

## **Flexible Manufacturing Methodologies Deliver Value throughout the Product Life-Cycle**

Traditionally, the manufacture of drug delivery and medical devices has been associated with highly sophisticated manufacturing systems and production environments that are in some way dedicated to a single device or kits of components. This view has been reinforced as devices have become more complex and require multi-component moulding and complex automated or manual assembly. Based on this view, it would be easy to surmise that efficient, automated manufacture can only *really* be achieved at higher output volumes where 'economies of scale' come to the fore and the cost of capital equipment and overhead costs are apportioned across many million devices.

This model is however increasingly being challenged as pharmaceutical, healthcare and device development companies look for experienced device manufacturers who can partner at any stage of the development cycle and who can actively add value at all stages in the product lifecycle. From device design through to creative manufacturing solutions that provide dynamic links with the clients supply chain. The variety of device designs is increasing too and whilst some remain complicated, others have become simpler and work in combination with sophisticated formulations yet may require bespoke elements, such as specialised coatings, novel elastomers or electronics embedded into the manufacturing process.

There is therefore an increasingly compelling argument for device manufacturers to adopt a more flexible approach to manufacturing. They should offer a range of production facilities that possess the same regulated framework as their high-volume counterparts, but that will operate efficiently at lower volumes or when producing less complex products. Flexible manufacturing cells enable manufacturers to deliver the value added services that have historically been the time consuming and expensive outputs from a manufacturing environment designed solely for other purposes. The client company are well aware of the commercial fragility associated with a new product during the earlier stages of development and a manufacturer that is able to appreciate the delicacy of this phase and propose flexible solutions that help belie such concerns offers a clear advantage.

## **Setting the Commercial Framework**

In selecting a device development partner it is perhaps the culture and experience or “the brand” associated with a manufacturer that first attracts. An organisation’s pedigree can almost guarantee it is always included on the list of potential suppliers but it may preclude it from being eventually selected if the manufacturer offers a limited number of manufacturing options and a skill-set that’s natural habitat is toward the high-volume and the complex.

A flexible manufacturer is one that can offer rapid turnaround on small numbers of devices for pre-clinical trials, or the scope and experience to quickly scale-up manufacturing as a second source supplier for an established product. There are economic arguments for both, as developers with a product at an early stage of its life-cycle will want low start-up costs, knowledgeable partners who have delivered devices from this stage before and appropriate manufacturing facilities that won’t require them to make large and possibly unnecessary capital investment or attract high overhead costs. On the other hand, a client company with an established product would perhaps look to invest more capital at an early stage in order to reap the benefits of the most effective manufacturing solutions from day one and therefore exploit sales opportunities before their product reaches maturity in the marketplace.

A developer should be able to take it for granted that the manufacturer is not only capable of operating within the appropriate regulatory framework, but that they are also well practised in this important element of device development. The appropriate selection of manufacturing solutions includes for certain standards of hygiene, quality and cleanliness and these differ depending on the target market, the type of materials used and the use of the end product. Consideration should be given at this stage as to whether the manufacturer could manage the regulatory burden required at later stages, for example during a US launch. As importantly, manufacturers should consider, and be able to communicate the benefits of the many manufacturing environments and layouts that could be considered and how these may impact on initial and subsequent regulatory approvals. Established manufacturers, such as Bepak, use a variety of environments from large hall cleanrooms to small controlled environments, even to the point of individual machines operating within controlled spaces and to controlled levels of cleanliness.

The early stages of the relationship between developer and manufacturer can therefore be characterised by the matching of commercial and technical needs to a range of solutions. It is at this stage that joint risk needs to be realistically evaluated and a supplier that has developed a structured way of evaluating risk can tangibly add value. The manufacturer should be able to offer a range of solutions for the current phase of

development and for all future phases, as events and milestones are reached or plans changed. This technical assessment will suggest whether product-specific or non-product-specific manufacturing cells are the more appropriate. A manufacturer that is dedicated to the healthcare sector, who is of sufficient scale, and who has a broad product portfolio should be able to mix and match projects and therefore maximise utilisation of its plant to minimise cost, yet be sufficiently responsive to commission new buildings and equipment quickly as required.

A manufacturer who can demonstrate competence at each phase of the product life-cycle would offer the ideal partner for most developers but it is equally important for a client company to consider how open the manufacturer is. Are they prepared to hand-over manufacturing to a second supplier once the product is developed? Can they provide Rapid Prototyping alone? Can they guarantee supply to the market by becoming a second source themselves? These examples give a flavour of the demands one can put upon a flexible manufacturer. Flexibility within a company is one thing, but the ability and maturity to step into or out of a relationship is an altogether different proposition. This offers the client company a sense of security in that it is then the obligation of the manufacturer to continually improve their processes, methods and service so that the customer remains 'delighted' and never feels the need to move.

## **Adding Value throughout the Life-Cycle**

### **Rapid Prototyping**

Fit for purpose prototypes can be created much more efficiently by using the appropriate tools. There is little value in using high volume, high speed equipment when what is actually required is small scale moulding and intuitive assembly that can be easily tweaked, calibrated and shaped as necessary. When a device is at an early stage of development, concepts will require a number of iterations, perhaps in response to focus group research or early clinical trial feedback, before the final design is agreed. Small scale, flexible equipment capable of producing only a handful of components is not only more easily customised, but is substantially more cost effective to run at a time in the devices life where development costs need to be controlled.

### **Design for Manufacture**

There have been notable cases where no amount of planning could have predicted just how successful a product would become once launched. In order to capitalise on this success production levels may have to increase substantially in a relatively short period of time. The importance of considering such factors at an early stage in development is not always obvious but manufacturers who have developed very successful products have celebrated the preparatory work at the Design for Manufacture stage for small savings in material costs or the ease of assembly will multiply many-fold.

In scaling-up rapidly, the transition required to deliver the necessary production levels while maintaining quality standards can be both complex and risky. Through a flexible manufacturing approach and careful planning, it is possible to introduce new facilities alongside the existing ones and thus maintain product volumes whilst obtaining the necessary validations of new equipment and facilities. Manufacturers who possess some 'stretch' in their facilities and people can scale-up more efficiently as they can accommodate temporary cleanroom space and add numbers of multi-skilled operators while permanent production lines are enhanced.

As the product reaches maturity and moves toward the end of its life, this scalability again becomes important. As production volumes start to decline an intelligent manufacturer would, in conjunction with the client company, allow for the introduction of different scheduling methods and perhaps switch from full-time manufacture to campaign manufacture. They would also assess whether it is economical to introduce equipment designed to operate efficiently at lower volumes rather than allow the continual turn-down of the potentially expensive high-volume equipment and environments used at peak production volumes.

### **Continued Communication**

From what has been said it is clear there is a need for dynamic management of a products future if the client company are to see the benefits from a flexible manufacturer. This requires the manufacturer to provide an open management approach and a framework for the governance of the product programme.

Bespak have created their own proprietary planning tool – the Bespak Product Introduction Process (BPIP) to guide and control product through the manufacturing process from concept creation to industrialisation, manufacture and on throughout life.

Based on the well established automotive principles of Advanced Product Quality Planning (APQP), the principles of BPIP enable a consistent, repeatable and pragmatic approach to new product introduction. BPIP provides for open, fact based planning with developer and manufacturer working alongside each other to govern the programme at strategic and tactical levels. Replacing reactionary decision making, BPIP leads to the most appropriate utilisation of the available facilities. This methodology has really created a platform for continuous improvement throughout the lifecycle of the product, touching every aspect of the process from consistently improving the supply chain to continually

reducing waste, from yielding higher quality standards to a lower cost of manufacture over time. Coupled with the flexible manufacturing approaches already discussed, BPIP has delivered effective, measurable and repeatable processes for every aspect of device development and has allowed the company and its employees to collectively and individually learn from their experience and embed this learning back into the organisation

to benefit future projects. Most importantly of all, it enables an approach which can be tailored to the needs of individual projects and upon which, risk can be assessed and actioned appropriately.

### **Mitigation of Risk**

Much of medical device development should be subject to formal risk assessment and mitigation. Identify and manage the risk effectively and the time taken to develop the device becomes substantially more predictable and development time is often reduced. Diagnose the risk badly or fail to take the necessary steps to resolve a project risk and there is potential to impact the critical path of the project resulting in more cost, delayed launch and a measurable loss of sales. A flexible manufacturer can provide assurance against a number of the most common risks.

Individual flexible cells can be used within the manufacturers own premises as a 'second source' of manufacture for critical components, ensuring that the supply line is maintained. Often, the skills and technology within the facility can be modified to build components which have been historically sourced from outside, ensuring a greater level of control and less risk over more of the device componentry. These cells provide a contingency, which gives both partners peace of mind in the event of a failure in some other part of the manufacturing process.

### **Conclusions**

Responsible, modern medical device manufacturers have a duty to ensure they offer their partners the best possible service. Culturally, this requires them to adopt an attitude of continual improvement to the methods, processes and project management outlook so that products are always manufactured in the most efficient, effective and value driven ways available.

Continuous improvement inevitably creates capacity which organisations such as Bepak have identified and embraced. By managing their capacity effectively, manufacturers are able to provide a flexibility of approach and a certainty of output their partners cherish. By embedding learning into their organisation they are also able to deliver the value added services that have traditionally been placed on the shoulders of the pharmaceutical or healthcare company to provide.

Above all else, a governance and risk management structure such as BPIP, coupled with flexible manufacturing delivers customers what they need in the most timely, appropriate and cost effective way possible.