# AI Chain Analysis Using Multi−Sigma®

## 1. AI Analysis of Multi-Step Processes: Challenges of Conventional Methods and AI Chain Analysis

A common practice in analyzing multi-step processes is using a single AI model. In such cases, it is necessary to reacquire experimental data for the entire system if there is a change in the conditions of a single process. Also, as multi-step processes are represented by a single AI model, it is difficult to understand the internal phenomena within the system. (See Figure 1)
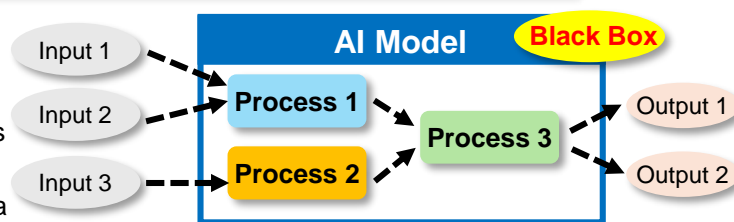


Figure 1: Using a Single AI Model for Multi-Step Processes

To address these challenges, Multi-Sigma® introduces an AI chain analysis system in which AI models are built for each individual process and connected to form a single integrated AI system for analysis. This integrated system of AI models enables prediction, factor analysis, and multi-objective optimization. (See Figure 2)
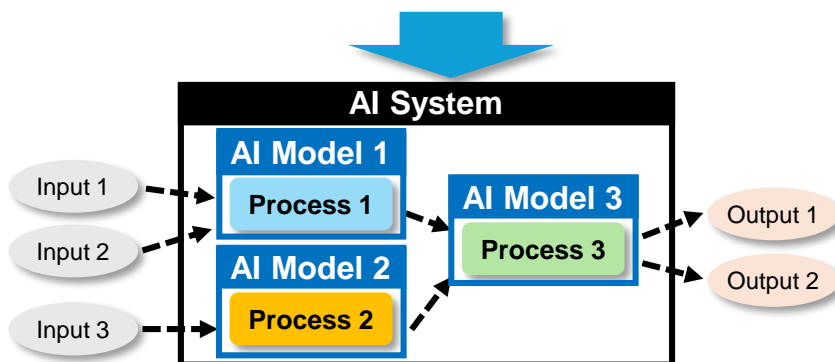


Figure 2: AI Chain Analysis of Multi-Step Processes.

## 2. Advantages of Chain Analysis Using Multi-Sigma®

The concept of breaking down complex multi-step processes into smaller units and then combining them into a system is referred to as **modularization**, often used in mechanical engineering. In semiconductor and chemical engineering disciplines, this concept is referred to as **process integration** and **process systems engineering,** respectively.

**AI chain analysis** feature in Multi-Sigma® helps teams collaborate across departments, streamline workflows, and ultimately maximize profits. For example, workflows in market research, design, development, sales, and marketing departments can be represented as individual AI models. These models can be connected to form a comprehensive AI system that encompasses the entire operational flow. (See Figure 3)
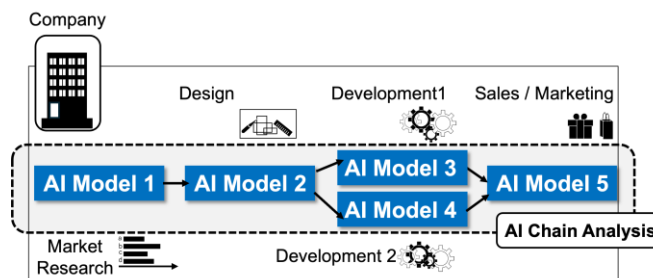


Figure 3: AI Chain Analysis Across Different Departments.

It is also possible to perform cross-organizational analysis. For example, if a series of business activities is carried out by a parts manufacturing company (A), a processing company (B), a heat treatment company (C), an assembly company (D), and an export company (E), the **AI chain analysis** feature can provide predictive analysis and workflow optimization across companies. This enables the creation of new business opportunities and promotes more effective collaboration between companies than ever before. (See Figure 4)
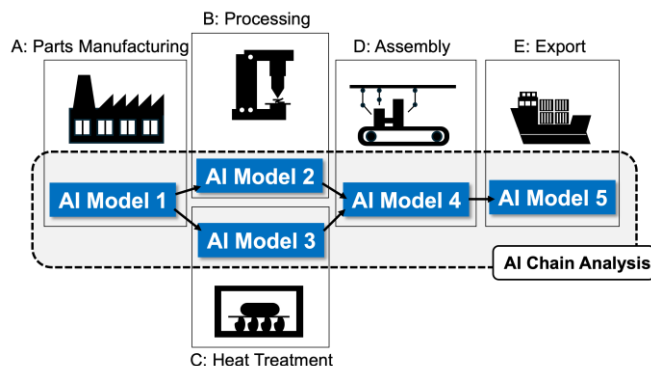


Figure 4: AI Chain Analysis Across Different Companies.