacturing process step that is not behaving as it should, get a Master Black Belt in there as soon as possible and get it fixed!
- **Supply Chain Planning:** How about being able to set inventory levels scientifically to optimise cost with pre-determined levels of customer service? Sounds appealing? Thought so. You need some real expertise here though, which may not involve a chemistry doctorate, in order to get it right. This represents a quick way to seriously damage the business if you don't know what you're doing (the ubiquitous Kanban may not be the answer to everything after all) but it is possible to use some clever thinking to select replenishment techniques that will reduce inventory and boost customer service. WCI has extensive experience here and has seen inventory levels reduced by 20% or more while simultaneously pushing service levels above 95%.
- **Visual Management and 5S:** Live and work in order, not chaos, and watch quality, productivity and morale increase as a result.
- **Lean processes:** A principle-based approach to process re-design will see waste eliminated not just from production and technology processes but from those outside the manufacturing arena as well. Get cash in more quickly; reduce the time to develop new products; wait less time for capital approvals. It's well-proven in other sectors, it will work here too.
- **Change Management:** Of course everybody wants to go on improving but do you have the processes established to ensure that you are doing it quickly enough? Are visual controls in place? Are process measures defined, visually displayed and always up to date? Are people empowered to eliminate waste from their own processes, become multi-skilled and squeeze every last drop from the assets at their disposal? And when an improvement project does deliver benefits are they maintained or do they gradually seep away?

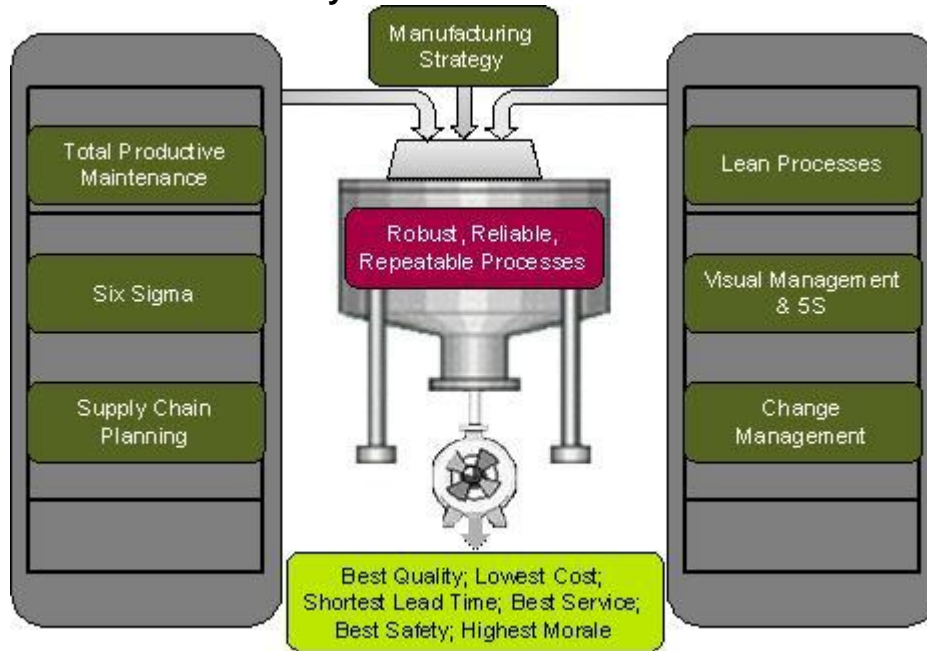
Naturally, world class manufacturers didn't become excellent overnight. What is required to transform the chemical industry is a lot of hard work, plus some kind of system. Figure 1, overleaf, shows a generic chemical production system that contains the elements needed to drive just such a transformation. It's a little bit more than simply a production system because some of the techniques can be applied across the organisation, but let's keep the language simple for now.



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# Industrial Alchemy for Chemists

**Figure 1: Chemical Production System**



In addition to the elements already described a key input to the system will be the overall manufacturing strategy. This will align with the business strategy and will determine, among other things, how to match manufacturing capacity to demand through improvement, investment, consolidation, outsourcing or disposal; where to locate production facilities; which technologies will be deployed; what service offerings will be provided; and what design of organisation will be required.

WCI has a lot of experience in this area, so that should make the copying and customising of good ideas even easier! We have implemented all of the elements of the system in the chemical industry and elsewhere. We have developed and implemented entire production systems in the most challenging of environments.

Maybe the chemical industry can borrow some useful ideas from other sectors after all. Clever people and smart processes simply have to be a winning combination, don't they?

You'll be pleased to hear that the outcome of my meeting with the intimidating doctors was successful. We chose a pilot project and unleashed onto it a Master Black Belt with plenty of six sigma experience but no previous detailed knowledge of the process. After the judicious application of the appropriate techniques and twenty days of consulting effort the process was in control, capacity had been increased and within twelve months a twenty-fold return on the consulting investment had been achieved.



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Needless to say, the organisation was convinced of the benefits of learning from elsewhere and soon after, with senior executive sponsorship, launched a widespread Lean Sigma programme to develop its own internal expertise as quickly as possible.

Makes you think, doesn't it?

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