

ANALYSE THE CHARACTERISTICS OF NEW PRODUCT DEVELOPMENT (NPD) MODELS THAT CAN IMPROVE THE APPAREL INDUSTRY'S SAMPLING PROCESS**Ezhilarasi k**

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ABSTRACT

The New Product Development (NPD) process presents significant difficulties for the apparel sector, especially during the sample phase when more lead times, expenses, and inefficiencies frequently restrict innovation and competitiveness. This study investigates the features of NPD models that could improve the sampling procedure used in the apparel sector, emphasizing increased response to market demands, waste reduction, and efficiency. This research analyzes key factors that support effective sampling procedures in the apparel sector by extensively reviewing the literature, current NPD models, and industry practices. For this study, a questionnaire was utilized as a research tool to characterize and evaluate the NPD model of the chosen executives from apparel company. To enhance the sample process, the study suggests ways to incorporate these features inside the NPD framework using agile-lean hybrid methodology (ALH) in conjunction with kaizen implementation. The objectives of Kaizen are to minimize waste, enhance productivity, and achieve consistent, continuous improvement in particular tasks and procedures within an organization. This study used a mixed-approach to investigate the issues and present practices in the sampling process of the apparel industry. It includes quantitative analysis of comparison and qualitative interviews with professionals in the field. The study's findings contribute to the theoretical knowledge and real-world understanding of apparel industry professionals who seek to improve their NPD procedures. Through the emphasis on modern technological practice system attributes and the provision of practical implementation strategies, this research provides a road map for improving the apparel industry's sampling process, which in turn motivates innovation, shortens time- to-market, and boosts competitiveness in the wider market.

Keywords:

agile-lean hybrid methodology, kaizen, Industrial practice, NPD, apparel sampling

INTRODUCTION

The current competitive environment is unsustainable for the apparel sector with its standard products since consumer needs are always changing. Apparel companies must launch new goods or alter their current lineup to satisfy consumer demands if they are to remain. For apparel manufacturers to benefit, their new items must meet the demands and desires of their customers. The entire process of bringing a new product to market for use and feedback from the chain's final consumer via methodical procedures and parameters is known as new product development. A consumable good or service could be the new offering. New products are items and services that are unlike those that the company has previously created in terms of their features. Basics purchased from a variety of merchants, including food stores, clothing stores, gas stations, and so forth, are examples of functional products. These items have extended life cycles and consistent, predictable demand because they meet basic needs, which do not change substantially over time. Several companies launch apparel products with innovations to provide consumers with an extra incentive to purchase their goods to prevent low margins.

Clothing that is in season is an excellent example. The demand for innovative items is unpredictable due to their novelty, even though it might help a company attain larger profit margins. The normal life cycle of these most recent developments is only fade in few months. In the modern apparel industry, coming up with new ideas and creating them should be organized processes that call for a careful, methodical approach and fundamental guidance from both a capable management team and a designer. An educated and innovative workforce like this guarantees that the most crucial aspect of product development in the apparel sector is establishing specifications and acquiring new

garments. to continuously plan in accordance with the priorities and circumstances of the moment. A great number of companies will struggle to survive if this process is ignored. By introducing a new product development (NPD) into the market, the apparel industry employed a form of strategic planning analysis that considered both external and internal factors. The company environment, market, customer expectations, society, legal regulations, ecology, society, and economics are all factors that are dependent on the external estimations and are not within the control of the planners to build strategic planning. However, the term "internal estimation" and "analysis of strength and weakness" in the apparel sector refers to controllable elements within the organization that shape the strategic planning during the product creation process. Not only should material costs and technological equipment be considered, but also the company's reputation, its current brand, the designer team's inventive activities, and marketing services.

Most of the apparel sector continues to use a traditional supply chain, which is unable to meet new product development (NPD) requirements because of a shortage of skilled workers, inadequate training, unjust salaries, time to market shifting consumer preferences, adoption barriers for new technologies, investment costs, bottlenecks in the supply chain, Product life cycle, fit concerns, Prices of raw commodities and inflation. The ultimate purpose of apparel product development is to effectively manage every phase of the product production process. It is responsible for overseeing the full product lifetime, from concept to manufacture. It is comprised A crucial step in the entire manufacturing process is product creation for the apparel sampling. Any apparel industry's initial phase, which involves product development prior to mass manufacturing, is the sampling department. The manufacturing and design teams work together to produce the initial iteration of the garment. To determine how the clothing would seem in real life, samples are made. It is also used to fit the clothing on a target size model to check how it fits. The approval of the final sample typically requires multiple rounds of sample creation, which delays the ability to satisfy the demands of the next new product development (NPD).

Executives are under pressure to follow system models of the new product development process to concentrate research on apparel sampling. These models include the entire range of stages that new products typically go through, from concept generation and prototyping to final production sample, and thus have shorter cycle times. A vital stage in the new product development (NPD) lifecycle is the sampling process, during which initial design concepts are turned into physical prototypes for assessment and improvement. However, there are several inefficiencies and difficulties associated with traditional techniques of sampling in the apparel sector, such as lengthy lead times, expensive expenses, and restricted flexibility. These difficulties may cause production costs to rise, product releases to be delayed, and chances to profit from new trends to be lost. The analysis of NPD models and their potential to enhance the sampling procedure in the apparel sector is the particular focus of this research study. To give a thorough grasp of applicable ideas and frameworks, the study will consult literature from a variety of fields, such as industrial engineering, supply chain management, and product development. Although NPD models will be the focus of the study, it will also examine adjacent subjects including lean principles, agile techniques, and sustainable practices that could have an impact on the sampling process.

This study project intends to examine the features of NPD models that can enhance the sampling process in the apparel sector, considering the necessity to address these issues and increase the process' efficiency. To improve the sampling procedure and stimulate creativity in product creation, this study aims 10 to identify important NPD model traits and investigate their application in the context of the garment sector.

Within the field of New Product Development (NPD) in the apparel industry, the sampling process may encounter a few frequent hurdles or issues. Here are a few instances:

1. Long Lead Times: The apparel industry's traditional sample procedures frequently entail several iterations of physical prototypes, which can lead to longer lead times between the creation of a design and the approval of the finished product. This delay could affect the company's ability to respond quickly to changes in the market and customer needs.
2. Expensive Costs: Creating several physical samples and the related labour and material costs might add up to expensive sampling costs. The company's budget may be strained as a result, particularly if samples need to be updated or changed regularly.
3. Ineffective Communication: Misunderstandings, mistakes, and delays in the sample process can result from poor communication between the design, production, and quality control teams. Inaccurate sample interpretations brought forth by poor communication may necessitate several rounds of corrections.

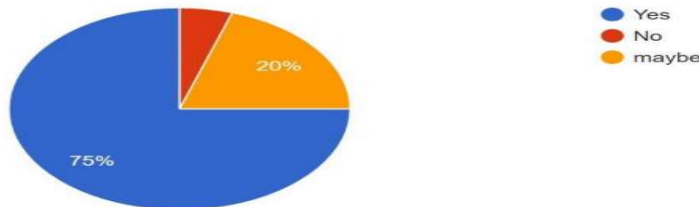
4. Inconsistent Quality: Differences in the sampling process can lead to variations in sample quality between various production batches or clothing styles. This discrepancy may lead to dissatisfied consumers and damage the company's reputation for producing high-quality goods. 5. Restricted Flexibility: The company's capacity to test out novel ideas, materials, or production methods may be hindered by the rigidity of conventional sampling procedures. A company's ability to innovate and compete in the market may be hampered by a lack of flexibility. 6. Waste and Environmental Impact: Producing several physical samples might result in a large amount of material waste, which raises environmental issues. For clothing producers, cutting waste, and using more environmentally friendly sampling techniques are becoming more and more crucial. 7. Absence of Data-Driven Inference: The lack of analytics and datadriven insights in the sampling process may make it more difficult for the business to recognize trends, predict client preferences, and make wise judgements. To tackle these obstacles within the NPD model's framework, creative thinking, and an openness to adapt are necessary. Apparel companies can improve their competitiveness in the market by introducing new product innovations, streamlining the sample process, cutting costs, improving quality, and utilizing digital technology and agile techniques.

OBJECTIVES AND METHODOLOGY

In my project, creating an apparel sample involves several steps, from the designer's concept to the final samples with the style ready for sampling. The fashion industry, which is primarily small- to medium-sized, faces significant challenges because of following traditional methods that impact their product life cycle and delay customer satisfaction due to long lead times. I was interviewing people who had connections to the apparel/other industrial person field with questions about my field research to collect data for a study. In my research, I was able to identify issues through my survey by asking people with specific information, insights, or experiences about my study case.

Do you aware about the new product development in fashion industry which involved?

45 responses



which area you feel the mostly affect in the new product?

45 responses



what are the you faced the difficulties in the new product development in fashion industry ?

45 responses



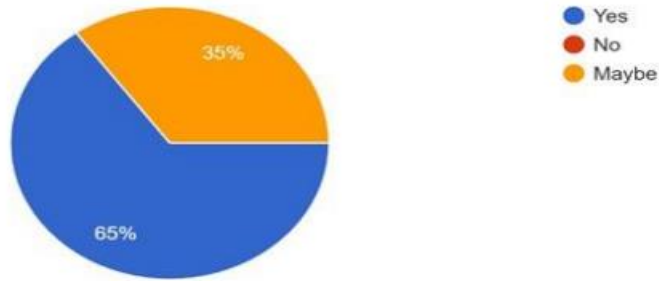
Is the possible to applied the lean technique method eg.,kanban, 5S, kaizen and so on which can applied in the new product development in fashion industry

45 responses



Do you believe in the lean manufacturer technique which can be applied in the new product development in fashion industry?

45 responses



My proposal aims to enhance the apparel sampling process by incorporating both Agile- Lean hybrid (ALH) approaches into its methodology in my project.

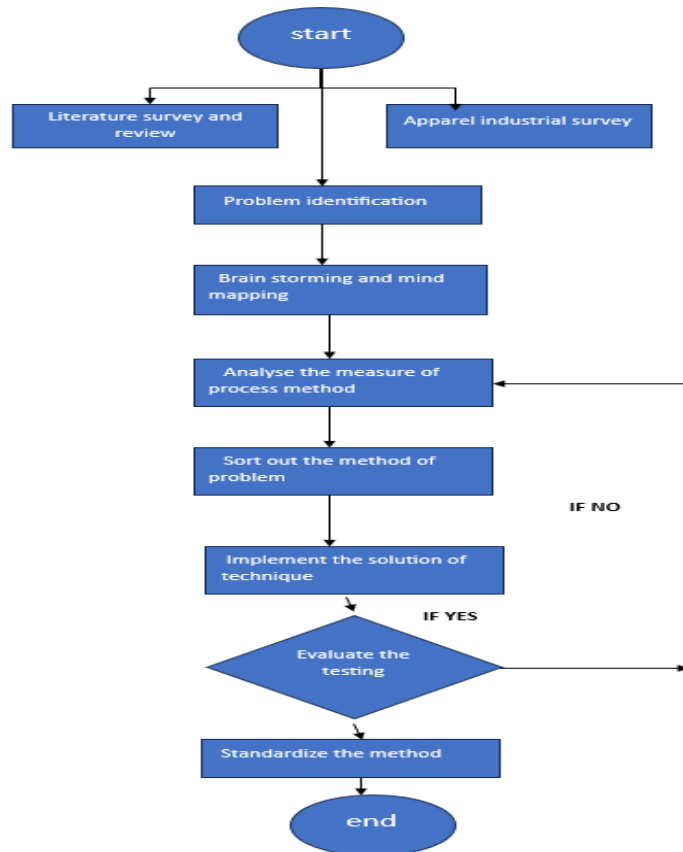


Fig. 1: Agile – lean methodology

Using an agile-lean hybrid methodology (ALH) in conjunction with kaizen implementation, I studied a project that applied the development of practical recommendations and methods for improving the apparel industry's sampling process based on research findings and industry best practices. employing methods that improve to develop a dynamic and adaptable strategy for enhancing the apparel sampling process, increasing productivity, quality, and customer satisfaction repeatedly over the duration of the product lifetime.

Analyze the measure of process method

Prior to initiating the process of garment sampling, as certain the kind of apparel produced by their organization. Productivity is a gauge of a company's performance in relation to its resources. Technology and structure are related in many ways depending on the kind of production, including process, flexible, mass, serial, and unit production. However, most newly developed products that fail in the mass production, single, and process production categories are flexible and poorly structured. This is made possible by increased group activity, a small labor division, increased liability in "role playing," and decentralization of decision-making. The best model for clothing sampling is a flexible technological production system, which makes it easier and faster to adjust to small series, a wide variety of models, sizes, and patterns, the demands of a saturated market, changes in consumer preferences, and the use of the same technological process for a variety of goods. For each type of garment, there is a particular organization of the technological process from prototype to shipping sampling. Every product is unique, necessitating a unique arrangement of technological processes. Properly chosen technological processes expedite the manufacture of apparel cases, lower production costs per unit, facilitate product flow through all stages without bottlenecks, minimize inventory, make optimal use of the machine park, and avoid low labor.

The process of changing materials from one form to another, from a lower to a greater use value, is the fundamental component of the technological system and directly influences the nature of new product development in the sampling process, such as • Product design and construction system • System maintenance • Inventory system • Workplace safety • Material transportation; • Quality control

Technological analysis is a focused activity that tries to present the product's manufacturing characteristics and any potential issues that may arise during the creation of a clothing sample. The process of defining the garment, producing the product, and arranging the technological aspects of the sampling process is where most errors in apparel sampling occur, and consequently, the costs associated with product quality. It is estimated that mistakes made during construction account for 75% of all problems that manifest on the final product. The most typical mistakes made when preparing for construction include are 1. The model's pattern components do not fit 2. Indentation without markings 3. Including % because stretch material 4. Different grading 5. Inaccurately carved patterns 6. High material consumption 7. Pattern components that do not suit the layout pattern and the layout pattern is too small 8. The setting and size of the workspace 9. different styles

As a result, technology analysis must be taken into consideration when designing technological items. to ascertain and, if required, enhance the product's technological capabilities. The apparel industry's functional clothing design system offers advanced technology and absorbs the power of new product development at the market level.

Sort out the methods of problem in apparel sample production

Overview of apparel sample production: There are typically three steps involved in producing samples at the manufacturers. The initial collection of samples is representative of the design phase, which covers everything from creating patterns to the original design. The assessment step includes the second sample set, which is used to finalize garment fit, estimate costs, place orders, etc. To guarantee the quality and uniformity of the entire batch, samples will need to be checked once more once the collection is authorized and sent to production. The quality control step is represented by these samples. Most of these samples, if not all of them, are necessary to ensure that your product is of the finest quality and will succeed in today's fiercely competitive market while also pleasing your clients. Creating 28 samples serves as a means of providing exporters with additional benefits in conjunction with large orders. In addition, the exporter can minimize bottlenecks of all types by optimizing the processing parameters for mass manufacturing. Production samples help an exporter's capacity to make decisions. Prototype sample, fit sample, size set sample, salesman sample, photoshoot sample, pre-production sample, top of production (TOP) sample, GPT sample, gold seal sample/ sealed sample, red tag sample, shipment sample and there so many types samples are there which depends upon

the buyer requirement of their product specification and their own protocols are followed.

Analysis of sample production with comparison of small and medium scale industry practices

I gathered information on sampling practices used in product development at the randomly selected company without lean production practices.

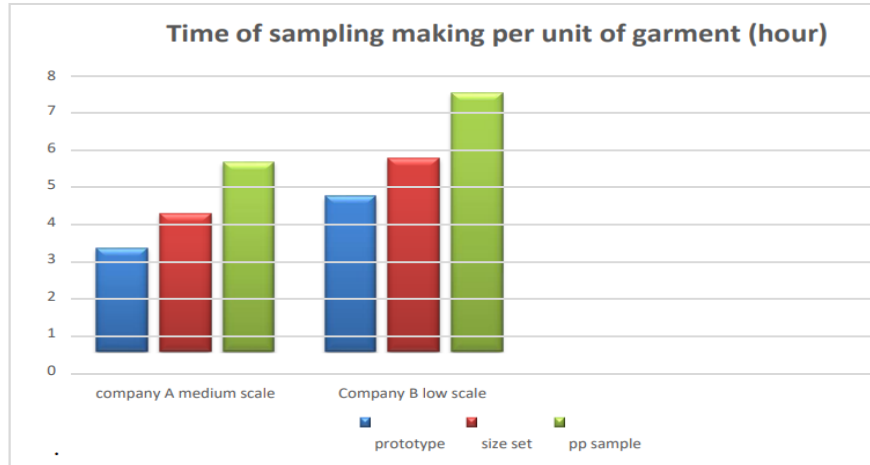


Fig 2- Time of sampling making per unit of garment (hour)

I can conclude that company B's sampling time was unreasonably longer than company A as based on the data collection shown in figure [2]. due to workforce variability, inadequate worker training, an unsuitable work schedule, downtime, an incorrect remuneration structure, and other subjective phase.

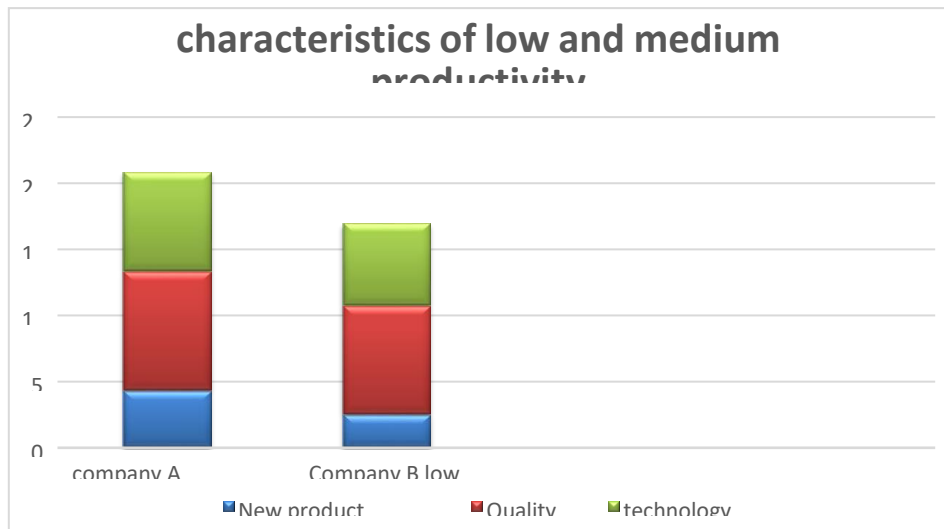


Fig 3- characteristics of low and medium productivity

Based on the data gathered above, figure [3] illustrates a case study of new product development implemented in a market comparison between small and medium-sized companies A and B, whose potential was predicted by them and achieved three years ago.

Implementation methods of technique to improve the apparel sampling

Step by step procedures for any part of tasks to apply this implementation technique using the hybrid lean-agile approach based on kaizen event

1. Analysis of current sampling practices: Observe and to find out inefficiencies, bottlenecks, and opportunities for improvement, thoroughly examine the current clothing sampling procedure. Examining every phase of the sampling process from the initial design to the final sample production is part of this.

2. Identification of improvement in their work task: To find areas where the sampling method needs to be improved. This entails putting together cross-functional teams to carry out Gemba walks, generate ideas, and get feedback from front-line employees.

3. Implementation of lean-agile technique: In the hybrid approach, use agile development methods, like Scrum or Kanban, to oversee the iterative creation and enhancement of clothing prototypes. To efficiently arrange work and priorities tasks, set up sprint cycles, backlog grooming sessions, and sprint planning meetings. Use of lean- kaizen event which focus on small things, Changes that are gradual and steady growth. These things should know before applying the implementation.

a) Value stream mapping (VSM): To visualize the existing apparel sampling process, perform an exercise in Value Stream Mapping (VSM). Determine where the sample process might be improved and where waste and bottlenecks exist.

b) Form a cross- functional team: Put together a team with various backgrounds that includes production managers, designers, patternmakers, garment technologists, and quality control experts.

c) Visual management and communication Use visual management tools to monitor the status of sample tasks, like Kanban boards. Organize daily stand-up meetings to talk about progress, share priorities, and resolve any issues

4. Training and empowerment of employees: To improve the skills, knowledge, and problem-solving abilities of staff members engaged in the sample process, offer training and development opportunities. Encourage staff members to offer suggestions and take an active role in tasks aimed at improvement. Make sure everyone in the team is aware of the meanings of customer focus, continuous improvement, and waste reduction.

5. Measurement and monitoring of progress: Create key performance indicators (KPIs) to gauge how well improvements that have been applied are working. Review methods and track progress against KPIs frequently to evaluate how tactics affect lead times, expenses, quality, and customer satisfaction. Make any necessary modifications to the agile-Lean strategies based on the findings of the monitoring and assessment. To promote continual improvements in the clothing sample process, iterate and improve the improvement initiatives frequently.

6. Record and documentation of knowledge sharing: Keep a record of the successes, lessons learned, and best practices from the projects you carried out for the clothing sample procedure. To encourage knowledge sharing and the replication of effective improvement initiatives, share your observations and lessons learned with relevant parties

7. continuous improvement culture: Encourage an environment of continual improvement within the company by rewarding efforts, fostering staff engagement, and encouraging continued experimentation and feedback. Integrate lean-agile concepts into the organization's procedures and culture to maintain improvement initiatives in the long run. Provide standardized work processes with precise instructions and quality requirements for every step of the sample

process. Make sure that everyone in the team follows the established protocols to preserve uniformity and excellence.

8. Connectivity with Primary Business Goals: Make that the suggested changes are in line with the organization's strategic 35 aspirations and overarching business goals. Work together with important stakeholders to rank improvement projects according to how much they will benefit the organization's long-term performance. To inspire team members, recognize and celebrate small victories throughout the sampling process. Acknowledge and honor groups or people for their efforts to advance process enhancements.

First Case study based on analysis data information

Following the use of the above-described solution strategies, it is imperative to examine the outcomes and hold conversations to assess the efficacy of the modifications made to the apparel sampling procedure. Here is how to approach the findings and debate using actual events case study examples and an analysis comparing the traditional and lean approaches.

Method process	Front Bodice with placket and pocket	Back bodice with yoke	Sleeves with cuff	Collar making
Traditional pattern drafting	347s	312s	210s	150s
Technological with pattern drafting [CAD/CAM] without lean approach	210s	97s	98s	45s
Technological with pattern drafting [CAD/CAM] with lean approach	200s	97s	95s	43s

Fig 4- Analysis of pattern making samples with average seconds(s) of process method in the various parts of practices method women's shirt

Method process	Final ironing	Folding and Packing	Quality control
Traditional performer	110s	402s	55s
Technology without lean approach	50s	146s	54s
Technology with lean approach	45s	135s	54s

Fig 5- Analysis of shipment samples with average seconds(s) of process method in the various parts of practices method women's shirt

Consequently, these studies were completed in two weeks by gathering data via industry professional interviews and observations. The technological method of making women's shirts, which uses 65% human labor and 45% machine effort, is depicted in figures [4] and [5]. By integrating the analysis of work in the product development process, lean approaches can be applied to better improve the final model while saving time. With careful analysis, the time needed to create a garment can be reduced by a few extra minutes each unit of product development samples.

Second case study based on true event

The buyer firm rejected the shipment sample from ABC apparel manufacturer due to a strong curry odor emanating from the garment, which ended up leading to the sample being returned to the factory. QC experts eventually identify

the issue: the worker's hands were not adequately cleaned after lunch, which occurred just before folding the garment.

In this case study I using the lean approach of kaizen event implementation. Based on kaizen lean approach:

Step 1: Identify the problem Step 2: conduct Gemba walks Step 3: explain your root causes to the workers Step 4: Generate improvement idea Step 5: Implement the small change Step 6: monitor and measure Step 7: standardize procedure

In my final suggestion for a minor adjustment would be to wear hand gloves to prevent clothing odor. This way of approach can be easily solving the problem and continues the standardize procedure

CONCLUSIONS & SUGGESTIONS FOR FUTURE WORK

In summary, combining Agile and Lean approaches offers a viable way to improve the industry's overall product development as well as the sample procedure for clothing. Adopting Lean concepts like waste reduction and continuous improvement along with Agile techniques like iterative development can help garment firms cut expenses, increase product quality, and streamline their sample procedures. The application of these approaches promotes innovation, agility, and customer-centricity, which improves not just the sample process but also the larger objectives of product development. The cost-benefit analysis's findings show that applying Agile and Lean approaches will likely yield more benefits than expenses, making the investment financially feasible.

The complexity and difficulties involved in incorporating Agile and Lean approaches into the apparel product development lifecycle must be acknowledged, though. Obstacles that must be successfully overcome may include things like the requirement for cross-functional cooperation, the need for organizational and cultural change, and the requirement to align with supply chain partners. There are difficulties involved in evaluating and applying new product development (NPD) models to the sampling method used in the apparel sector. Organizations may occasionally experience difficulties with measurement, risk of over-engineering, complexity, reluctance to change, and resource limitations. Therefore, overcoming these obstacles calls for thorough planning, successful stakeholder participation, and a dedication to ongoing development. There is a lot of opportunity for more investigation and study in this area in the future. Subsequent research attempts may focus on enhancing and modifying Agile and Lean approaches to the distinct demands of clothing product creation. Furthermore, exploring how digital technologies like 3D prototyping, virtual sampling, and data analytics can be integrated could open new avenues for improving productivity, cutting costs, and shortening time-to-market for the development of apparel products. It could also inspire new opportunities for sustainable practices among buyers. In the end, even though there are obstacles to overcome, there are a lot of potential advantages to using Agile and Lean approaches in the creation of apparel items. Certain traditional apparel industry procedures are still used in India; these are primarily found in small and medium-sized enterprises. It is necessary to replace the current practices. Apparel companies can position themselves for success in a dynamic and increasingly competitive environment by utilizing technology-driven solutions, embracing a culture of continuous development, and encouraging cross-functional cooperation.

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