Product design / development / engineering | Retail | Product design and testing | FEA

Enhanced Digital Capability through the use of Simulation in Footwear Product Creation

BUSINESS PROBLEM

Digital capabilities have been identified as a key growth opportunity for footwear companies. The goal is to increase speed to market by reducing the average product creation timeline, in large part through an end-to-end digital strategy. A Product Creation Center serves as a nexus of collaboration, creation, and education in footwear, and may be seeking to evolve its capabilities by investing in performance-focused digital tools. Specifically, this project investigated Finite Element Analysis (FEA) simulation programs and other design-aiding software as tools for improving design process flows while generating cost and time savings.

APPROACH

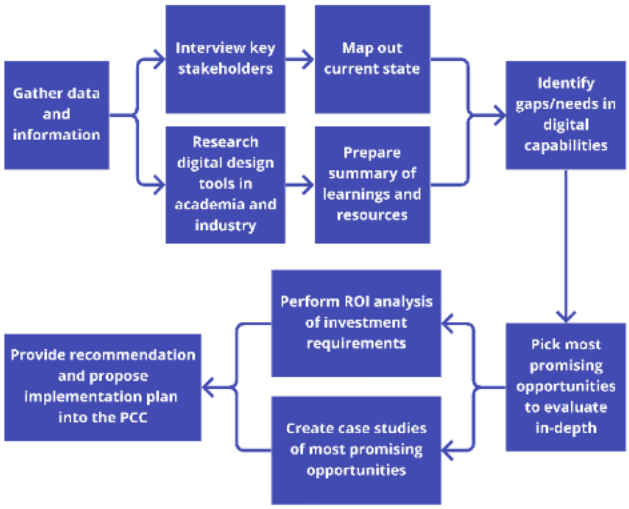
Information was gathered by interviewing key stakeholders and researching state-of-the-art simulation tools in product creation. Potential areas of analysis related to digital simulation capabilities were identified, and one example was detailed through a technical case study on the performance of soccer cleats. A cost-benefit analysis of the investment requirement for this example was developed.

DATA SOURCES

Information about digital capabilities was obtained through a state-of-the-art literature review, speaking with simulation experts, exploring existing internal knowledge through stakeholder interviews at the host site, observing internal processes, and shadowing work in a product creation center.

Data Types and Format

Qualitative data obtained through stakeholder interviews, CAD models, physical test data from 3D-printed models, and outputs from FEA software programs (stress, strain, and displacement data)



Author: Zoe Hinton

IMPACT

Enhanced digital capabilities have the potential to enable better decision making in the product development process at footwear companies. While there are no regulations or standards to be met as is usually the case in other industries that utilize tools like FEA, simulation is still valuable in footwear creation when comparing relative design features and models. One benefit of FEA is the potential to increase communication between designers, engineers, and manufacturing partners. Teams can test and iterate on multiple designs without making a physical sample while being able to visually communicate product behavior to designers. Design teams can have increased confidence in their products earlier in the design process as opposed to waiting for physical testing. FEA can also help save critical time and cost. FEA saves some cost by eliminating the machining of tooling needed for additional physical sampling rounds. But most importantly, teams can avoid waiting longer lead times to receive samples. Enhanced digital capabilities can also contribute to a company's sustainability goals by reducing materials and tooling used for physical sampling.

DRIVERS	**Footwear companies must balance multi-year product development timelines and the risk with changing trends and attitudes of their consumers. It is therefore critical to shorten development timelines as much as possible. Digital simulation tools are commonplace in many industries, though it has previously been difficult to apply to the soft materials and geometries of footwear. Exploring how to implement digital tools is considered a top priority.**
BARRIERS	**Learning the appropriate FEA program to run simulations on footwear materials and geometries can take 6–12 months of training, which was out of the scope of the internship. It was a barrier to pick an appropriate technical case study that demonstrated this complexity that could be learned and performed quickly alongside a trained engineer. Coordination among engineering departments to get appropriate models and data was also vital.**
ENABLERS	**I had great support from multiple teams, as well as my manager. When I started, I was provided with a thorough deck outlining an organizational matrix and annual goals, as well as a list of important stakeholders to meet with among engineering and product teams. Later on, I was given priority to gather information from multiple teams, and even had support from business leaders to follow up with teams on my behalf.**
ACTIONS	**I began by immersing myself in all the teams I would be working with by performing one on one meetings to gather context and information from all levels, from designers and engineers to senior directors and VPs in product creation. From this I defined opportunity areas and gathered feedback. I down selected to one specific opportunity in order to provide a detailed technical and business analysis.**
INNOVATION	**On the technical side, I was able to demonstrate an example of a simple engineering analyses that could be used in place of full FEA simulations. On the business side, I developed a new take on a cost-benefit analysis that attempts to replace a quantitative return on investment analysis with something that addresses the qualitative factors that affect product creation and development.**
IMPROVEMENT	**My solution was able to map out the state of engineering analysis among multiple teams to provide transparency and sharing of knowledge. While FEA may not be best suited for a prototyping environment like a product creation center, I was able to demonstrate the advantages and benefit of the digital tool as well as outline different methodologies with varying levels of complexity to gather information for footwear designs decisions.**
BEST PRACTICES	**It is essential to get context surrounding current goals and practices as well as culture from the team level up to the department or company level. Final solutions should be tailored to the final audience, so having a solid understanding of a company's strategies, goals, and method of communication is invaluable.**
OTHER APPLICATIONS	**My solution only identified one use case for a specific performance metrics in sports footwear. This could be applied to different types of footwear or metrics. In addition, the process of going through a qualitative cost-benefit analysis can be applied to other investment decisions in the future, especially those that relate to digital tools in product development.**