

CHEMICAL VIRUS DETECTION SYSTEM

A new product development project
Design Brief

Module :ACPA 7006

Management of NPD Assessment B

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MADE UWTSD 2023

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Synopsis

Through a Knowledge Transfer Partnership with a local university, the Company identified an opportunity to extend the chemical alcohol detector system which is at the heart of their breathalyser products to cover the detection of other organic materials, including those generated in the breath because of various virus infections. The new system has been trialled successfully in the laboratory and the necessary patent applications have been registered.

In light of the recent Coronavirus pandemic, the Company see great potential in developing a product that can meet both clinical and personal requirements for such virus detection and are therefore anxious to bring the new product to market as soon as possible.

However, the nature of the changes to the detector system is such that the existing breathalyser products cannot be employed as the basis for a new 'Virus Detect' product. Consequently, a completely new product design is required.

The Company have successfully prototyped the electronic and mechanical systems which form the new product and will be engaging a London-based company to design the 'physical envelope' and appearance of the new Virus Detector.

The company have decided to adopt a similar strategy to that which they use for their current range of breathalyser products, i.e. sourcing the electronics and mechanical elements of the product externally, and undertaking final assembly, testing, packing and shipping at the company's Welshpool factory.

The NPD brief follows the template and categories as identified in "The Informational Elements of Product Design Briefs: An Exploratory Investigation" by Ian Parkman (Parkman 2018), as a means of organising the elements in several categories. There are many other breakdowns and classifications within the world of NPD, which can be used as viable alternatives in compiling the brief.

The 2 core prerequisites of a successful NPD process are:

- Having the pertinent considerations being presented and answered. Many of considerations will appear under informational elements in different categories, as the team looks at the NPD brief from different perspectives. This repetition highlights the relationship between different properties (see an example in Figure 1)

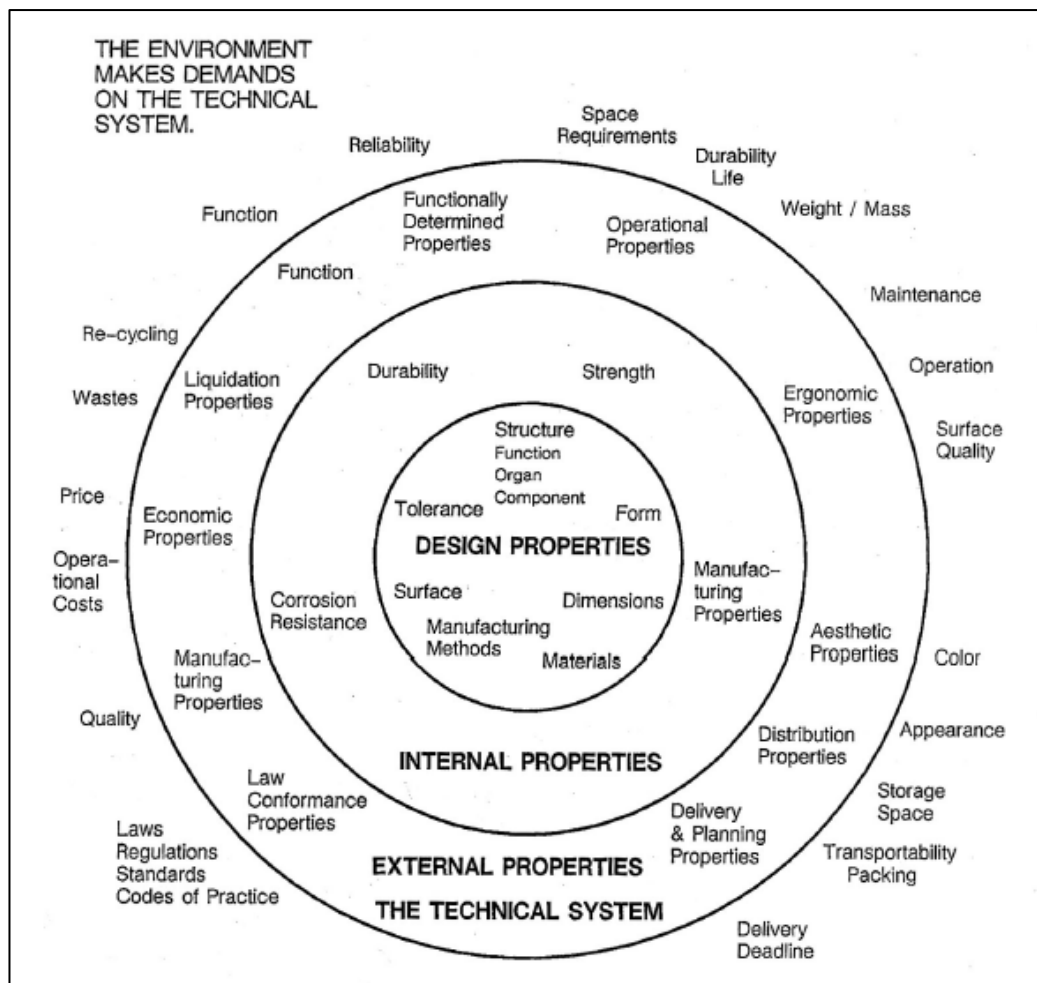


Figure 1 Relationship between Classes of Properties (Hubka and Eder (1988)) (Osteras, Rausand et al. 2008)

- Having the active participation of a cross-functional team (Minguela-Rata, Arias-Aranda 2009). This participation will be internal to the company's departments and supplemented by collaboration with external stakeholders, i.e. university, government agencies, specialists.

<i>Category</i>	<i>1</i>	<i>Target market</i>	<i>2</i>	<i>Quality and Workmanship</i>	<i>3</i>	<i>Place and Distribution</i>
<i>Informational elements (Parkman 2018)</i>	1.1	Sales price	2.1	Product Quality	3.1	Distribution/Suppliers
	1.2	Product Price Point	2.2	Product Performance	3.2	Related Promotional or Advertising Strategy
	1.3	Forecasts	2.3	Workmanship	3.3	Product Life Span
	1.4	Target Dates	2.4	Product Weight	3.4	Sustainability of the Product
	1.5	Specific Consumer Segments	2.5	Comfort	3.5	Sustainability of the Production Process
	1.6	Product-level Positioning	2.6	Maintenance and Repair		
	1.7	Project Goals	2.7	Circular economy		
	1.8	Product as a new market introduction or continuation	2.8	Standards and Specification		
	1.9	Politics				

<i>Category</i>	<i>4</i>	<i>Consumption expertise</i>	<i>5</i>	<i>Aesthetics</i>	<i>6</i>	<i>Risk and Safety</i>
<i>Informational elements (Parkman 2018)</i>	4.1	Expertise required to use the Product	5.1	Graphics	6.1	Product Risk and Safety
	4.2	Product-user Interactivity	5.2	Associative (Name, Image, Logo)	6.2	User Health
	4.3	Consumer Involvement with the Product	5.3	Aesthetics	6.3	Testing
			5.4	Design Language	6.4	Legal considerations

Category	7	Symbolic Value	8	Production
Informational elements (Parkman 2018)	7.1	Prestige of the Product	8.1	Specific Production Facility or Location
	7.2	Emotional Appeal of the Product	8.2	Specific Production Capability
			8.3	Materials to be used

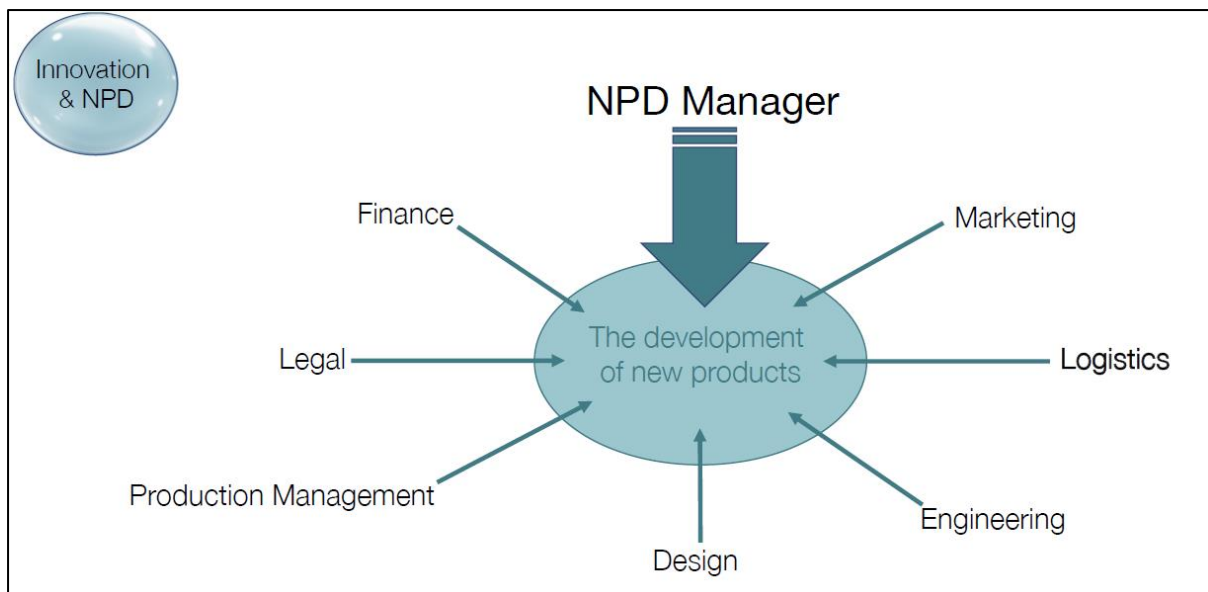


Figure 2 - Stakeholders involved in NPD (Mumby 2023)

Departments acting as stakeholders in the Design specification based on this brief: D&E - design & engineering, MAN- manufacture, PR- procurement, FI- finance, LE- legal, MAR- marketing, QA - quality assurance, HR – human resources, and LO- logistics.

- What information are we going to gather?
- Where will it come from?
- Are there any new skills/ personnel we need to acquire or contract?

1. Target market

The Marketing department has a primary responsibility in this first category.

Contributions: D&E, MAN, PR, FI, HR, QA, LO

The factors to be considered include the following:

1.1 Sales price

We will need to consider the sales price of the product based on the following criteria:

- What are the costs associated with the various stages of the production process: design, purchasing, manufacture, assembly, testing, logistics, etc.?
- What is the expected profit margin for this product based on? What elements must be considered? i.e., board expected return percentage, type of profit margin: gross, operating, pre-tax, net. (Segal 2023)

Other categories concerned: Target Market 1.2 ➔ 1.9; Quality and Workmanship, Place and Distribution, Consumption Expertise, Aesthetics, Risk and Safety, Symbolic Value, and Production

1.2 Product Price Point

We will need to consider the product price point of the product based on the following criteria:

- Fixed and variable costs
- Market demand
- The spending power of the target customer (NHS, Government agencies, Private companies, General public)

1.3 Forecasts

- Demand and Sales Forecasting
- Market Forecasting: the future size, growth, and characteristics of a specific market or industry.
- Trend Forecasting: identifying and predicting emerging trends in consumer behavior, preferences, and market dynamics.
- Competitive Analysis: Forecasting can also be used to predict the actions and strategies of competitors. By predicting what the competition might do in the future, businesses can prepare counterstrategies or take advantage of opportunities.
- Budgeting and Resource Allocation
- Risk Management
- Product Launch Planning: estimate initial demand, plan production or service capacity, and determine marketing budgets.
- Long-Term Planning

- Data-Driven Decision-Making: Forecasts are based on data and analytical methods, making them a key tool for data-driven decision-making in marketing. Businesses use historical data, market research, statistical models, and machine learning algorithms to generate forecasts. (Ulonska, Welo 2013)

It is crucial to acknowledge that although predictions offer valuable perspectives, they may not always be precise due to the inherent uncertainty surrounding future occurrences. Consequently, it becomes imperative for businesses to consistently observe and revise their forecasts to align with evolving market dynamics and enhance their strategic approaches accordingly. (Petala, Wever et al. 2010)

1.4 Target Dates

A careful consideration of the timescales involved in a project is an important informational element for the NPD team (Parkman 2018). Some of the milestones to be considered are:

- Project Kick-off Date
- Concept Development Date
- Market Research Deadline
- Prototype Completion Date
- Design and Development Milestones
- Product Testing and Quality Assurance Date
- Regulatory Approvals
- Manufacturing Readiness
- Marketing and Launch Dates
- Sales and Distribution Planning
- Post-Launch Evaluation
- Project Completion Date

It's important to note that while target dates are crucial for project management, they should be realistic and flexible (Chandrasegaran, Ghazilla et al. 2020). Unexpected challenges and changes can arise during product development, so project teams should be prepared to adjust timelines as necessary while maintaining a focus on delivering a high-quality product to market. Effective communication and collaboration among team members are also essential to successfully meeting target dates.

1.5 Specific Customer Segments

Dividing the market into specific groups of consumers that share certain needs and other characteristics (*Marketing. What is market segmentation.* 2021):

- Demographic Segmentation: age, gender, income, education level, marital status, and occupation.

- Geographic Segmentation: different geographic areas, such as regions, countries, cities, or neighborhoods.
- Psychographic Segmentation: includes factors like values, attitudes, interests, hobbies, personality traits, and social class.
- Behavioral Segmentation: factors like brand loyalty, purchasing frequency, product usage, and the decision-making process (*Marketing. What is market segmentation. 2021*).
- Usage-Based Segmentation: Usage-based segmentation is a subset of behavioral segmentation and involves categorizing customers based on how frequently they use a product or service. For example, in the telecommunications industry, customers may be segmented as heavy users, moderate users, or occasional users (Weinstein, Weinstein 2004).
- Benefit Segmentation: customers may have different needs and priorities, and businesses can tailor their offerings to address those needs.
- Generational Segmentation: this approach categorizes customers by their generational cohort, such as Baby Boomers, Generation X, Millennials (Generation Y), and Generation Z. Each generation may have different preferences and communication channels.
- B2B (Business-to-Business) Segmentation: industry, company size, annual revenue, and purchasing processes (Weinstein, Weinstein 2004).
- Technographic Segmentation the type of technology customers uses, their digital behaviors, and their tech preferences.
- Ethnic or Cultural Segmentation: ethnicity, language, or cultural background to create a culturally relevant/appropriate product.
- Income-Based Segmentation: different income brackets, selling to the Government, a private business, an agent, a distributor, or direct to the consumer. It allows businesses to alter pricing, products, and marketing accordingly (*Marketing. What is market segmentation. 2021*).

1.6 Product-level Positioning

The continuous process of product-level positioning is a crucial aspect of business success in today's ever-changing marketplace (Davila, Wouters 2004). By implementing an effective strategy that differentiates its offerings and fosters customer loyalty, the company can ensure sustained prosperity for years to come. This requires constant vigilance and adjustment as market landscapes shift and consumer preferences evolve. With careful planning and execution, businesses can carve out a unique position within their industry while maintaining a strong connection with customers (Davila, Wouters 2004).

- Identifying Target Market: Understanding the needs, preferences, and characteristics of the target audience.
- Determining Unique Selling Proposition: a distinctive feature or benefit that sets a product apart from its competitors. "Why should customers choose this product over others?"
- Market Research: Conduct thorough market research to gather insights into customer perceptions, preferences, and buying behavior.

- Competitive Analysis: strengths and weaknesses of competing products in the market. Identify gaps or areas where your product can outperform or differentiate itself.
- Positioning Statement and Map visually represent the product's position in relation to competitors. This map helps in understanding where the product stands in terms of price, quality, features, and other relevant attributes.
- Visual Branding: The product's visual identity, including its packaging, logo, and design, should align with its positioning and reinforce its unique qualities.
- Price Positioning: Is it a premium product, a budget-friendly option, or positioned somewhere in between?
- Distribution and Channel Selection
- Reevaluation and Adjustment

1.7 Project Goals

The project goals are to be considered as company specific and more intangible than other information elements in this category. Regularly tracking progress toward these goals is essential to ensure that the NPD project stays on course and achieves its intended outcomes. (Blackman 2020)

- Product Innovation
- Market Viability
- Customer Satisfaction
- Time-to-Market
- Cost Control (Ellram, Tate et al. 2020)
- Quality Assurance
- Resource Allocation (Grabner, Speckbacher 2016)
- Compliance and Regulations
- Risk Management
- Prototype and Testing Milestones
- Cross-Functional Collaboration and Supply Chain Collaboration (Handfield, Ragatz et al. 1999)
- Market Entry Strategy
- Intellectual Property Protection
- Sales and Revenue Targets
- Customer Feedback and Iteration (Krishnan, Ulrich 2001)
- Sustainability and Environmental Goals
- Competitive Positioning (Segal 2023)
- Brand Alignment
- Long-Term Success
- Post-Launch Monitoring and Evaluation

1.8 Product as a new market introduction or market continuation

Companies frequently employ a blend of these two methods, considering their overarching growth strategy and the prevailing market circumstances (Weinstein, Weinstein 2004). They may venture into fresh markets upon recognizing profitable prospects while simultaneously engaging in innovative practices within established markets to sustain and augment their market presence. The decision between introducing a new market or persisting with existing ones ought to harmonize with the organization's wider strategic objectives (Weinstein, Weinstein 2004) and its evaluation of optimal avenues for expansion.

New Market Introduction	Continuation in an Existing Market
Considerations	
Market Opportunity and Research	Market Synergy
Product Adaptation	Customer Base
Distribution Channels	Competitive Advantage
Marketing Strategy	Cross-Selling Opportunities
Risk	Marketing to Existing Customers

1.9 Politics

- Regulatory Compliance
- Policy Advocacy
- Environmental Regulations
- Trade and Tariffs
- Government Contracts
- Public Opinion and Social Issues
- Political Stability
- Intellectual Property and Patents
- Taxation and Incentives
- Globalization and Geopolitical Factors
- Consumer Privacy and Data Protection
- Health and Safety Regulations
- Ethical Considerations
- Risk Assessment
- Government Funding

2. Quality and Workmanship

The Quality Assurance, Design & Engineering and Manufacturing departments have the primary responsibility in this category. The factors to be considered include the following:

2.1 Product Quality

- Customer Requirements and Expectations
- Quality Standards and Regulations
- Design for Quality
- Testing and Prototyping
- Supplier Selection
- Quality Control Processes
- Continuous Improvement
- Reliability and Durability
- Quality Assurance Team
- Documented Standards
- Complaint Handling and Feedback Loops (Ayag 2005)
- Cost-Quality Trade-offs
- Risk Management
- User-Friendly Design
- Regulatory Compliance
- Training and Skill Development
- Post-Market Surveillance

2.2 Product Performance

In addition to the consideration in the product quality section, the company must also take into account:

- Performance Objectives: specifications for speed, accuracy, reliability, durability, efficiency, or other relevant metrics.
- Benchmarking against competitors' products (Ayag 2005)
- Technology and Innovation
- Design for Performance
- Efficiency and Energy Consumption
- Scalability
- Compatibility with existing systems, software, or hardware that it may interact with.
- User Experience
- Performance Monitoring

2.3 Workmanship

Workmanship considerations are critical in NPD as they clearly impact the quality, reliability, and overall view of the product (Chandrasegaran, Ghazilla et al. 2020). High-quality workmanship guarantees that the product is well-built and meets or beats customer expectations (Davila, Wouters 2004). Here are key workmanship considerations to incorporate into the NPD process:

- Skilled Workforce
- Design for Manufacturability (Manufacturing 2020)
- Materials and Components
- Quality Control Processes
- Workstation Ergonomics (Manufacturing 2020)
- Training and Skills Development
- Standardized Work Instructions
- Process Documentation
- Continuous Improvement
- Tool and Equipment Maintenance
- Waste Reduction
- Supplier Quality
- Internal and External Feedback Loops
- Root Cause Analysis

2.4 Product Weight

- Customer Requirements and Preferences
- Weight-to-Performance Ratio
- Transportation and Shipping Costs
- Environmental Impact
- Materials Selection
- Balance and Ergonomics
- Structural Integrity
- Energy Efficiency (Murata 2017)
- Portability
- Competitive Advantage
- User Perception
- Testing and Certification
- Customization and Innovation Opportunities
- Lifecycle Analysis

2.5 Comfort

- User-Centered Design
- Ergonomics
- Materials and Textures
- Temperature Control
- Cushioning and Padding

- Adjustability
- Vibration and Noise
- Ease of Use
- Safety
- User Feedback (Martínez-Noya, García-Canal 2021)
- Durability
- Environmental Factors
- Aesthetics
- Cost-Effective Solutions (Lee, Tang 1997)

2.6 Maintenance and Repair

- Single or multi-use
- Serviceability Design
- Modular Design (Manufacturing 2020)
- Standardization of components
- Spare Parts Availability
- Error Reporting
- Warranty Policies
- Quality Control
- Lifecycle Cost Analysis
- Vendor/Agent Partnerships (Handfield, Ragatz et al. 1999)

2.7 Circular economy

Circular economy considerations involve designing products with the goal of minimizing waste, maximizing resource efficiency, and promoting sustainability throughout their entire lifecycle (Bjørnbet, Skaar et al. 2021). Here are key circular economy considerations to integrate into NPD:

- Design for Durability
- Modular Design
- Reuse and Remanufacture (EU Environment 2014)
- Recyclability
- Sustainable Materials
- Resource and Energy Efficiency
- Supply Chain Transparency (EU Environment 2014)
- Reverse Logistics
- Lifecycle Assessment
- Circular Design Principles: Cradle-to-Cradle, Biomimicry, and Design for Disassembly, etc. (Bjørnbet, Skaar et al. 2021)
- Regulatory Compliance
- Innovation and Research
- Marketing and Branding

2.8 Standards and Specifications

- Industry Standards and Regulations
- Product Performance Standards (Osteras, Rausand et al. 2008)
- Tolerances and Variability
- Testing and Validation
- Quality Control Procedures (Osteras, Rausand et al. 2008)
- Documentation and Record-Keeping
- Safety Standards
- Environmental Standards
- International Standards
- Testing and Certification Bodies
- Cost Implications (Krishnan, Ulrich 2001)
- Cross-Functional Collaboration
- Regulatory Changes
- Supply chain Compliance (Handfield, Ragatz et al. 1999)

By incorporating standards and specifications into the NPD process, we enhance product quality, safety, and compliance (Osteras, Rausand et al. 2008), which in turn can lead to increased customer trust, market competitiveness, and reduced risks associated with non-compliance.

3. Place and distribution

The Purchasing and Logistics departments have a primary responsibility in this category. The factors to be considered include the following:

3.1 Distribution/ Suppliers

Distribution	Suppliers
Considerations	
Market Analysis	Early Supplier Involvement
Distribution Partners	Supplier Selection
Channel Selection	Supplier Audits
Pricing Strategy for Distribution	Dual (Triple) Sourcing

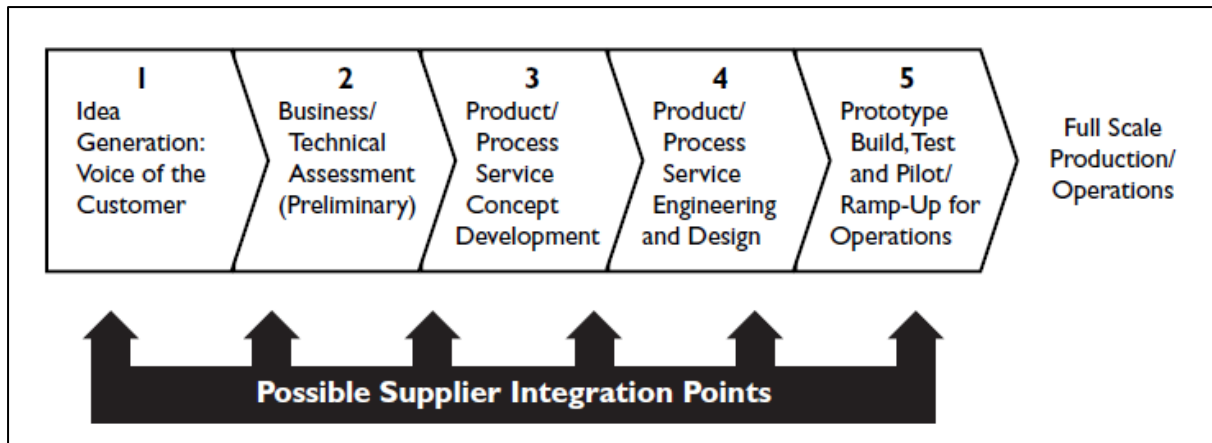


Figure 3 Possible Supplier Integration Points (Handfield, Ragatz et al. 1999)

3.2 Related Promotional or Advertising Strategy

This information element is closely tied in with Market Research and Segmentation (1.5 and 1.8). In addition to the elements identified there, we must also consider:

- Value Proposition
- Branding and Positioning
- Marketing Mix
- Advertising Channels (Yang 2017)
- Content Creation
- Launch Timing
- Influencer Marketing (Kotler, Kartajaya et al. 2017)
- Customer Reviews and Testimonials
- Legal and Ethical Compliance
- Long-Term Brand Building (Harper 2018)
- Sustainability and Social Responsibility

3.3 Product Life Span

Understanding where a product is in its lifespan supports us in making informed decisions about marketing, production, pricing, and investment in innovation and new product development (Vendrell-Herrero, Vaillant et al. 2022). The new product will go through the following stages in its lifespan:

- Launch to market
- Growth stage
- Maturity stage: Competitors are numerous, and price competition may intensify.
- Saturation and Decline
- Discontinuation or Revival

3.4 Sustainability of the Product

- Life Cycle Assessment
- Sustainable Materials
- Design for Disassembly and Recycling
- Packaging Sustainability
- Supplier Sustainability
- Regulatory Compliance
- Eco-Design Principles
- Certifications and Labels

3.5 Sustainability of the Production Process

- Energy Efficiency
- Resource Efficiency
- Transportation and Distribution
- Social Responsibility
- Waste Reduction
- Continuous Improvement
- Circular Economy Considerations

4. Consumption expertise

Multiple departments have an important duty in this category. Consumption expertise refers to how the product will be used by customers or end-users once it is introduced to the market (Chandrasegaran, Ghazilla et al. 2020). Understanding the intended use of the product is essential throughout the NPD process, as it directly impacts product design, features, marketing, and overall success. Here are key considerations related to the use of the product in NPD:

4.1 Expertise required to use the Product

- Use-Case Scenarios
- Usability Testing
- Scalability and Adaptability
- Integration and Compatibility
- Data Protection and Security

4.2 Product-user Interactivity

- User-Centered Design
- Functional Design
- User Interface and User Experience (Chandrasegaran, Ghazilla et al. 2020)
- Safety and Compliance
- User Training and Onboarding
- User Feedback and Iteration (Murata 2017) (Martínez-Noya, García-Canal 2021)

- User Education and Marketing

5. Aesthetics

Aesthetics considerations are fundamental in NPD because they substantially influence a product's visual appeal, user experience, and market recognition (Harper 2018). A well-designed product that is aesthetically pleasing is more likely to attract customers, set itself apart from competitors, and foster positive brand awareness. Design & engineering and Marketing will take the lead in this category. The factors to be considered include the following:

5.1 Graphics

- Product Design and Prototyping
- Concept Sketches
- 3D Modeling and Visualization
- Packaging Design
- Labelling
- Product Photography
- Brochures and Flyers
- Product Renders
- Digital Marketing
- Website Graphics
- Social Media Graphics
- Email Marketing
- Advertising and Promotion
- User Manuals and Documentation
- Illustrations

5.2 Associative (Name, Image, Logo)

- Branding and Logo: Ensure that the product's branding, logo, and visual identity align with the overall brand strategy and convey a consistent message to customers.
- Accessibility: Ensure that they are understandable and usable by individuals with disabilities. This may include providing alternative text for images and using accessible colour contrast.
- Cultural Sensitivity

5.3 Aesthetics

- Form and Shape
- Color and Material Selection
- Texture and Finish
- Consistency Across Product Line

- Typography
- Sustainability and Eco-Friendly Design
- Brand Alignment
- Feedback and Iteration

5.4 Design Language

- Symmetry and Balance: Ensure that components, features, and details are proportionate and visually pleasing.
- Simplicity and Minimalism: Eliminate unnecessary elements and focusing on essential features.
- Visual Hierarchy: Use visual cues such as size, color, or typography to emphasize key information.
- Iconography and Symbols: Use icons and symbols that are intuitive and universally understood to enhance user comprehension and navigation.
- Typography: Ensure that text is legible in all use scenarios.

6. Risk and Safety

Quality Assurance, Human Resources, and Legal have the main duties in this category. The factors to be considered include the following:

6.1 Product Risk and Safety

Product risk and safety considerations should be integrated into the entire NPD process, from ideation and design to manufacturing and post-market surveillance. By highlighting safety and regulatory compliance, we can minimize risks, protect consumers, and build trust in our products and brand. All the considerations below have been mentioned earlier in the design brief, as they play an important role throughout:

- Regulatory Compliance
- Risk Assessment
- Safety Standards and Testing
- Design for Safety
- Material Selection
- Documentation and Labelling
- User Training and Education
- Quality Control and Testing
- Product Recalls and Post-Market Surveillance
- Supplier Audits
- Product Liability Insurance
- Sustainability and Environmental Impact
- Cross-Functional Collaboration
- Continuous Improvement

6.2 Legal Considerations

- Intellectual Property Protection
- Regulatory Compliance
- Consumer Protection Laws
- Product Liability
- Contracts and Agreements with Suppliers and Clients
- Privacy and Data Protection
- Export Control and International Trade
- Environmental Compliance
- Labor and Employment Laws
- Contractual Obligations
- Dispute Resolution
- Market Entry Strategies

By proactively addressing these legal considerations, we can reduce legal risks, protect our intellectual property, and ensure a smoother path to market for the new product (Trott 2016).

7. Symbolic Value

These considerations recognize that products often serve as symbols, representing values, aspirations, and identities for individuals and communities. Researching and understanding the emotional feedback of the consumer pre and post launch (Rathore, Ilavarasan 2020) can significantly impact the product's success and market acceptance. The Marketing department will take point in this category. The factors to be considered include the following:

7.1 Prestige of the Product

- Cultural Significance
- Identity and Self-Expression
- Brand Identity
- Product Backstory
- Social and Cultural Trends
- Customization and Personalization

7.2 Emotional Appeal of the Product

- Community and Shared Values
- Rituals and Traditions
- Aspirational Value
- Emotional Connection through User experiences
- Sustainability and Values Alignment
- Consumer Research and Feedback

8. Production

The Manufacturing and Procurement departments will lead this category. Production-specific considerations in NPD are crucial for ensuring that a product can be manufactured efficiently, cost-effectively, and at the desired quality level. These considerations involve various aspects of the production process, from selecting manufacturing methods to optimizing supply chains. Here are key production-specific considerations in NPD:

8.1 Specific Production Facility or Location

- Production Scalability
- Supplier Relationships
- Logistics and Supply Chain Management
- Stock Management
- Environmental Sustainability
- Regulatory Compliance
- Packaging and Labelling

8.2 Specific Production Capability

- Manufacturing Processes: optimize processes for efficiency, quality, and cost-effectiveness.
- Tooling and Equipment
- Quality Control and Assurance
- Cost Analysis
- Lead Time and Production Time
- Subcontractor Reliability and Backup

8.3 Materials to be used

- Ease of manufacture
- Materials and Components: components that are readily available, reliable, and cost-effective.
- Supplier Relationships
- Prototyping and Pilot Production
- Continuous Improvement

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