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WHITEPAPER

How to build a robust packaging strategy for rapid commercialization

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Abstract

When initial clinical trial results for a new drug show promise, the focus begins to shift to commercialization and planning for a pharmaceutical packaging strategy. A robust strategy is essential for success and consideration must be given to all packaging design and development requirements, including the most cost-effective options for packaging regardless of annual product volumes. This whitepaper looks at the elements involved in building a robust packaging strategy and the key technical considerations in packaging design and operational planning for products of various sizes.

Getting started

Introducing a product into the market can be daunting. There's often uncertainty about when to begin developing a packaging strategy, what partners are available and what options must be considered as part of launch planning. Putting a plan together often begins with technical considerations such as stability and shipping studies, serialization, and packaging design (see Figure 1). Strategic decisions then follow including areas such as supply chain continuity, distribution plans, and launch readiness. Finally, considering the impacts of delays on profitability and product viability also comes into play as well.

Packaging in the development lifecycle

Packaging is integral to the drug development lifecycle, from filing an Investigational New Drug (IND) to product launch—and it must be considered from the outset. The US Food and Drug Administration (FDA) and other regulatory agencies mandate that producers have enough information about packaging materials to ensure a container closure system will protect the product. According to the FDA, a "container closure system refers to the sum of packaging components that together contain and protect the dosage form. This includes primary packaging components and secondary packaging components, if the latter are intended to provide additional protection to the drug product"[1]. The container must be suitable for its intended use, provide the necessary protection, be compatible with the product being contained, and enable it to be transported and perform properly.

Packaging selection must take into consideration all the risks to which the product might be exposed. While risks will vary depending on the dosage form and the route of administration, they may include factors such as light exposure, solvent loss, sterility maintenance, the effects of water vapor, reactive gases and oxygen, and even interactions between the container closure system and the product itself. Not only should the primary packaging be considered, but also the overall packaging system and the role of secondary packaging in product protection.

Packaging stability studies

It is critical to packaging planning to test the commercial container closure system that protects the product. When undertaking stability studies, it is important to use the container that is planned for commercial production. Studies are usually set up according to the International Council for Harmonization of Technical Requirements for Pharmaceuticals for Human Use (ICH) guidelines. These guidelines outline the testing frequency, storage conditions, temperature, and humidity that must be maintained to conduct studies examining long-term, intermediate, and accelerated storage conditions. Testing may require examination of both the drug substance and the drug product, and typically spans three different batches. It involves physical, chemical, and possibly biological and microbiological testing, with the goal of fully understanding the degradation pathways of the product and the associated risks. This data underpins shelf-life justification and defines proper storage conditions.

The road to success begins with a plan…

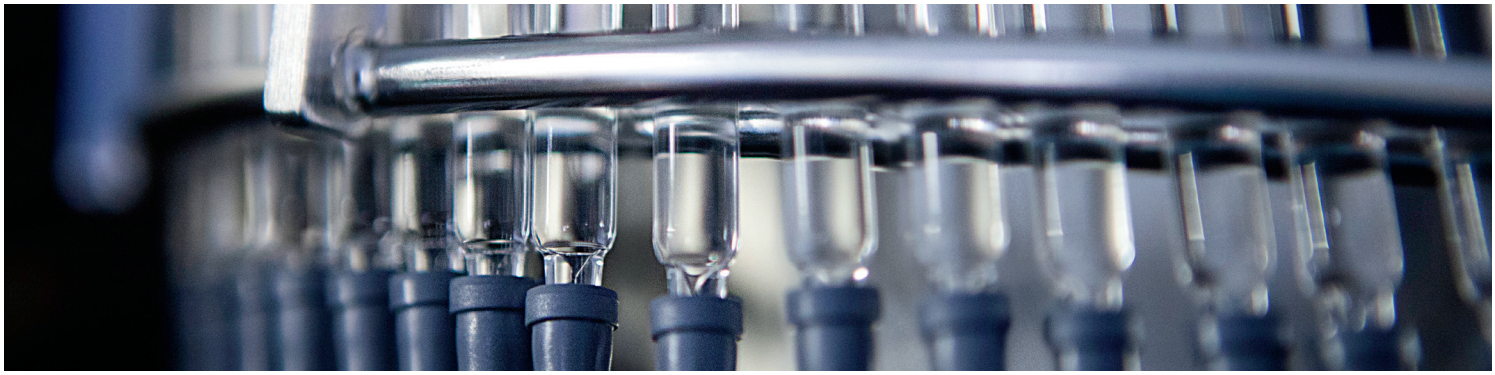
Technical considerations

- Packaging design considerations
- Packaging stability studies
- Shipping studies
- Serialization
- Artwork creation and development
- Packaging line trials/validation

Strategic decisions

- Supply chain continuity
- Distribution plans
- Launch readiness

Figure 1



Stability studies are often numerous and complex but are essential to developing packaging plans. Consequently, many organizations now many organizations seek help from external partners to external partners who have the capabilities to package, place packages on stability studies, and test the product.

Packaging design considerations

Another area for consideration is the development of packaging components, which includes primary and secondary packaging, as well as the technical specifications for the various elements. Technical specifications must include details such as:

- Materials of construction—ex. the type of resin for bottles or the colorants used.
- Physical construction—ex. the overall thickness of the bottle or the different layers of a blister material.
- Supply and shipment information—ex. the way the material is supplied to the packaging vendor and how it is sealed and cleaned.
- Compliance with individual requirements—ex. subjecting the material to light resistance tests or extraction or toxicological studies.

Given how many elements must be considered when putting together product plans, working with specialist contract packaging organizations that have standard components may offer cost-efficient and convenient options for some of these selections.

Shipping studies

Protecting the product during the entire transportation cycle, which might include truck, ocean, and air shipment segments, is critical. Shipping studies tend to use standard practices, such as those prescribed by ASTM, and have evolved to reflect all the transportation likely to be encountered. Standard testing will simulate loading and unloading, stacking and compression, truck transport, low pressure—high altitude, vibration, and physical impact. It can be varied to better reflect the kind of journey a product is likely to make and the specific requirements for each product. It is also important to look at both the container and the contents as testing progresses to ensure both are fully evaluated and the results are successful in all cases. External laboratories and packaging contract manufacturing organizations can often provide useful sources of support in coordinating and performing this type of testing.

Finding out what a product's shipping conditions are is essential—from the packing and palletization to the choice of shipper, and through all the transportation methods used. For example, if boxes of vials were dropped in transport causing damage to the product, there would be a wider quality issue. Apart from the visible damage to broken vials, it would not be possible to know if there were hairline fractures to others, and if sterility might be compromised. Failures have both financial and supply implications, and potentially risk leaving patients without medication.

The key is to ensure that all the work is done upfront to test and validate the packaging format and make sure that all the packaging and the product can withstand the worst possible conditions. Done correctly, this gives confidence that the product can be shipped and will arrive intact and safe every time.

Artwork creation and development

Another important topic for early consideration is creating and developing the packaging artwork. The regulatory details of label content, format, naming, and serialization [2] requirements are all critical. The packaging artwork lifecycle can be a complicated area involving various stakeholders. Marketing, operational, and regulatory requirements must all be considered.

As marketing teams develop brand information and generate logos and branding, it is essential to ensure that enough time is allowed for integrating their work into other aspects of the process. Operational aspects to consider include the settings and capabilities of packaging equipment and the time required to carry out feasibility checks for printing and insert/outsert handling. As the complexity of the artwork and printing processes increases with the growing need for serialization and the expansion of information that must be shared, it is important that the product can run easily on the line with the artwork that has been created. Different components of the packaging must work together so that, whether production is internal or through a packaging vendor, everything runs well to create the overall finished package. Again, specialized help is available in these areas.

Considering serialization

Legislation changes in recent years are making serialization, which protects products from counterfeiting, a regulatory issue across the world. European Union (EU) regulations took effect in February 2019, while in the US compliance deadlines extend into late 2023[3],

Currently, standards for managing serialization vary in different countries with no moves at present toward harmonization. Serialization must be part of developing a packaging plan and many questions must be worked through, especially in terms of where the product will be marketed. Thus, it pays to begin early, whether working in house or with external consultants.

Whether or not a consultant is involved, there will almost certainly be a relationship with an electronic product code information supplier (EPCIS) that can help with the generation and management of serial numbers. Management includes supplying numbers to the packaging lines, either in house or at a CMO, and then managing them through the distribution chain. As industry connectivity grows, this task will become increasingly complex, with IT requirements and master data management all having to be worked through in readiness for packaging. Having the right support to provide the necessary critical expertise is vital.

Management of batch initiation, execution, and batch accountability are all critical to carrying serial numbers through the supply chain.

Serialization requires early and careful planning. The complexity surrounding it can be surprising and has the potential to derail timelines. Many organizations do not have the necessary capabilities in house and will need to seek external expertise. In addition to having all the validation considerations associated with onboarding a traditional piece of equipment, serialization brings additional challenges. Much of the work happens in the cloud: information exchange, connectors to various pieces of local and remote equipment, the engagement of servers and troubleshooting, and the generation of huge amounts of data that must be retained[4]. Even those who choose to onboard their own serialization process will need a strong IT partner. Management of batch initiation, execution, and batch accountability are all critical to carrying serial numbers through the supply chain. A dedicated serialization engineer can help support these needs.

Packaging line trials and validation

Packaging line trials should be part of packaging plans and will help avoid any deviations when approaching validation itself. Trials, which should be conducted on the line that is intended to run the product, involve running the product, the container closure, and any secondary components through a setup and into normal operation. Effectively, this trial stress test, tests the operation to confirm everything is working properly in time for the validation stage. Packaging line trials can help ensure all setup and critical run parameters are understood and that the product can be made continuously. They also help confirm correct transfer and backup of serialization data.

Investing time and resources into these types of trials will pay dividends in the long run and has ancillary benefits as well. Most notably, packaging line trials provide an opportunity to familiarize operators and mechanics with the whole process to be ready for validation.

Packaging validation is intended to verify that overall performance will meet the requirements for routine system operation. During the planning stage, it pays to consider the different formats of product that will be required. The more formats, the greater the complexity and more challenging it is to manage testing requirements. Matrixing approaches, for example, may provide a frame-work around testing and simplify operations.

Supply chain continuity

Packaging is an integral part of the supply chain and includes several important considerations. Among these are issues of whether packaging is completed in-house or by specialist packaging contractors, and whether packaging should be co-located with product manufacturing or at a separate facility. Whatever the decision, continuity between manufacturing, packaging, and distribution vendors is critical.

The multiple steps in a supply chain include bulk manufacturing, shipping to the packaging site, transportation to a distribution center, order fulfillment, and delivery. Whether this is an in-house operation, a third party, or a mix of both, there are several considerations including redundancy planning for business continuity. Redundancy options include having multiple locations within the same vendor or qualifying multiple vendors. There is considerable value in identifying partners capable of bringing both multi-site redundancy and continuity within their organizations.

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Planning for unusual events, as COVID-19 disruptions to global supply chains has demonstrated[5], is critically important. Everything from political actions to adverse weather events can have an impact on production and logistics. These types of circumstances call for planning the worst-case scenario. Organizations must be ready to capitalize on a product's success or a competitor's misfortune. Being ready to ramp up production can make a big difference, and redundancy planning allows for some of those possibilities as well.

Distribution plans

Distribution plans include warehousing, order fulfillment, and transport services, which may include the expertise of external partners. Cold chain and controlled substance management can add complexity to the planning efforts. The complexities of the import/export regulations must be also be considered. Third-party logistics companies can be helpful in managing these challenges and the right partner will give you the confidence that they have considered and understood all aspects of the product and requirements associated with it.

Launch readiness

In achieving launch readiness, time truly matters. In developing the plan, all the revenue and market demand is based on delivery and a launch date. Delays mean loss of sales, as illustrated in Figure 2, which also shows several launch readiness risk factors. In competitive situations, getting product into the market quickly is essential. Component availability can be a limiting factor here, as can generating labels and other printed materials ahead of regulatory approval. Printing of components can be set up and ready to go, provided there is a good relationship with all the external partners involved, and this gives an option for streamlining launch readiness.

Plan, partner, and prepare

As discussed above, packaging is an essential component of commercial planning (see Figure 3) and this key function must be considered both early and often during product development and into commercialization. Getting the right packaging to safeguard product stability is critical throughout the product life cycle, as is making certain that regulatory requirements are met, and marketing needs are fulfilled. Effective, timely planning and implementation are necessary to bring all these elements together for a successful launch.

Careful selection of support needs and suitable partners can make a significant difference to the outcome. Specialists in areas such as artwork and design, production, serialization, and distribution can add great value and expertise, as well as help streamline the whole process. Their contribution to the development of a launch plan can help ensure launch readiness, support supply chain continuity, and provide a range of distribution options.

Launch readiness

Launch readiness factors:

- Artwork regulatory approval timing
- Printed material production at risk
- Validation execution at risk
- Printed material delivery planning
- In-house printed material

Plans should consider:

- Actual sales may under or over perform marketing estimates
- Can your vendor partners respond to upside volumes of 2x or 3x current plans?

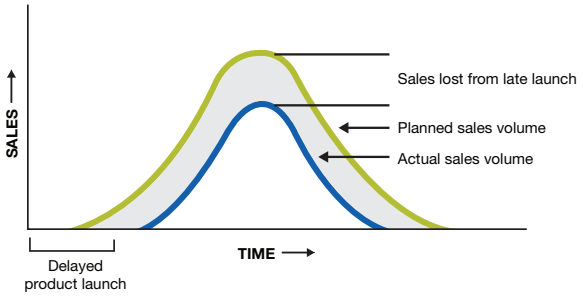

Figure 2

Conclusion: Packaging planning is an integral part of your commercial plans

PLAN

Consider packaging early and often

- Stability
- Design development
- Shipping

PARTNER

Select your support needs carefully

- Artwork and design
- Production
- Serialization
- Distribution

PREPARE

Develop a successful launch plan

- Launch readiness
- Supply chain continuity
- Distribution options

Figure 3

Conclusion

Packaging planning is an integral part of commercial planning and multiple elements must be considered when developing a packaging plan for commercial launch of a pharmaceutical product. Key technical considerations include packaging design, packaging stability studies, shipping studies, serialization issues, artwork creation and development, packaging line trials, and validation. Strategic decisions must also be made regarding supply chain continuity, distribution plans, and launch readiness. The key to success is to consider packaging at every stage, to partner effectively by carefully selecting support needs, and to prepare thoroughly in the development of a successful launch plan.

Do your clinical results look promising? If so, are you ready for launch? Learn more here.

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About us

Thermo Fisher Scientific provides industry-leading pharma services solutions for drug development, clinical trial logistics and commercial manufacturing to customers through our Patheon brand. With more than 55 locations around the world, the company can provide integrated, end-to-end capabilities across all phases of development, including API, biologics, viral vector services, formulation, clinical trials solutions, logistics services and commercial manufacturing. We give all sizes of pharma and biotech companies instant access to a fully integrated global network of facilities across North America, Europe, Asia and Australia. Our global leadership is built on a reputation for scientific and technical excellence. This includes specialized capabilities for highly potent and controlled substances, viral vector expertise, aseptic filling and lyophilization, complex formulations, solubility enhancement and difficult-to-manufacture APIs. We also offer integrated services for drug development that aligns development of drug substance and drug product in a coordinated drive toward proof of concept that can reduce development timelines. We have more than 17,000 scientific and professional staff and over 40 years of experience. As a leading global CDMO, we deliver unrivaled quality, reliability and compliance. Together with our clients, we're rapidly turning pharmaceutical possibilities into realities.

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With more than 25 years of experience in the pharmaceutical industry, Chris Howell currently serves as Packaging Engineering Director for Thermo Fisher Scientific. He provides leadership and support to a global network of commercial packaging sites in North America and Europe. He also acts as Thermo Fisher Scientific's Global Serialization Program Manager.

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Published 03/21

ThermoFisher SCIENTIFIC