AI in Product Management
Prof. Zillur Rahman
Department of Management Studies
Indian Institute of Technology, Roorkee

Lecture - 39
Transforming New Product Development: The impact of AI (Part 2)

Welcome to this NPTEL online certification course on artificial intelligence in product management. Now, we are talking about module 39, which is transforming new product development and the impact of AI. So, to give an overview of this module, this module focuses on building a robust business case for product innovation and the critical decision-making processes involved in moving to development. It explores how AI plays a significant role in both the middle and back end of product innovation and processes such as design optimization, testing, and market analysis. Then, we will discuss strategies for post-launch evaluation, including using AI to analyze customer feedback and performance metrics.

By the end of the module, participants will understand how to leverage AI to streamline product development and improve outcomes throughout the innovation lifecycle. So, to introduce in today's competitive landscape, building a strong business case for product innovation is essential for success. This involves a thorough analysis of market needs, potential return on investments, and alignment with strategic goals, ultimately guiding the decision to move a project into development. Once in the development phase, AI plays

a transformative role, enhancing design processes, optimizing workflows, and facilitating data-driven decision-making. As products transition through the middle and back end of innovation, AI tools assist in testing, refining, and preparing for launch. After launch, leveraging AI to analyze consumer feedback and performance metrics ensures that products not only meet market demands but also drive ongoing improvements and innovations. Together, these elements create a comprehensive framework for effective product development and long-term success. So, we will now start with building a business case.

Many tasks in this stage resemble those in the concept stage but are conducted with greater depth and precision. This phase demands more accurate data and improved forecasts to build a solid business case. AI plays a crucial role in this process, providing valuable

insights and analysis that enhance the accuracy of predictions and support informed decision-making. As teams refine their product strategies, this is how it plays out. So, there are these five gates and PLR: discovery, idea generation, stage one concept, stage two build business case, stage three development, stage four testing and validation, and stage five commercialization launch.

So, we are talking about this, which is building a business case. Now, AI tools and applications for business cases seek and analyze online market data, provide insights, make predictions, market size, sales pricing, and cost. Monitor competitors' activity, launches, pricing, etc., spot technology trends and technology disruptions, get facts on a specific technical subject, answer technical questions, for example, ChatGPT, analyze financial data and make revenue and profit projections, simulate different scenarios, gauge the impact of factors like price and competition on profits, predict how well a particular product will sell. And identify potential risks and propose mitigating actions. So, these are the AI tools that are used here.

So now, let us start with market analysis. AI is utilized to gain insights into market size, competition, and target customer segments. By analyzing marketing data from various sources such as online reviews, social media, and sales figures, AI tools can provide a comprehensive understanding of the marketing landscape. These tools also enhance predictions related to market trends, sales forecasts, pricing strategies, and costs, enhancing decision-making for product development. When equipped with the appropriate data, machine learning algorithms can identify patterns that may not be recognizable to humans, significantly improving prediction accuracy.

Numerous software solutions are available that specialize in market data collection and analysis, including platforms like Monday Funnel and SAS Customer. These tools empower businesses to make informed strategic decisions based on robust market insights. The next is Technology Analysis. AI software offers real-time insights into emerging technology trends, investment activities, and potential disruptions in the tech landscape.

With tools like CB Insights leading the way by continuously monitoring various data sources, these platforms help organizations stay informed about the latest developments and shifts in technology that could impact their product development efforts. Tools like ChatGPT can answer questions in real time, swiftly aggregating relevant facts and information on specific technical topics. Competitive intelligence AI-powered tools like Crayon play a vital role in monitoring competitors' activity. And tracking key elements

such as product launches, pricing changes, and marketing campaigns. By utilizing sophisticated algorithms, these platforms gather and analyze vast amounts of data to provide organizations with insights into their competitors' actions. This continuous monitoring enables companies to stay updated on market trends and shifts, ensuring they are aware of the competitive landscape. AI enhances competitive intelligence by

Delivering real-time insights into competitors' strategies, market positioning, and customer targeting efforts. By analyzing this data, organizations can gain a deep understanding of how their rivals operate and where they focus their resources. This knowledge is essential for project teams as they seek to define their own strategies and offerings in response to competitive pressures. With these inputs at their disposal, project teams can make informed decisions regarding product differentiation and identify potential market opportunities. By understanding competitors' strengths and weaknesses, businesses can tailor their product development efforts to better meet customer needs and carve Out their unique positions in the market. Leveraging AI for competitive intelligence not only improves strategic decision-making but also enhances a company's ability to innovate and thrive in a dynamic environment.

Financial Analysis AI-powered tools are instrumental in analyzing market sales and other financial data, assisting project teams in constructing robust business strategies for their initiatives. By leveraging historical data from similar products, these tools can predict sales performance and potential earnings for new offerings. This capability enables teams to make data-driven decisions and enhance the overall viability of their projects. AI can simulate various scenarios to assess the potential impact of different factors such as pricing strategies and competitive dynamics. Risk Assessments and Management Risk assessment and management represent one of the most advanced applications of AI in the business landscape.

By utilizing big data and machine learning, these tools enable project teams to identify potential risks that may not be immediately apparent. These proactive approaches enhance the team's ability to foresee challenges and prepare accordingly, ultimately strengthening the project's resilience. AI applications are evolving to not only propose mitigating actions but also to adjust product plans automatically in response to identified risks. As these capabilities continue to develop, organizations can expect more dynamic and responsive project management processes to navigate uncertainties with greater agility and precision. This level of automation will further enhance decision-making and improve overall project outcomes.

The next thing that we will talk about is the decision to go to development. So, the go-to-development decision is one of the most critical resource commitment choices in the new product development process, marked at gate 3 in the given figure. Figure given below. So, this is stage 3, and the AI tools and applications for development and testing include creating 3D models and generating technical drawings, creating mock-ups, virtual prototypes, digital models, designing products with the right features and dimensions, designing products that are more user-friendly and aesthetically pleasing, developing digital models and virtual prototypes for rapid and iterative product testing, doing multiple design iterations and analysis quickly, Undertaking structural optimization, reducing weight and cost, optimizing design with digital twins, being able to mimic a product in the field, monitoring it and collecting data on its operations, creating or discovering products, chemicals, and drugs, and automating project management.

So, this is what we are talking about: development and testing. While AI provides valuable tools for enhancing project selection and prioritization, the idea of relying solely on a robot to make go-kill decisions in an NPD project remains a significant leap. An AI expert and vice president of an AI software firm in Shanghai noted, just like Tesla's autopilot driving system, AI is not yet reliable enough to replace a human driver. It serves as a useful co-pilot or assistant to help individuals navigate.

He elaborated that organizations could leverage AI to assist in new product selection decisions, but human oversight remains essential for verifying and evaluating the results. His prediction suggests that it may take another 5 to 10 years before AI can independently make go-kill decisions without human interaction. This underscores the importance of human expertise in the decision-making process, even as AI continues to evolve and improve. AI has the ability to identify development-ready projects that possess the right fundamentals and predict which projects are more likely to succeed or deliver significant benefits.

By analyzing large volumes of data and recognizing patterns more effectively than humans, AI decision models can also eliminate human biases from the decision-making process. Through neural network analysis, which is a figure given on the next slide, AI can predict the success or failure of new products with greater accuracy than human decision-makers. So, this is neural network analysis of data from past product projects, resulting in a predictive model of new product success. So, here we have product features: unique superior product, higher value to user, market needs, growth and size, attractiveness,

leveraging the firm's core competencies, and market and tech newness of the firm. Then we have the input layer: feature 2, 1, 2, 3, 4.

There is a hidden layer, and then there is the output layer. So, that gives the commercial success probability. For instance, the new product model utilizes characteristics such as market attractiveness, unique product benefits, and the competencies of the firm to forecast outcomes. This model was developed using both neural network analysis and traditional statistical methods. Drawing from data on several hundred past new product projects with known commercial results.

While senior management remains cautious about fully entrusting NPD decision-making to AI, the finance sector demonstrates a different trend. A Hong Kong venture capital fund, for instance, attributed its recovery from near bankruptcy to an algorithm named Vital rather than a seasoned investment professional. This highlights the potential for AI. To play a significant role in decision-making processes, including those in NPD, though it remains to be seen how quickly this transition will occur. AI can assist in portfolio management by evaluating multiple projects and selecting or prioritizing them to achieve a more balanced project portfolio or maximize overall value within specific constraints.

For example, Accolade utilizes AI to optimize a firm's development portfolio, ensuring that resources are allocated effectively. Now, we will look at AI's role in the middle and back end of product innovation. So, we will start with the development stage. Numerous AI applications are recognized, with various software vendors promising additional capabilities. However, the primary AI applications for physical new products can be distilled into four key areas, as illustrated in the figure given on the next slide.

So, we are talking about stage 3. And these are the four: AI optimizes and creates optimized product design, undertakes rapid test iterations, and even discovers products. So, we have product design; AI automates design tasks. For example, creating 3D models or making technical drawings with the right features and aesthetics. Rapid iterative product testing is next.

AI develops digital prototypes or models for rapid testing. For example, GE and Turbine, Moderna and mRNA. The next step is design optimization. AI optimizes product designs, reduces weights and costs for structural components. GE uses digital twins to optimize product performance.

The next is product discovery. Pharma uses AI for drug discovery. AI screens many compounds; Pfizer and Atomwise, Unilever, new cleaning enzyme, new skincare products. So, AI reduces... lots of development time and cost at the development stage, the use of AI to design the product, the development of digital prototypes and models to permit rapid testing of product iterations, design optimization, the discovery of new products, for example, the identification of a molecule that meets certain requirements. So, the development stage, the first is product design.

AI significantly enhances the product design process by automating various design tasks, such as generating 3D models and creating technical drawings. Deepan Mishra, a senior advisor at Amazon Web Services, notes that developing a physical prototype or even a 3D representation of a product requires substantial physics knowledge. However, AI can produce mockups and virtual prototypes within just a few hours. Mishra emphasizes that the ability to generate content rapidly and with a high degree of accuracy is one of the most exciting aspects of this technology.

AI's capabilities extend beyond engineering design. Autodesk leverages prompts to guide AI in assisting clients with designing products that feature the appropriate specifications for their target markets. For instance, John Houser from MIT, in collaboration with General Motors, has developed two models. A generative model that produces new car designs based on designers' prompts regarding viewpoints, colors, and body types, and a predictive model that anticipates consumer ratings of car designs concerning aesthetics, appeal, and innovation.

Through predictive modeling, automakers can swiftly discard designs that are predicted to have low appeal among buyers, preventing them from advancing to consumers' theme clinics for evaluation, which are time-consuming and costly, often exceeding $100,000 each. This approach leads to significant savings in both time and cost during the development process. The second is rapid iterative product testing. AI facilitates rapid testing of multiple product iterations by enabling the development of digital prototypes and models during the design phase.

For instance, humans employ AI to generate virtual prototypes that can be tested and refined before actual production begins. This technology also optimizes design for performance, significantly reducing the number of required iterations. High-fidelity digital prototypes are created for validation, and the results from these validations are utilized to enhance both the product design and the associated manufacturing processes. The outcome

of digital product validation is remarkable. GE has managed to halve design times by incorporating AI into its rapid design testing for turbine development. Traditionally, it took engineers two days to conduct a computational analysis of fluid dynamics for a single turbine blade design. However, with machine learning,

a surrogate model can now evaluate a million design variations in just 15 minutes. In a different industry, Reynolds utilized AI simulations to streamline the development of its automated manual transmission. This simulation technology is based on neural networks, which mimic the human brain's learning processes. Design engineers can predict the AMT's behavior and performance, allowing them to make necessary adjustments early in the development cycle.

This proactive approach helps avoid late-stage issues and delays, effectively reducing AMT's development time by nearly half. Similarly, the biotech company Moderna harnesses AI to develop and test thousands of mRNA-based medicines and vaccines. In an industry where drug development can cost billions with a mere 15% success rate, AI enhances these odds to 50% and accelerates the time to market. Moderna's web-based drug design applications streamline the input of information encoded in synthetic mRNA molecules, with AI algorithms guiding molecular design through data-driven predictions of optimal code sequences.

The third step is design optimization. Design optimization problems are typically addressed iteratively by designers who refine an initial design through multiple rounds of engineering analysis and interpretation. A common application of AI in design is structural optimization, which involves creating parts that deliver adequate strength, stiffness, and fatigue resistance while minimizing material use. Across various industries, including automotive and aerospace, generative algorithms have achieved reductions in part cost by 6-20%, weight by 10-50%, and development time by 30-50%. For instance, McKinley highlights a tool manufacturer that reduced the weight of a forged steel component by 38% and its cost by 15%.

AI and machine learning are integral to GE's digital twin technology, enabling the collection, analysis, and actionable insights derived from data to optimize products. GE has developed an extensive catalog of digital twins, which has generated approximately $1 billion in value. The fourth is the discovery of products. Major pharmaceutical companies are increasingly utilizing AI for drug discovery. A successful drug discovery project aims

to identify biologically active lead molecules that are chemically distinct from existing drugs targeting specific diseases.

AI significantly accelerates this process by screening numerous compounds from extensive sources and libraries. Lilly and Sanofi have partnered with the AI firm Atomwise to employ AI deep learning techniques to analyze millions of potential drug compounds and identify promising candidates for further testing. The next step is project management. AI tools significantly enhance project management by facilitating scheduling processes and drafting detailed plans and resource requirements. These automated reporting systems produce real-time data, replacing traditional reports.

that are often weeks out of date. These tools offer deeper insight than currently possible, clearly displaying project status, benefits achieved, potential delays, and team sentiment objectively. AI-based product management tools such as Albert, Invent, Asana, and Trello assist in efficient data management, project scheduling, and resource allocation. According to the Project Management Institute, AI enhances project management and planning in several ways, including automating time-consuming tasks such as project planning with dynamic and flexible timelines, Gantt charts, and resource allocation models.

AI facilitates data collection and analysis of data compilation times, resource utilization, and project costs. It employs predictive analytics to analyze extensive project data, uncover hidden patterns in time and resource usage, and forecast project outcomes. Natural language processing is utilized to analyze project documentation like charters, plans, and reports, while machine learning improves prediction accuracy over time and optimizes resource allocation by identifying the most efficient use of resources for each task. Real-time monitoring and control systems track project progress and alert project leaders to potential issues.

AI also provides decision support by delivering data-driven insights, enabling more informed decisions. such as whether to allocate additional resources to a task or adjust the project schedule. Validation and Testing: While much iterative testing occurs during the development stage with models, virtual products, digital twins, and digital prototypes, many firms still engage in formal and rigorous field trials, beta tests, or in-home consumer tests of pre-production physical prototypes or minimum viable products. The testing and validation stage The figure that is given on the next slide is crucial as it ensures that the final product meets requirements and specifications under real-use customer conditions.

So, this is what we are now talking about: testing and validation. So, develop pre-production prototypes. AI creates optimized, pre-tested product designs and also real products. Tested designs are easily converted to 3D-printed or physical products ready for customer testing. Processing test results from customers.

Generative AI and NLP convert unstructured feedback from customer tests into useful data, charts, and trend lines to gauge acceptance and learn what customers like or dislike. Digital twin algorithms analyze data from sensors in test products to identify defects. That is, for self-driving vehicles, test cars contain sensor data that collect on-the-road data and feed the virtual twins. IoT and systems for smart and IoT products, and products with multiple systems, advanced automated simulations, and system testing software allow early detection of defects and self-correcting processes. AI significantly enhances this vital stage in several ways.

The first is building physical prototypes. AI is employed to create prototypes more quickly and efficiently. As mentioned earlier, AI aids in generating optimized or pre-tested engineering CAD designs, facilitating a swift transition from a blank screen to rapid or 3D-printed near-final prototypes or actual components ready for physical product testing. Building physical prototypes in the realm of consumer products, Unilever's Materials Innovation Factory has utilized robots and AI for product development and testing for the past five years. Unilever claims that MIF has the highest concentration of robots engaged in material chemistry globally, with each machine capable of processing colossal amounts of data and maintaining consistency across samples and tests.

In 2022, products developed by MIF accounted for one-third of Unilever's tech-driven product sales, leading to the successful creation of items like Dove Intensive Repair Shampoo and Conditioners, Living Proof Perfect Hair Day, dry shampoo, and Hourglass cosmetics. The second stage is testing the methods of creating and testing digital products, digital twins, and models that have been previously discussed. These digital twins or models are also beneficial for field testing physical products. Algorithms analyze data from sensors embedded in the test product to identify potential defects or quality issues.

For example, road testing of new vehicles often utilizes digital twins in the development of self-driving cars. These test vehicles are equipped with numerous sensors that collect on-road data, which is then fed back into the digital twins for analysis. The next step is commercialization and launch. AI significantly enhances how companies market their new products more effectively. So, that is the figure given on the next slide.

It guides project teams in developing comprehensive marketing launch plans, outlining strategies and tactics to effectively reach target markets. With AI-driven marketing plan generators such as TaskAid, project teams can easily create highly effective marketing plans. AI also aids in executing various elements of the marketing mix, with numerous tools available for creating, planning, decision-making, and execution. So, this is what we are now talking about, which is commercialization and launch. So, AI tools and applications for the backend market launch create the market launch plan, the strategies and tactics, create advertising text, images, and videos, do lead scoring of customers for the sales force, also routing, even suggest the best action for the sales teams, manage product distribution, get the right product assortment, and optimize pricing strategy.

Then we move on to production and manufacturing, optimize production processes and warehouse processes, use digital twins to simulate machines and factories, employ digital twin simulation to validate new production techniques and systems, manage the supply chain, provide employee training, manage quality control, and employ blockchain to track goods in real time. At the post-launch stage, analyze customer feedback and market data to see usage patterns. User comments and complaints use digital twins to monitor the performance of products in use and to spot issues. For instance, a substantial 78% of B2B and 65% of B2C firms now utilize generative AI such as ChatGPT to produce advertising text, images, videos, and other content. Google employs AI to target ads to individuals who are likely to be interested in its products, while Amazon leverages AI-powered product recommendations to engage customers and boost revenue through strategies like 'Recommended for You' and 'Frequently Bought Together.'

In the areas of salesforce and distribution, AI automates lead scoring and sales routing, predicts customer behavior and preferences, and suggests the next best action for sales teams. For example, Procter & Gamble utilizes machine learning algorithms to determine the optimal product assortment for both physical and virtual stores while analyzing in-store data regarding product availability. Regarding pricing, AI assists companies in establishing appropriate pricing strategies. Netflix employs AI to personalize subscription pricing based on individual viewing habits. While Uber uses AI to optimize its pricing strategy through machine learning algorithms and predictive analytics, dynamically adjusting prices based on real-time demand. After a product launch, AI continues to play a crucial role in its success. AI and natural language processing algorithms meticulously analyze customer feedback and market data to identify usage patterns, comments, and complaints. This enables companies to pinpoint

potential issues or areas for improvement in the newly launched products, facilitating design refinements aimed at achieving total customer satisfaction. The analytic insights provided by AI are also invaluable for developers, guiding the direction of future product development efforts. For example, each new Tesla vehicle on the road is paired with a digital twin that collects performance data through embedded sensors and relays this information back to the twin. This allows for invaluable feedback based on the vehicle's real-world operations.

In the aviation industry, GE has implemented digital twins for its GE90 engines on Boeing 777 aircraft, which helps predict engine degradation. Similarly, Siemens, a pioneer in digital twin technology, has introduced ATOM, a virtual model for its gas turbines and compressors. Blockchain technology is expected to serve as a robust repository for the vast amounts of data generated by the digital twins. So, to conclude, AI has truly arrived in full force, significantly transforming new product development by enhancing speed, efficiency, and quality for early adopter firms.

The impact of AI has been likened to the industrial revolution, but today's rapid pace of technology adoption promises even quicker changes in business dynamics. This is the moment for organizations to embrace AI as a transformative technology, not just for NPD but across all facets of the business. Experts emphasize that the journey should not involve adopting AI in a piecemeal fashion, as it is easy to be captivated by isolated applications in NPD, marketing, or production instead of holistic transformation, which is essential. According to Deloitte, one of the key practices for successful AI transformation is the establishment of a bold enterprise-wide strategy championed by an organization's highest leadership.

The time for such decisive action is now. These are some of the references from which the material for this module was taken. Thank you.