Technology transfer
– meet expectations and ensure product compatibility

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Obtain technology transfer success through an integrated approach
Rapidly deployment of biomanufacturing capacity as a strategic asset

To keep up with the fast-paced growth in the biopharma industry, manufacturers have to be able to rapidly establish biomanufacturing capacity. Transfer of technology is a key discipline in establishing the required capacity.

Ensuring GMP compliance when entering new markets

Entering into new markets requires transfer of technology and systems – and sometimes it requires implementation of new processes to meet the specifics of local regulations. We can help you reduce the risk to your investment with our extensive knowledge of local GMP regulations.

In tune with technology transfer of biopharmaceutical products

In the attempt to continuously discover other new biologies as well as next generation biologics, the industry is developing new product candidates at an accelerated rate. FDA approved 41 novel drugs and biologics in 2014, which is the largest number in 18 years and a 52% increase from the 27 approved in 2013. Ten of the 41 approvals were for biologies representing a five-fold increase from 2013.

In addition to the increasing number of new biologics approval, FDA just recently approved the first follow-on (biosimilar) product in the US. With legislation for biosimilars recently in place in US, it is likely that others will follow soon. Biosimilar or osimilars recently in place in US, it is likely that others will follow soon. Biosimilar or "near-identical" biologic products have already been available for years in Europe in numerous emerging markets. Furthermore, biosimilar versions of major blockbuster products will likely become available in different markets in the near future due to patent expiry. Demographic and local market forces in emerging markets such as the public-private partnership models drive the business of promoting access to biologics. This places emerging markets in a position to be leading the way in the innovation of flexible, multipurpose and cost-effective biopharmaceutical manufacturing. The technology required for local manufacturing is often going to be sourced from established technology providers that already have ongoing programmes for biosimilar products. Ensuring successful technology transfer from these technology partners is crucial for a fast establishment of local biopharmaceutical manufacturing.

Biosimilar products are highly complex and the notion that "the product is the process and the process is the product" is widely acknowledged by the regulatory bodies. This underlines the importance of product and process knowledge and project execution to support successful technology transfer and market entry on time.

NNE was born and raised with the end goal in mind from the beginning. Key elements include the principles described in the ICH guidelines Q8, Q9, Q10 and Q11. These guidelines on QbD concepts, the underlining science- and risk-based principles and quality systems are cornerstones in defining quality target product profile (QTPP), critical quality attributes (CQAs), critical process parameters (CPPs), design space and, in particular, control strategy. These ICH guidelines are thus an integral part of the technology transfer guidelines issued by EMA and WHO as well as of the recent technical report from FDA on technology transfer.

The goal of technology transfer activities is to transfer product and process knowledge between development and manufacturing, and within or between manufacturing sites to achieve product realization. This knowledge forms the basis for the manufacturing process, control strategy, process validation approach and ongoing continual improvement (ICH Q10).

Technology Transfer Playbook - linking business needs with product understanding and process knowledge

A successful technology transfer has the end goal in mind from the beginning. Key elements include the principles described in the ICH guidelines Q8, Q9, Q10 and Q11. These guidelines on QbD concepts, the underlining science- and risk-based principles and quality systems are cornerstones in defining quality target product profile (QTPP), critical quality attributes (CQAs), critical process parameters (CPPs), design space and, in particular, control strategy. These ICH guidelines are thus an integral part of the technology transfer guidelines issued by EMA and WHO as well as of the recent technical report from FDA on technology transfer.

Risk analysis and management is the cornerstones of any science- and risk-based approach for technology transfer of biologics.

Risk analysis and management helps you:

- Focus on what is critical
- Achieve further knowledge of process/product
- Achieve a structured way to collect and evaluate performance of the CPPs and CQAs during product lifecycle
- Establish a common language and tools for cross-disciplinary thinking around the process
- NNE has developed the Risk Analysis and Mitigation Matrix (RAMM) to provide a pragmatic compromise where other risk tools such as preliminary hazard analysis (PHA) or failure mode effects and criticality analysis (FMECA) may be either too simple and lacking in detail, or they are too complicated, making it difficult to work consistently with limited resources.

One of the objectives in the development of RAMM has also been to align it with ICH and FDA guidelines (Q8, Q9, Q10 and Q11 series and process validation), especially around tracking CQAs and CPPs in a pragmatic manner. The RAMM:

- Neatly handles CQA and CPP parameters in one document and is easily aligned with latest guidelines
- Is fast, by presenting data in a matrix that overlaps CQAs against CPPs, it is relatively straightforward to set up and rank
- Has speed, but is also relatively detailed, allowing risk quantification or other risk flags to be identified in detail
- Gives excellent overview – an entire process can be printed on just one to two sheets, showing the overall process to be very easily explained in detail
- Is very easy to incorporate into a quality system, follow up on, and make documented changes with
The advantages of single-use technology are many, one of them is faster tech transfers: With no fixed installations, the latest and best process technologies can be introduced quickly. Other advantages include reduced investment cost, high flexibility, faster scalability and lower contamination risk.

Achieve flexible production with Bio on demand™

From 2011-2016 NNE designed 20 Bio on demand™ facilities for top players in the pharma industry. These projects show that the flexibility and open architecture philosophies provide a robust basis for meeting diverse demands in line with the trend towards smaller batch manufacturing.

Bio on demand™

Focus on technology transfer for early market supply

Compared with other biopharma products, mAbs are large proteins that require relatively high dosing and thus necessitate high-volume manufacturing facilities. NNE has developed Bio on demand™ which is based on a single-use technology and a flexible base concept that can be customised for local site conditions.

Impact of migration actions on total process and material risks: Mitigation actions change the risk flags from red to yellow or green.

Faster technology transfers with single-use technology

The business drivers

Emerging markets represents the major growth engine of the global pharmaceutical industry with a high unmet demand and very little local manufacturing.

One of the most important enablers – together with flexible manufacturing – for biopharmaceuticals is the ability to rapidly optimise facility installations based on product and process know-how. The ability to rapidly adapt to changes in market demand. So getting to market is easy to reconfigure and can thus be ready for a new product in a matter of days. Such flexibility reduces technology transfer timelines and accelerates the time it takes a product get to market.

A facility based on single-use technology is easy to reconfigure and can thus be ready for a new product in a matter of days. Such flexibility reduces technology transfer timelines and accelerates the time it takes a product get to market.

Emphasis on technology transfer

Attention should be given to enablers of technology transfer supporting fast and predictable establishment of the biomanufacturing process which can bring high quality biosimilar products to the market. Cost is probably one of the most important enablers – together with flexible manufacturing – for biomanufacturing pipelines consisting of several different products. For calculations of cost of goods manufactured, one of the most important enablers points in biologic manufacturing is capacity. Depending on the biomanufacturing mix, local manufacturing may only need an annual capacity of 100 kg or less. Hence, from a COSM perspective, the inflection point for using single-use technology versus traditional stainless steel positions single-use technology and its inherent flexibility as technology enabler. The economic advantage may favour a hybrid single-use/stainless steel solution or even a traditional stainless steel solution for high capacity requirements. COSM is also highly dependent on facility cost and capacity utilisation which may shift the inflection point for installed capacity to favour single-use technology at even higher capacities. Thus, these considerations are important factors in planning a technology transfer.

FLEXIBLE PRODUCTION

The flexible nature of the facility also allows you to integrate new technologies in the future to further increasing capacity.

TRANSPORTATION

The start of large-scale production= the end of small-scale production. For high-quality products, the scale-up time is often the most important step.

From the perspective of technology transfer, the most important inflection points in biologic manufacturing are capacity, cost and the ability to rapidly optimise facility installations based on product and process know-how.

Single-use technology is easy to reconfigure and can thus be ready for a new product in a matter of days. Such flexibility reduces technology transfer timelines and accelerates the time a product get to market.

Environmental impact studies show that single-use technology is up to 50 percent less energy intensive than stainless steel manufacturing, which may appear counterintuitive. Nevertheless, the emissions from disposing of plastics are more than offset by elimination of the cleaning and sterilisation processes required for reusable technology, basically because heating up many tons of water is extremely energy intensive. In reality, however, the important issue is not choosing between stainless steel and disposables, but rather how those technologies can be combined to provide the most productive and cost-effective process in a fast and predictable way to ensure a smooth technology transfer. Choosing one or the other technology concept, or a hybrid of the two, should be based on strategic considerations and feasibility studies of each individual case.

Today, new biopharma manufacturing facilities will likely be smaller and more flexible, efficient and cost-effective and capable of adapting quickly to changes in market demand.

New bio manufacturing facilities will likely be smaller and more flexible, efficient and cost-effective and capable of adapting quickly in line with market demand. So getting to market is not really about technology, but again about product and process know-how. In this respect, single-use technology is a significant enabler. The ability to rapidly establish local manufacturing capacity based on new market opportunities will become an important success criterion for companies in the future. By combining single-use technology with next-generation facility design, our Bio on demand™ concept gives you just that ability.

NNE has developed Bio on demand™ which is based on a single-use technology and a flexible base concept that can be customised for local site conditions.

Impact of migration actions on total process and material risks: Mitigation actions change the risk flags from red to yellow or green.
Ensuring access to the right technology and contract manufacturing

Finding the right technology provider or the right contract manufacturer is crucial – but represents a daunting task for most companies. Over the years we have built a vast network of suppliers and CMOs and can help you find the partners which fits your needs and meets your requirements the best.

PRODUCT – PROCESS – TECHNOLOGY TRANSFER PLAYBOOK

Beside the technical enablers and business drivers, efficient flow of communication plays a central role in all technology transfer activities. Not only between keyplayers from the sending and receiving sites but equally to other parties like regulatory bodies. When you talk to regulators from one country, do they speak the same language, cultural and business language as you or as regulators from other countries?

NNE have put great effort into improving and standardising our project execution across organisational and geographical borders and have developed Our Model and Our Wiki as common global tools to ensure good engineering practice to help raise the bar on quality in our projects.

We have used a similar Project execution approach based on Our Model and Our Wiki, developing a framework that can be used for structuring and manage technology transfers – we call it the technology transfer playbook.

The technology transfer playbook is based on NNE global experience and use of Our Model configured to match customer product and process specific needs. The technology transfer playbook include links to standards, templates and examples that will be provided by or/and developed together with customer/technology partner.

Our pharma consultants are with you all the way from project idea through project execution to ramp-up and beyond. Through focused pharma engineering we help you obtain and maintain an optimal production so you can always deliver on demand.

End-to-end support from consultants specialised in pharma

No. | Function | Description
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1 | Process Overview | Overview of tech transfer process
2 | Activity Map | Activity mapping of tech transfer
3 | Document Links | Links to standards, templates, examples and tools
4 | MS Excel Interface | Export of activity map to MS Excel
5 | MS Project Interface | Export of activity map to MS Project
6 | List of Documents | Generation of list of documents required
7 | Project Library | Creation of a project library
8 | Project Documents | Generation of initial project documents
9 | Document Progress | Monitoring completion of project documents

The Technology Transfer Playbook will generate project specific activities, documents and their relationship as exemplified.

Three phase development of the technology transfer playbook for a project specific execution plan:

1 (black arrows): A standard technology transfer model is established and maintained centrally referring to standards, guidelines, templates, examples and tools.
2 (red arrows): A project specific technology transfer program is created and adapted to project specific needs.
3 (green arrows): Project specific documents are created dynamically from either templates or examples from standard model (see table 1).
NNE is an international company specialised in pharma engineering. We help pharmaceutical companies bring products to market by providing flexible, compliant and future-proof solutions. We have close to 2,000 professionals delivering global knowledge and best practices, all dedicated to supporting our customers globally and on local sites.

Through focused pharma engineering we enable our customers to deliver on demand.