Problem Statement Worksheet (Hypothesis Formation)

How can Nordic Sensing Company approve and enact a plan to address sensor failure rates for InSense systems within 24 hours that will implement the changes required to reduce failure rates to less than 5% for systems produced at the production volume required to meet existing order deadlines for these systems?

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1 Context

Nordic Sensing Company (NSC) is a well-situated entity in the IoT sensor space that focuses on energy consumption and production. InSense is an energy tracking sensor offered by NSC to the residential energy usage space. VP of InSense received reports from a team in Singapore of a major spike in sensor failure rates for packages undergoing pre-ship testing. A 1-2% failure rate was considered normal during early-stage development testing. March summaries indicate a current failure rate of 15%. NSC has large orders for these systems, and failure rates need to be reduced to less than 5%. The InSense system is a sensor package manufactured in Asia. There are four factories "refocused solely" on these systems. Each system is made of 7 parts. There are 26 suppliers for these parts.

2 Criteria for success

1 - NSC leadership must unite on and approve a plan of action within 24 hours. The analysis provided by Manufacturing Analytics will combine with esoteric domain knowledge and existing order deadlines to form the basis of this plan and the details of its implementation.
2 - The Engineering and Manufacturing departments must certify that this plan will reduce failure rates to less than 5% without reducing production volume below the rate required to fulfill existing orders for InSense systems.

3 Scope of solution space

This problem is limited to InSense systems. A fixed solution *implementation* deadline cannot be imposed without additional information. A solution is this context is limited to the development, certification, and approval of a plan of action within 24 hours. Solutions will involve meetings with Manufacturing Analytics, NSC leadership, and InSense leadership. Plan formulation may involve analysis of testing data, analysis of testing equipment and test procedure, inquiry about and analysis of any changes made immediately preceding the spike in failures (to supplying, manufacturing, testing, storage, shipping, or handling), analysis of early-stage development testing for miscalculation or potential design flaws, investigation of alternative manufacturing techniques, projected cost analysis of increasing production capacity to offset increased failure rate (provided 'sensor failure rate'' refers to percentage of systems that do not work, and not a condition in which all sensors fail 15% of the time), and inquiries regarding the availability and production capacity of alternative facilities for InSense systems or alternative suppliers for InSense system components.

4 Constraints within solution space

The phrase "maintain sufficient production volume to meet existing orders" is inherently time-bound, as production volume measures units produced per unit of time. The failure rate reduction to 5% or lower must be delivered by a nonarbitrary calendar date between now and the order deadlines, but said date cannot be expressed explicitly without order information and esoteric domain knowledge. A specific number of units produced at 5% or lower failure rate within a specific timeframe is quantifiable, but the actual deadline for this deliverable can only be expressed in terms of unprovided information. In general, this issue is constrained by a lack of data and incomplete communication. A plan detailing a solution addressing these issues must be concrete within 24 hours. Certification and approval within 24 hours are measurable as booleans. Constraints include the amount and quality of data provided, the quality of analysis returned, and the availability of personnel required to formulate, certify, approve, and enact this plan.

5 Stakeholders to provide key insight

Vince Maccano - Head of Data Science
Jane Smith - Data Scientist
Shane Buchholz - Head Engineer
Gary Neumont - Head of Manufacturing
Jessica Jones - QA/QC Engineer
Otto Evans - InSense President
Tony Abaraham - InSense VP
NSC Executive Management
Bernard Ong - CTO
James Hansk - CEO

6 Key data sources

A thorough definition of 'sensor failure' is required. Order data for these systems is required. The complete InSense testing data is needed. A 20,000 row subset of the data has been made available as an excel file. Testing equipment diagnostic data and information regarding testing procedure are also required. If unavailable, the testing equipment must itself be tested immediately. The early-stage development testing data and parts/manufacturing details for sensors used in these tests would be useful in ruling out inherent design flaws. Further information on manufacturing processes, component vendors, and logistics may be required. Component inventories may be required. If analysis does not suggest any apparent causal relationship for increased failure rates from specific components, suppliers, facilities, practices, employees, or combinations thereof, additional data on the storage, shipping, handling, and testing procedures for assembled systems may be required. Data on alternative manufacturing facilities may also be required.

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