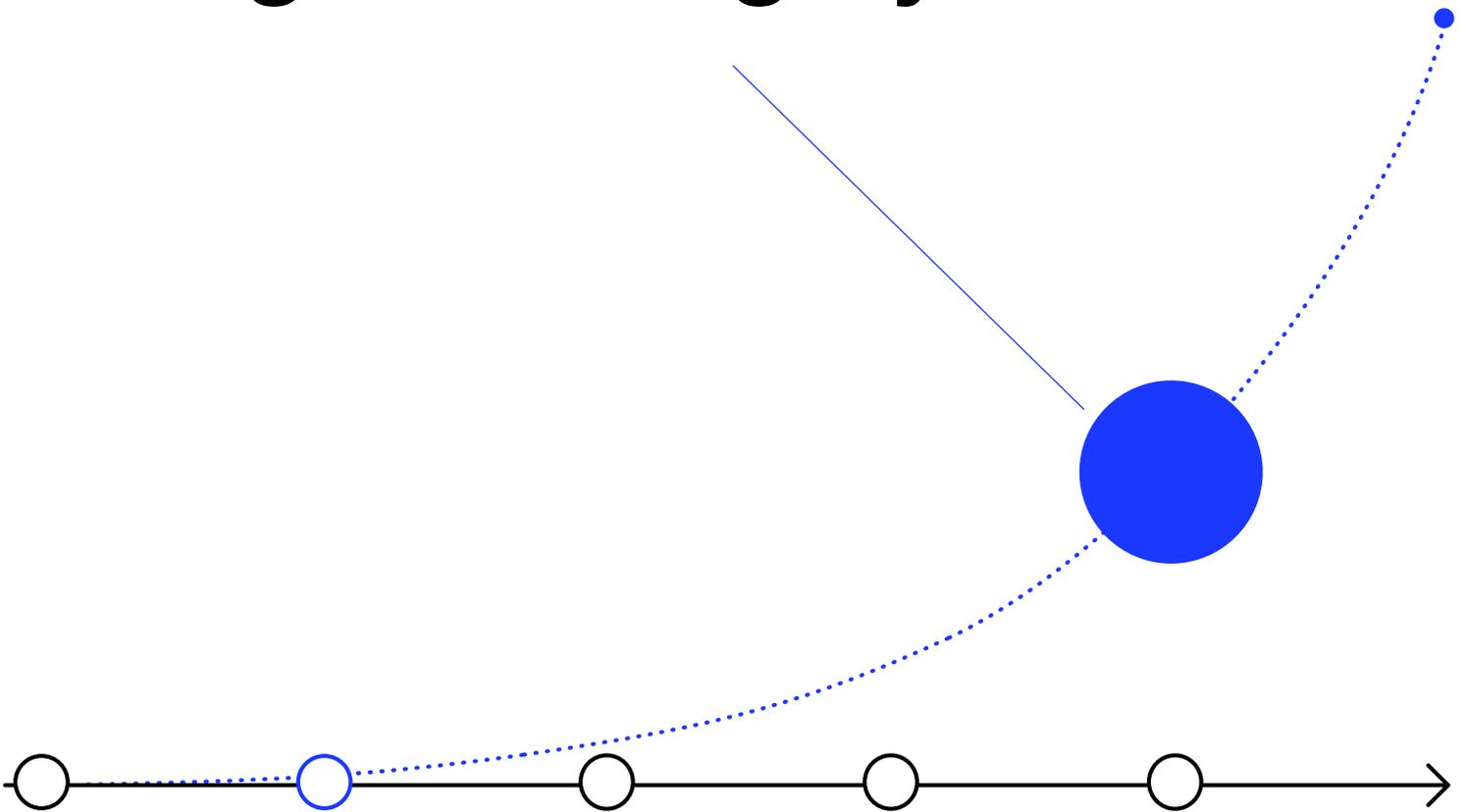


The NPI Mandate for High Tech Manufacturing: Transform with Intelligence & Agility



Executive Summary

Increased Complexity, Uncertainty, and Shorter Product Life Cycles are Just The Beginning

Complexity and uncertainty has found its way into every facet of the electronics industry. Globalization has led to immensely complex supply chains, while product development continues to feel the pressure of new designs, technological innovations, and shorter life cycles.

Combine this with shrinking margins and a decade's worth of over optimization in costs. Now, place this within an ecosystem of shortages and the ongoing COVID-19 pandemic, and you can perceive the full scope of challenges for manufacturers across the globe.

Based on the latest Dimensional Research report published in April 2020, over 53% of executive supply chain leaders in global manufacturing companies believe that their “product launches have been delayed or canceled.” Over 45% claim that their now distributed engineering and procurement teams are collaborating with intense focus on understanding impact on “cost, risk and timing for release to manufacturing.”¹

Excellence in managing New Product Introduction (NPI) processes is more important than ever. Data showcases a desperate need for more efficient systems and actionable insights that address the complexity of new product manufacturing and the global supply chain:

- **The average manufacturer invests 25% of its personnel in New Product Introduction (NPI) and introduces a new product in 24 months, on average.**
- **91% of companies still rely on spreadsheets and electronic documents to track Bill of Material (BOM) requirements and phase gate review checklists.**
- **Only 56% of new products meet all NPI success criteria.²**
- **92% of surveyed engineers and designers believe product complexity has doubled in the last five years.³**
- **Product life cycles have shrunk by 25% in the last fifteen years.⁴**

Given the essential role of NPI processes within a global manufacturing organization, it's critical that teams have access to relevant market intelligence, decision-support systems, and collaborative tools in order to meet the new challenges and uncertainty surrounding them.

1. Source: 2020 State of Electronics Sourcing: A Survey of Sourcing Decision Makers, April 2020.

2. Source: LNS Research. Modern Approach to New Product Introduction (NPI)

3. Source: Engineering.com

4. Source: Roland Berger. Mastering Product Complexity

Introduction: Increasing Supply Market Volatility Necessitates a Different Approach

In 2020, the world is facing a global pandemic that has added unforeseen challenges to global supply chains. Things were difficult before, and in the aftermath of this public health crisis, new complications are bound to reveal themselves.

In every season, your supply chain should be poised to mitigate risk. In recent years, global networks have been pummeled with shortages, the ongoing trade war, and now the COVID-19 pandemic. These obstacles are nothing new, but for many manufacturers, the concept of mitigating risk in the product design phase is a novel one.

In many cases, the approach is more reactive than proactive. While it's not possible to pinpoint when risks will emerge, or when delays will strike, it is possible to engage new real-time sources of insight that allow for timely responses to emerging risks, and the ability to develop strategies that minimize their impact.

From a top-down perspective, here are some considerations for managing risk:

- **Examine suppliers for risk. Consider their capabilities, potential hazards associated with specific manufacturing sites, and their impact lead times.**
- **Analyze design BOMs for part life cycles, EOL status, technical readiness, past performance, ramp-to-volume capacity, and compliance with key regulations.**
- **Gather market data and historical quote rates for any repeat components to better position the organization during initial NPI sourcing events or sustaining price negotiations with suppliers.**

Current risk mitigation strategies will inform parts of an NPI system, but ultimately there's a need to dig deeper and establish metrics within the supply chain that measure everything from cost to service, delivery performance, sourcing strategy, and manufacturing processes.

Rethinking A New Product's Journey

New product introductions begin with the inception of a design bill of materials (BOM). While many companies are focused on customer-driven innovation in product concepts (rightly so), this intelligent design approach should carry over to later phase gate reviews. From early BOM and part selection, through target costing, design-for-manufacturing, and go-to-market strategies.

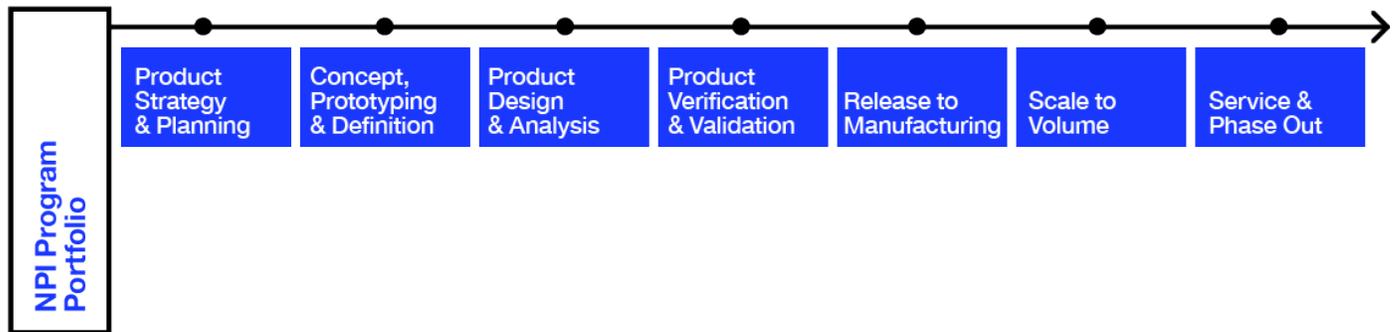
More than ever, it should also be a collaborative effort. Today's products cannot be created in isolation based on limited part component libraries and past supplier cost performance. An intelligent NPI process now requires the cross-functional support of teams throughout the organization. Everyone from manufacturing, to marketing, to packaging, sourcing, and even customer service play a critical role.

“It's not designed and sent over, that sounds like there's no interaction. The truth is, the process engineering and process development associated with our products require innovation in and of itself. Not only the product but the way that it's made, because we want to make things in the scale of hundreds of millions, and we want the quality level of zero defects. That's always what we strive for, and the way that you get there, particularly when you're pushing the envelope in the type of materials that you have, and the precision that your specifications are forcing, requires a kind of hand in glove partnership. You don't do it by throwing it over the chasm. It would never work. I can't imagine how that would be.”

- Tim Cook, CEO of Apple

Furthermore, this focus on internal collaboration requires constant tradeoff analysis, balancing competing goals from multiple internal stakeholders. It is easy to see why outdated tools and siloed structures would hamper the efficiency and innovation that the NPI process sorely needs.

Traditional NPI Program Phase Gate Review Process



Through your NPI process, one goal will persist: reducing risk across every step of the journey. An effective way of doing this is to utilize a phase-gate process, which aims to mitigate risk immediately and consistently as you move through each “gate.”

It also aims to do this with minimum possible expenses, and the lowest possible effort from administrative personnel. This is one such example of a typical phase gate structure:

- **Product Strategy and Planning** - Portfolio and NPI program managers review customer and market feedback, identify new product ideas and prioritize potential programs.
- **Concept, Prototyping, and Definition** - Engineering teams develop initial concept, functional design, technical specifications and move to early prototype development.
- **Product Design and Analysis** - A product definition, plan, and business case presented to management give them the scope to decide when funds should be released for continued development. Design deliverables and models can include 2D/3D models, concept level drawings, partially defined design BOMs and critical supplier selection.
- **Product Verification and Validation** - Extends the BOM analysis to review preferred and alternate suppliers, component part attributes, lifecycle risks, design for manufacturing requirements, and related supply availability. Deliverables include Design Failure Mode and Effects Analysis (DFMEA), Design Verification and Report (DVP&R), Preliminary Engineering Design Freeze, safety and regulatory audit reports, and BOM scoring or grading through each phase gate review. A broader cross-functional team is typically involved to consider manufacturing strategy, target cost analysis, market demand assumptions, and risk analysis for the design BOM.

Traditional NPI Program Phase Gate Review Process

- **Release to Manufacturing** - The program moves into manufacturing (internal or external partners) with confirmation of process, tooling requirements, yield, and quality objectives. In parallel, cross-functional teams often review and support product packaging (pricelist, marketing deliverables, technical content), production control plans, process capability studies/Statistical Process Control (SPC), process work instructions and final safety/regulatory review.
- **Scale to Volume** - NPI program teams may participate in monitoring both product design, NPI sourcing event responses, and constraints to achieving early target volume production goals, in collaboration with manufacturing and supply chain teams. Additional best practices taken by NPI teams includes a post-mortem assessment of what went well and what went wrong in the recent full NPI program cycle.
- **Service and Phase Out** - NPI program teams often will monitor sales performance, quality and market feedback as the product lifecycle matures and transitions to service and support.

This traditional NPI phase gate review process is only as good as the performance goals and external intelligence applied. Product and part/component analytics and market intelligence can act as the underlying foundation of the review process.

Leveraging data-driven insights in cross-functional tradeoff analysis and decision offers a powerful way to optimize NPI programs to achieve the key objectives of delivering with minimized total risk, on time, on quality, and on margin.

Transforming Traditional NPI Processes

Today's NPI processes suffer from a number of obstacles that can be mitigated or eliminated with a more intelligent, agile, and data-driven approach. Consider these common issues:

- **Managing and sharing the most accurate versions of design BOMs across multiple stakeholders within the organization.**
- **Assumptions on product cost, supplier preference, sources of manufacturing, and component risk based on obsolete information.**
- **Facilitating phase gate review activities with small, cross-functional teams that have limited visibility and data intelligence across global commodity management, sourcing, and supply partners.**
- **Limited predictive insights on lifecycle cost and risk drivers, post product launch.**

These obstacles are symptoms of a larger issue tied to systems and sources of insights used to support these NPI programs. Some leading high tech, medical device, and industrial equipment manufacturers are already driving transformation and innovation based on new forms of intelligence and cross-functional decision making.

“It’s not all that uncommon to see supply chain issues stop production lines. Sometimes it’s a part that has gone end-of-life, other times it is just poor quality from a supplier, but a lot of issues that we run into could have been mitigated if the right people had been involved earlier in the design stage.”

- Ross Valentine, Jabil Senior Director of Product Line Management

Many of these obstacles, and the concurrent issues surrounding them, boil down to a lack of visibility and collaboration across the various silos and departments of manufacturers. To better understand the goals of a digital transformation within the current NPI process, let’s look at each focus point in greater depth, and pinpoint potential solutions for each step of a product’s journey.

1: Intelligent BOM Analysis

The bill of materials lies at the heart of any product design, but despite this importance it's often a static document. Without any kind of digital connection, it becomes outdated and unreliable almost immediately. Even worse, it often mutates into multiple shared versions and is out of sync with concurrent changes.

Key analytical dimensions such as component risk, availability, cost analysis, and market intelligence are not easily maintained in a static spreadsheet or product data management (PDM) system. Even collaboration between various teams is extremely difficult. Disconnects and gaps between your teams are bound to emerge from this approach.

Limited visibility across the entire BOM also contributes to product delays, quality issues, and costly redesigns. Given the multi-faceted nature of a product launch, the solution here lies within a dynamic approach that connects your BOM to market intelligence and up-to-date component databases, all of which allow you to better manage costs and sourcing.

A dynamic approach to your BOM management also allows for enhanced collaboration as it gives each team access to the latest version of your design and sourcing needs.

2: Optimize for Target Cost

The first use of value engineering in Japan—known as “genka kikaku”—occurred at Toyota in 1963. Later “genka kikaku” was translated into “target costing,” the term now used throughout the world.¹

Though it remained a secret for some time, it was widely recognized in the 1980s as the competitive edge that Japanese companies had over Western ones. As America and Europe raced to adopt their own target costing strategies, numerous versions of the concept emerged and were applied in different ways.

A broad view of the subject divides it into three categories ranging from market-oriented to engineering-oriented, and product function-oriented definitions. Target costing itself is a profit management activity during the NPI process that includes the following:

- **Focusing on design objectives that achieve target customer market goals and maximize share gain and lifetime revenue potential for each product. Some study or analysis is conducted based on assumptions related to market conditions, adoption rates, forecast by segment, competitive product prices, lifecycle target cost, and product margin.**
- **Determining best cost opportunities across standard parts, sourcing locations, manufacturing value add, and related drivers to product margin goals at launch and over time.**
- **Iterating on balanced tradeoffs between lowest costs, key to quality, and supply risk factors to optimize lifecycle product margin in the design phase.**

In more mature manufacturing companies, techniques like value engineering (VE) and design for manufacture and assembly (DFMA) have traditionally provided key inputs into the NPI Program related to cost modeling and assumptions.

The challenge is that most of the supporting systems and models are built on static information that does not reflect real-time market dynamics, trends for cost drivers across commodity groups, external risk drivers, or prediction models that anticipate cost drivers over time.

1. Source: Patrick Feil, Keun-Hyo Yook, Il-Woon Kim.
Japanese Target Costing: A Historical Perspective

3: Increased Internal Collaboration & Tradeoff Analysis

Throughout the design and prototyping process of a NPI program, obstacles often emerge as specifications shift and BOM specifics are finalized. Unexpected snags in the development of a new product quickly add up to cause delays in the overall timeline.

To combat this, many organizations have adopted a phase-gate review sequence to properly drive the scope and flow of work across various aspects of the company. As we discussed earlier, the purpose of this governance structure is to monitor and authorize tasks as they progress through various stages. All of this is driven by established metrics and decision-making criteria.

These phase gates are typically overseen by a dedicated NPI program team that monitors completion of analysis activities across multiple phases, which often include review, validation or consideration of issues across multiple functions. Regular meetings with the governance team allow distributed professionals and internal experts to present their recommendations and share feedback and advice on when to make key decisions in each phase.

This type of review structure offers a number of benefits for NPI programs:

- **Ensures alignment across departments and their teams.**
- **Controls the flow of work across silos with clear accountability.**
- **Facilitates a unified scope for the program.**
- **Improves visibility for the entire organization including related executive stakeholders.**
- **Improve alignment of performance measurements including sales, financial and supply chain goals.**

Implementing a review process like this one will bridge the gap between various stakeholders and improve the scope of decision making. Collaboration across silos is an integral part of the overall digital transformation leaders need to drive in this area.

However, one common objection of this process focus is the idea that phase gates can stifle agility and innovation by forcing it through a funnel. In reality, innovation and risk assessment initiatives can expand the potential for realizing new ideas by tempering experimental concepts with rock-solid foundational data that provides insight on emerging risks or cost drivers.

Tradeoff decisions should be driven by both historical information and past product performance combined with real-time market intelligence and new external sources of insight that improve the depth and scope of risk assessments.

4: Optimized Design For Manufacturing (DFM)

A lack of team alignment can lead to a product's failure to meet technical specifications during the prototyping phase. Following the principles of a design for manufacturing (DFM), the following should be at the forefront of the conversation as early as possible:

- **Managing and reducing the number of components, reviewing reuse across product generations or families which often drive additional manufacturing cost efficiencies.**
- **Focusing on standard off-the-shelf components (as opposed to specialized solutions).**
- **Prioritizing compliance and leveraging established design footprints or CAD models that can be used in DFX simulation or manufacturing process design.**

There are, of course, other guidelines to a complete DF, but these represent the subjects that should be top-of-mind when discussing NPI across design, engineering, sourcing, and procurement.

5: Post-Launch Lifecycle Management

Given the nature of a complex new NPI program, many are fully aware that this is only the beginning of the journey. Once a product has been released to market, the true test comes from proper lifecycle management as new challenges arise during continued manufacturing and ramp-to-volume.

It's imperative that collaboration, cost analysis, market intelligence, and BOM risk mitigation all continue to play a major role in the post-launch timeline. Available component inventory may not meet ramp-to-volume goals, alternate suppliers not included in the prototype design may need to be evaluated or included in a new sourcing event, and modifications to tooling or manufacturing process design may be required.

It is incredibly difficult to manage these changes and identify alternative suppliers or parts in the context of a complex spreadsheet or static PDM system, which leaves organizations flying blind during the most crucial part of the process.

The solution is to connect BOMs to a system or platform that allows for collaboration and shared decision making between multiple teams, including full audit trails and continual monitoring of market intelligence.

Furthermore, cost analysis and risk assessment should be conducted in the context of the active BOM with an intelligent NPI platform itself to ensure your components fall within acceptable levels of availability, price fluctuation, and potential end-of-life (EOL) status.

Leading Digital Transformation of the NPI Process

For hardware design teams at global manufacturers, new and emerging technologies like virtual and augmented reality, along with the continued proliferation of 3D printing, offer exciting ways to visualize innovation and enhance the design process. Now is the time to embrace innovation in the downstream area of NPI program management.

The supporting systems, internal data sources, and external intelligence that traditional NPI programs utilize today are no longer sufficient to maintain competitive advantage. The “status quo” that has traditionally relied on static documents, underqualified tool sets, and rigid silos will not offer growth and competitive benefits to organizations seeking to transform their NPI process design and execution.

Before you can accurately judge potential technology partnerships, you must first define and accelerate your digital transformation. Consider these statistics:

- **Over 70% of companies have a digital transformation strategy, or they are actively working on one.**¹
- **Only 21% of companies believe they've already completed their transformation.**²
- **And 55% of companies without a digital transformation strategy believe they have less than a year before they begin losing market share.**³

A digital transformation of NPI begins with alignment with the senior leadership of the organization, with an executive sponsor that is committed to success. From there, it's important to measure incremental success in the first wave of programs that follow the new NPI program, with a focus on improvements in risk reduction/grading of products, on time/on target release to manufacturing, 100% comprehensive BOM analysis, and on target cost goal completion.

Sharing insights and lessons learned along the way with the senior leadership is also critical to build momentum for additional investment in innovation.

Ultimately, digital transformation is a shift in culture just as much as technology. The ability to demonstrate early wins, achieve buy-in, and redefine your relationship with digital solutions will ultimately fuel future growth and victories.

It will also allow for a collaborative approach, as most solutions in this field are online platforms. In the season of COVID-19, this can be a crucial way to maintain communication in telecommuting roles and extended structures where employees are working from home. It also gives you keen insights that can mitigate risk in this uncertain landscape.

This will also allow you to create a “digital thread” in your organization that provides actionable insights and data downstream to other members of the company and for other phases of the NPI process.

Connecting and energizing your design BOM with real-time data is something that almost every level of the organization can benefit from, which makes it a critical element of your digital transformation strategy.

1. Source: Survey by Tech Pro Research

2. Source: Forrester. The Sorry State of Digital Transformation

3. Source: Progress eBook. Are Businesses Really Digitally Transforming or Living in Digital Denial?

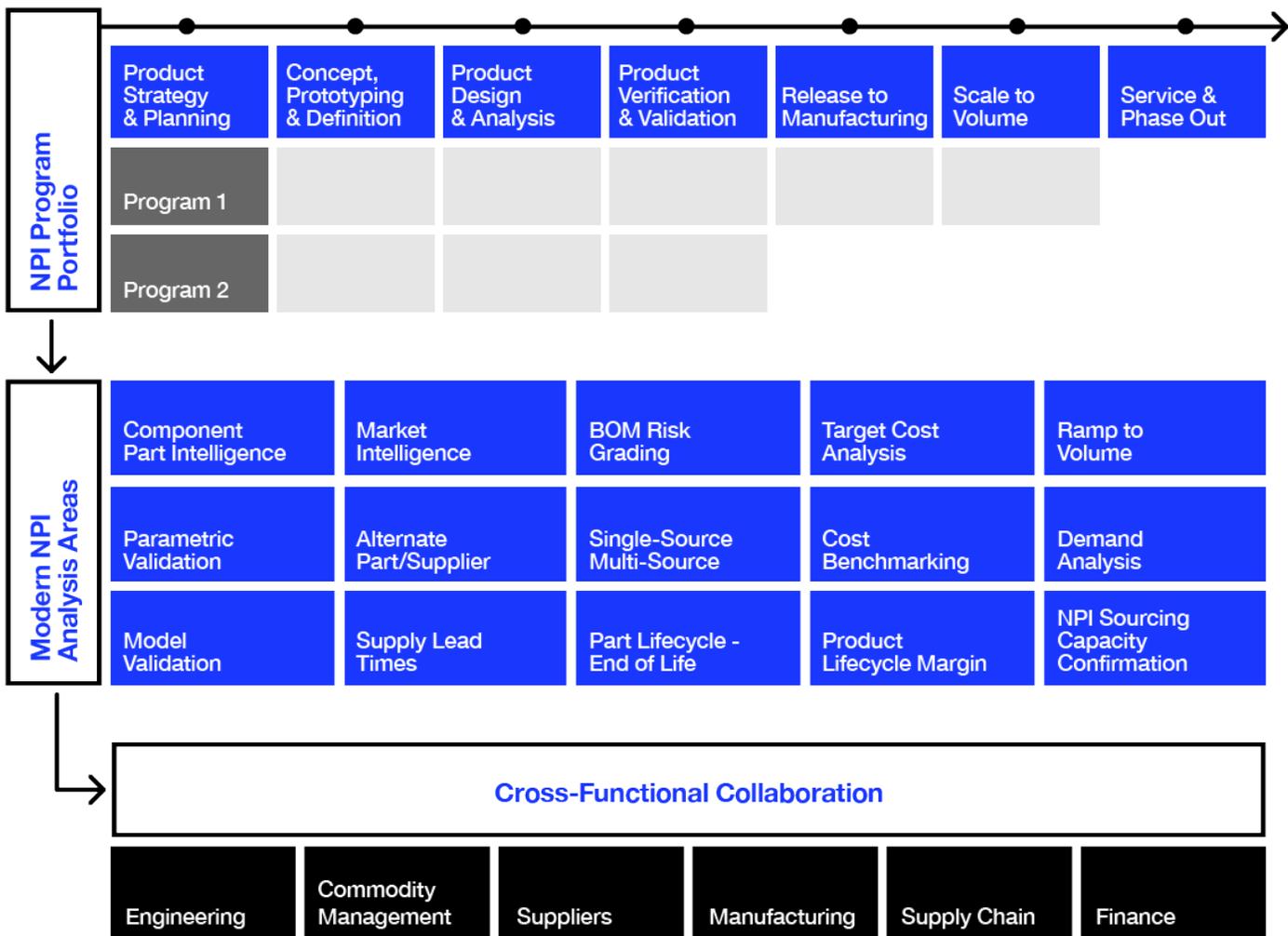
Supplyframe Drives Modern NPI Program Transformation

The status quo of NPI is no longer “good enough.”

Supplyframe is committed to helping our community address the increasing complexity of global supply markets, and support innovation in design cycles and new product introduction, with a focus on increased agility, intelligence, and collaboration.

We partner with industry leaders to re-examine their NPI management process, supporting systems, sources of insight, and achieve lowest product cost and risk prior to release to manufacturing.

Based on our experience working with leading global manufacturing companies and a broader community of over seven million engineering and procurement professionals, Supplyframe offers a unique vision for modernising the NPI process.



Supplyframe Drives Modern NPI Program Transformation

The Supplyframe platform also offers enhanced collaboration, market intelligence, and contextual analytics to transform the depth, scope, and value of tradeoff decisions made by the team in the NPI phase gate review process.

In the early product strategy and concept/prototyping phases, Supplyframe offers in-context intelligence for engineers to review component part parametric attributes, and automatically convert technical part content into 2D or 3D models for insertion in active designs.

This intelligence can complement or even replace the limited and often out-of-date information maintained in component part libraries in the EDA/CAD environment lead engineers are using.

As the program moves into Product Design and Analysis, Supplyframe offers a new way to assess individual components and weighted product/system risks. This includes real-time intelligence for standard component parts, including a proprietary Part Risk Rank™, materials compliance (RoHS, Pbfree, HTS, etc.), global available inventory, supply lead times, part lifecycle/EOL considerations, and comparative analysis for quickly finding matching Form- Fit-Function (FFF) equivalents.

Additional areas of analysis can include evaluating approved suppliers and alternate suppliers based on financial health, sources of manufacturing, related geo-political risks, tariff and trade regime changes, and supply performance.

The capabilities extend into Product Verification and Validation, with expanded insights across the full design BOM, including recommendations for best cost opportunities, consolidated risk factors, cross-referenced customer part numbers (CPN), multiple manufacturing part numbers (MPN), and alignment to preferred or qualified supplier lists.

Furthermore, the system enhances internal collaboration with full BOM version control, line item comments, and ownership control with audit history.

As the program moves into release-to-manufacturing and Scale-to-Volume, teams can improve product demand analysis and forecast aggregation, with related insights on impact part availability, supplier capacity, and related manufacturing or supply chain risks.

The intelligent quotation management system takes the BOM analysis and immediately converts it into the context of an NPI sourcing event with supplier engagement and bid review in a matter of hours and days. All of these enhanced collaboration capabilities accelerate iterative review with shared analysis across multiple teams to achieve new levels of agility and speed.

Supplyframe is reimagining modern NPI program management in a way that harnesses global supply chain data and converts it into actionable insights that foster agility, build resiliency, and drive innovation in a connected and uncertain world.

For further information contact Supplyframe at (866) 786-8339 or on www.supplyframe.com.

Appendix: The Modern NPI Program Checklist

Supplyframe provided this short checklist for NPI Program leaders to self-assess current NPI systems and processes. A modern NPI program should include 80% or higher coverage across each of the identified areas.

Modern NPI Program Operations Checklist

- Do we have a systematic process of BOM grading and cost analysis for each phase gate review of our NPI program?
- Do we have a dedicated NPI program “system of orchestration” that manages all net changes to the BOM in terms of cost and risk drivers vs. a BOM “system of record” such as a backend PDM or PLM system?
- Do we have automated and in-line market intelligence and contextual insights for each part, supplier, and manufacturer related to availability, lead time, cost, lifecycle and related risks?
- Do we have intelligent recommendations for alternate parts, suppliers, or FFF equivalents available in both the CAD/EDA environment through BOM analysis and phase gate review?
- Technical content (such as datasheets, 2D/3D models, footprints, etc.) related to the BOM, part component, or related design requirements embedded in the NPI phase gate review process?

Supply Chain Checklist

- Does our supply chain strategy consider turnkey or hybrid manufacturing options?
- Will our contract manufacturer operate locally or offshore. Tradeoff analysis related to contract manufacturing or original design manufacturer (ODM) partner options?
- Does our production strategy lean towards build-to-order or build-to-forecast? What is the capacity to support time to volume assumptions for the program?
- How much time do we need for quality assurance (QA) processes?
- Have we established production capacity requirements and plans for expansion?
- What is our Finished Goods (FGI) distribution plan?
- How are we modeling and planning to manage total supply chain costs for the product after release to manufacturing?

Appendix: The Modern NPI Program Checklist

Engineering Checklist

- Are the engineering team aware of gates, deliverables, and approvals?
- How are we managing data and changes to design or engineering?
- Are we using custom or standard part numbers in our BOM?
- Have we confirmed Design Verification Testing (DVT)?
- Do we have results from Product Reliability testing (HALT)?
- What are our test specs?
- Do we have diagnostics available?
- Will we need any special test equipment?
- Are there any feedback loops we need to address?

Sales and Marketing Checklist

- Will we use a direct model for sales, or opt for distributors/partners?
- Do we have plans in place for selling in other regions?
- What are the standard order ARO requirements?
- Have we drafted our terms and conditions?
- How much Stock Keeping Units (SKUs) do we need to have available?
- What is our sales forecast process? Do we have the best picture of weekly and monthly unit level forecasts shared with the engineering and sourcing teams to accurately manage ramp-to-volume goals and supplier lead times/availability?
- How will we manage customer warranties, returns, or spare units?
- Do we have confirmation on compliances (UL, FCC, RoHS, WEEE, FDA)?
- What is our software delivery structure (Physical media, website access, etc.)