Building a Digital Thread and Analytics Model to Improve Quality Controls in Medical Product

Johnson & Johnson

BUSINESS PROBLEM

The Ethicon supply chain currently collects data in various stages of its supply chain but the information is fragmented across the end-to-end chain, resulting in a more reactive supply chain. The goals of this project are: 1) enable end-to-end visibility into the supply chain and help create a more proactive and reliable supply chain by building a digital thread for a surgical stapler product 2) create visualizations to provide visibility and insight into the existing production process 3) Use advanced analytics models to identify key components or measurements that affect the product's Force to Fire final quality inspection results

APPROACH

1. Understand the concept and advantages of supply chain digital transformation, digital twins, and digital threads 2. Define project scope and goals 3. Identify and retrieve available data 4. Understand how data from different systems connect 5. Build digital thread 6. Visualize data 7. Build models 8. Model selection 9. Analyze and validate model output 10. Recommendations for next steps
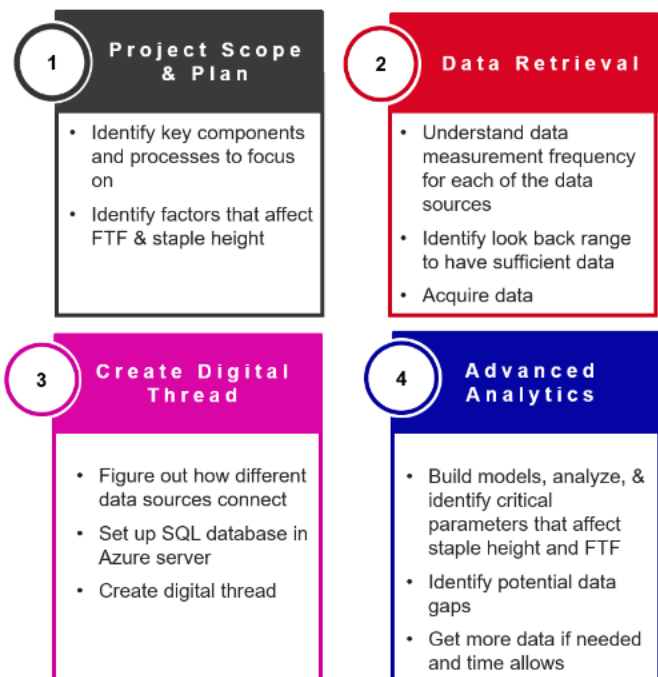
DATA SOURCES

Supplier data containing measurements sampled during the production process, process documents and inspection results for manufacturing & assembly, and customer complaint data

Data Types and Format

Measurements manually recorded onto Excel spreadsheets, paper, images of machinery settings per batch

1 Project Scope & Plan

- Identify key components and processes to focus on
- Identify factors that affect FTF & staple height

2 Data Retrieval

- Understand data measurement frequency for each of the data sources
- Identify look back range to have sufficient data
- Acquire data

3 Create Digital Thread

- Figure out how different data sources connect
- Set up SQL database in Azure server
- Create digital thread

4 Advanced Analytics

- Build models, analyze, & identify critical parameters that affect staple height and FTF
- Identify potential data gaps
- Get more data if needed and time allows

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IMPACT

Reduce the risk and variability in the circular stapler product, understand the current state of the data as it relates to the physical process, identify data gaps, and gain a better understanding of product and process relationships. The digital thread provides visibility into the end-to-end physical material flow of the product and has the opportunity to provide real-time monitoring and control of the end-to-end supply chain in the future.

DRIVERS

As technology advances, companies have been embracing digital transformation, digitizing their factories to create visibility into the process and enable data-driven decisions that improves product quality, production efficiency, and provides feedback to designers, creating a closed-loop and transparent system. Digital transformation is now one of J&J Ethicon's primary focus, with goals of having end-to-end connectivity over the next four years.

BARRIERS

Connecting with people remotely, particularly establishing trust and rapport with external suppliers in order to get them comfortable enough to share their data. Navigating the matrix organization structure of J&J where everyone is on multiple projects at the same time and getting time from people, data availability, quality, and maturity were also sometimes a challenge given the tight timeline.

ENABLERS

A well-scoped project, a supportive and knowledgeable project team and supervisor who can point me in the right direction, and others willing to share their experiences. Another ongoing project in the company laying the groundwork and working through the initial challenges enabled me to move more quickly to the model building phase of the project.

ACTIONS

A lot of interviews with stakeholders to understand their position on the project. Interviews with subject matter experts to learn about the process and current state. Research on existing industry examples and academic results. Continued relationship building conversations with supplier representatives and efforts in demonstrating the collaborative effort this project is hoping to establish.

INNOVATION

- The creation of a digital thread that can be used and easily understood by users. - Machine learning models built that demonstrated correlations between key components of the product and the end-of-line quality test results

IMPROVEMENT

More visibility into the current system and proof that more granular (serialized) data needs to be collected to enable Ethicon's vision of predictive models catching potential errors during the assembly process.

BEST PRACTICES

Connect with stakeholders early on and start building rapport with them, especially if they are external to the company and key to the project's success

OTHER APPLICATIONS

Any manufacturing system could benefit from having digital threads and digital twins in their systems.