**Case Study: Design for Manufacturing & Assembly (DFMA) in Automotive Industry**

📌 **Case Study Focus:** Redesigning an **Automotive Engine Bracket** to Reduce Cost and Assembly Time

**1. Background**

A major **automobile manufacturer** was facing **high production costs and assembly time** for an **engine bracket** used in multiple vehicle models. The original design was **heavy, difficult to assemble, and required multiple fasteners**.

**Challenges Identified:**

❌ **High Material Cost** – The bracket was made of **stamped steel**, increasing weight and material usage.
❌ **Difficult Assembly** – Required **four bolts and washers**, increasing installation time.
❌ **Excessive Weight** – A heavier bracket increased fuel consumption and impacted **vehicle efficiency**.
❌ **Manufacturing Complexity** – The **stamping and welding process** had multiple operations, increasing defects.

**2. DFMA Implementation**

The company applied **Design for Manufacturing and Assembly (DFMA) principles** to simplify manufacturing and **optimize assembly time**.

**A. Design Changes for Manufacturing (DFM)**

✔ **Material Change:** Switched from **stamped steel** to **die-cast aluminum**, reducing weight by **40%**.
✔ **Integrated Features:** Designed a **single-cast component**, eliminating welded joints.
✔ **Eliminated Secondary Operations:** The new design **reduced machining** by incorporating **as-cast holes and ribs**.

**B. Design Changes for Assembly (DFA)**

✔ **Fastener Reduction:** Number of bolts **reduced from 4 to 2**, decreasing assembly time.
✔ **Self-Locating Features:** Added **guide pins and chamfers** for easy alignment.
✔ **Standardization:** Used **common fastener sizes** to eliminate tool changes.

**3. Results & Benefits**

| **Metric** | **Before DFMA** | **After DFMA** | **Improvement** |
| --- | --- | --- | --- |
| **Material Cost** | High (Stamped Steel) | Lower (Die-Cast Aluminum) | **30% Cost Reduction** 💰 |
| **Weight** | 2.5 kg | 1.5 kg | **40% Lighter** ⚖️ |
| **Assembly Time** | 3 min | 1.5 min | **50% Faster Assembly** ⏳ |
| **Fasteners Used** | 4 bolts & washers | 2 bolts (integrated fasteners) | **50% Reduction** 🔩 |
| **Manufacturing Steps** | Stamping + Welding + Machining | Single Die-Casting | **Simplified Process** 🏭 |

✅ **Overall Impact:** Lower production costs, faster assembly, improved vehicle efficiency, and reduced weight.

**4. Lessons Learned from DFMA Implementation**

🔹 **Material selection can significantly impact weight and cost.**
🔹 **Reducing fasteners and assembly steps lowers labor time and errors.**
🔹 **Integrated design reduces secondary manufacturing operations.**
🔹 **Standardized parts help in mass production and quality control.**