

Bringing a New car to Market 7a

Production and Quality Control

Jim Rauf

Steps in Bringing a New Car to Market

Introduction

A little history

Automobile industry

Product Planning-Market Analysis & Identification of Opportunities

Understand market trends, consumer preferences, emerging technologies and government regulations

Analyze competitors - identify gaps in the market for new car

Concept and Design

Translate market insights into conceptual ideas for a new car

Collaborate with design teams and engineers to develop innovative and appealing vehicle concepts

Engineering and Development

Design the vehicle - safety, performance, and efficiency

Extensive testing - prototype testing, crash testing, emissions testing and performance testing

Address any design or engineering challenges that arise during the development phase

Regulatory Compliance

Demonstrate safety , emissions, mileage compliance

Certify models' configurations

BEV mandates

Manufacturing Planning:

Manufacturing plan - consider production volume, assembly processes, and quality control

Identify component suppliers establish partnerships

Set up manufacturing facilities and production lines

Production and Quality Control:

Begin production - ensure adherence to quality standards and specifications

Implement quality control measures - identify and address manufacturing defects

Launch and Distribution

Marketing campaigns to generate excitement and drive sales

Coordinate with dealerships and distributors to ensure a smooth rollout

Monitor customer feedback - address post-launch issues

Production and Quality Control Costs

Materials can range from **40% to 60%** or more of the total cost, depending on factors such as the type of materials used (e.g., steel, aluminum, plastics), the complexity of the vehicle, and the scale of production.

Labor costs might account for around **10% to 20%** of the total production cost.

They can vary widely depending on wage rates, productivity levels, and automation levels.

Research and Development (R&D) costs typically represent around **5% to 15%** of the total production cost

Tooling and Equipment cost (machinery, tools, dies, and molds needed for manufacturing and assembly) might account for around **5% to 10%** of the total production cost

Energy and Utilities such as electricity, water, and gas can represent around **2% to 5%** of the total production cost

Transportation costs for moving parts and components to the assembly plants and finished vehicles to dealerships can account for around **1% to 5%** of the total production cost

Marketing and Advertising expenses typically range from around **1% to 5%** of total production cost

Quality Control and Testing usually represent around **1% to 5%** of the total production cost

Overhead and Administrative Costs might represent around **5% to 10%** of the total production cost

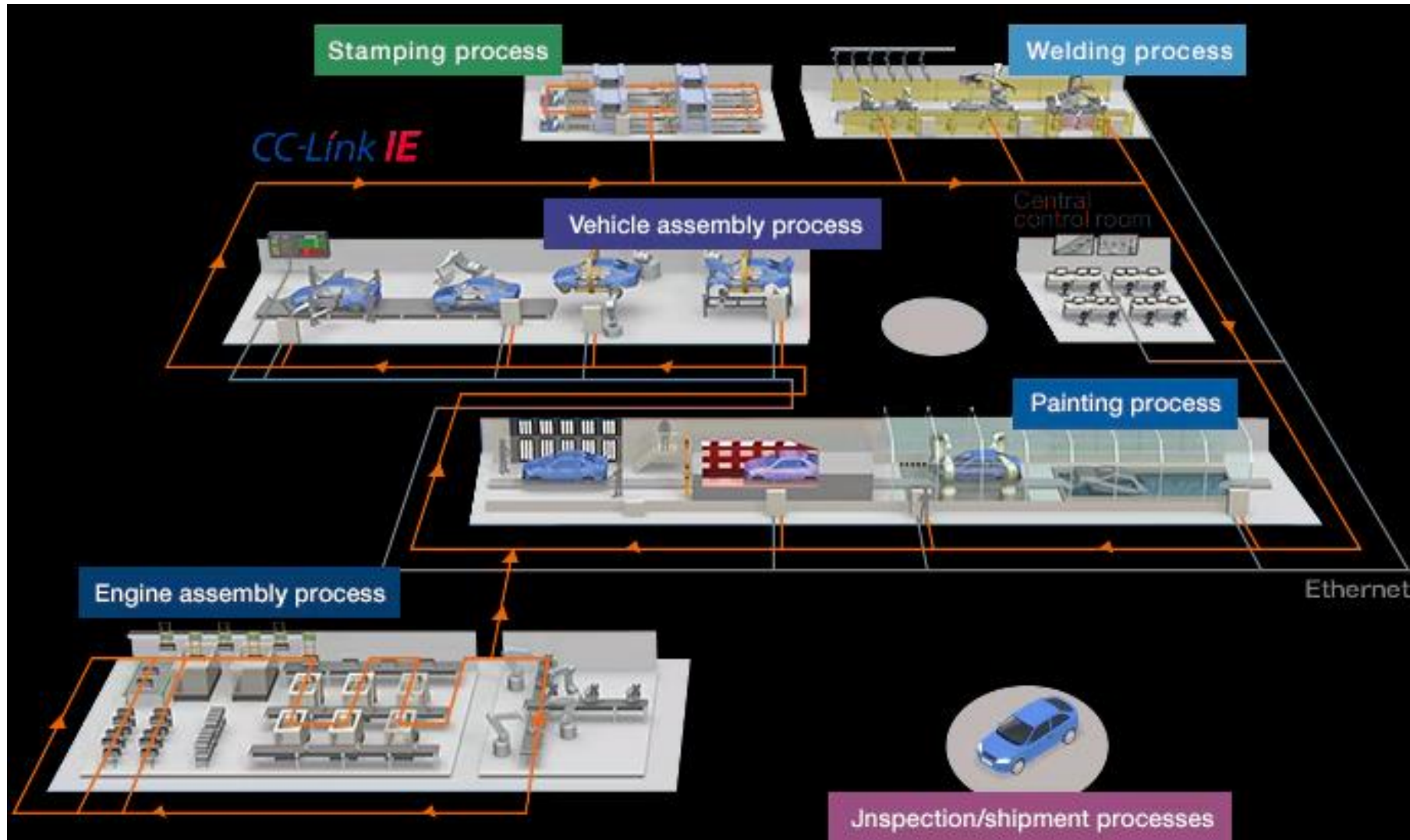
Taxes and Tariffs represent around **1% to 5%** of the total production cost

Supply Chain Management including procurement, inventory management, and supplier relationships, might represent around **2% to 5%** of the total production cost.

Depreciation and Amortization expenses might represent around **5% to 10%** of the total production cost

Production and Quality Control

General Sequence



Production and Quality Control

Unibody:

Sheet metal sections are welded by robots to form car's unibody structure

Painting:

The body including hood and doors are painted (painted doors are removed to allow access to body interior and assembly of door components)

Powertrain Installation:

This involves installing the engine, transmission, and other drivetrain components into the chassis

Suspension components:

Springs, shocks, brakes and suspension subframes are installed to the unibody

Electrical and Mechanical Systems:

Wiring harnesses, fuel lines, brake lines, exhaust system and other mechanical and electrical systems are installed

General Sequence

Interior Installation:

Components like seats, dashboard, carpeting, and trim are installed into the vehicle

Body Panels:

The outer body panels, such as completed doors, hood, trunk, and fenders, are attached to the unibody

Glass Installation:

Windshield, windows, and sometimes sunroof or moonroof are installed

Final Assembly and Quality Checks:

Any remaining components are installed, and the vehicle undergoes quality checks to ensure everything is functioning correctly

Testing and Inspection:

The vehicle goes through various tests, including dynamic testing on a dynamometer

Finishing Touches:

Any final detailing, such as polishing, waxing, and applying protective coatings, may be done before the vehicle is ready for shipment

Production and Quality Control

- **Manufacturing Preparation**

- Supply Chain Management
 - Logistics
 - Quality assurance
- Tooling and Equipment Setup
 - Procure tooling and equipment
 - Modify as required
 - Robot programming
- Assembly Line Design
 - Layout parts flows
 - Balance times for steps

Steps in Assembly

- **Body Shop**

- Metal Stamping
 - Sheet handling
 - Maintain dies
 - Shape quality
- Body Welding
 - Program robots
- Quality Inspection of Welds

- **Body Paint Shop**

- Body Cleaning and Pre-Treatment
- Primer Application
- Base Coat Painting
- Clear Coat Application
- Curing Process
- Final Paint Inspection

Production and Quality Control

- **Assembly Line**
- Remove doors after painting
- Installation of Wiring Harnesses
- Installation of Insulation and Sound Dampening
- Dashboard Assembly
- Dashboard Installation
- Seat Installation
- Interior Trim Installation
- Glass Installation (windows, windshield)
- Assemble Doors
- Door Installation
- Suspension Assembly
- Suspension Installation

Steps in Assembly

- Brake System Installation
- Exhaust System Installation
- Fuel System Installation
- Engine Installation
- Transmission Installation
- Brake System Installation
- Exhaust System Installation
- Drivetrain Assembly
- Radiator and Cooling System Installation
- Battery Installation
- Installation of Wheels and Tires
- Fluids filling

Production and Quality Control

- **Quality Control**
- Initial Quality Check
- Electrical System Testing
- Engine Testing
- Safety Feature Testing
- Alignment and Calibration
 - Headlights and wheels
- **Dynamic and Environmental Testing**
- Test Driving on chassis dynamometer
- Climate Testing (hot/cold environments)
- Leaks - Water spray

Steps in Assembly

- **Final Quality Check**
- Comprehensive Inspection
- Final Road Test?
- **Delivery Preparation**
- Vehicle Detailing
- Final Inspection
- Documentation and Record Keeping
- Shipping Preparation

Production and Quality Control

Design and Development Records:

Design Specifications:

Detailed blueprints and CAD models

Engineering Change Orders (ECOs):

Documentation of design changes

Prototype Testing Reports:

Results from tests on prototype models

Compliance Certifications:

Records of compliance with safety and regulatory standards

Supply Chain and Procurement Records:

Supplier Contracts:

Agreements with parts and materials suppliers

Purchase Orders:

Orders placed for raw materials and components

Quality Assurance Reports:

Supplier quality audits and inspections

Records

Production Planning and Control Records:

Production Schedules:

Timelines and schedules for production runs

Work Orders:

Instructions for production activities

Manufacturing Process Records:

Bill of Materials (BOM):

Detailed list of parts and components required for each vehicle

Manufacturing Instructions:

Step-by-step procedures for assembly

Process Control Charts:

Monitoring of manufacturing process parameters

Quality Control Reports:

Inspections and tests conducted during production

Equipment Maintenance Logs:

Records of maintenance activities on production equipment.

Production and Quality Control VIN

- A **Vehicle Identification Number (VIN)** is a *unique code* assigned to every motor vehicle when it is manufactured
- The **VIN** serves multiple purposes throughout the vehicle's lifecycle, from production and registration to service and resale
- The VIN acts as the vehicle's fingerprint, *no two vehicles have the same number*
- Government agencies use the VIN to register vehicles and issue titles
- Manufacturers use the VIN to **track the vehicle through the production process**
- Each VIN **corresponds to specific production details**, such as the factory, production date, and vehicle specifications.
- The VIN helps in **tracking quality control processes**, ensuring any manufacturing defects can be traced back to the source
- Dealerships use the VIN to manage their inventory, track vehicles from manufacturer to showroom, and record sales
- Services like Carfax or AutoCheck use the VIN to **provide detailed vehicle history reports**, which include information on previous ownership, accidents, and service records
- Repair shops and service centers use the VIN to access the vehicle's service history and ensure the correct parts and procedures are used
- Manufacturers and regulatory bodies use the VIN to **issue recall notices for specific vehicles** when defects or safety issues are identified⁵. Law Enforcement and Security
- Law enforcement agencies use the VIN to track stolen vehicles and recover them
- The VIN can be used to track down the history of a vehicle involved in an accident, aiding in investigations

Production and Quality Control VIN

- Insurance companies use the VIN to determine the vehicle's risk profile, coverage options, and premiums
 - In case of an insurance claim, the VIN helps in verifying the vehicle's details and history, streamlining the claims process
 - The VIN is used to track compliance with environmental and emissions standards, ensuring the vehicle meets regulatory requirements
 - The VIN is used in legal documents to verify ownership, such as in the transfer of title during the sale of a vehicle
 - When vehicles are **imported** or **exported**, customs officials use the VIN to track and verify vehicle details, ensuring compliance with regulations
- A VIN consists of 17 characters, which include both numbers and letters. Each segment of the VIN provides specific information about the vehicle:
 - The **first three characters** indicate the **manufacturer** and the **country of origin**
 - **Characters 4 to 9** describe the **vehicle type, model, body style, engine type, and other characteristics**
 - **Characters 10 to 17** provide information about the **vehicle's model year, assembly plant, and the unique serial number.**
 - For a hypothetical VIN: 1HGCM82633A123456
 - **1HG**: Manufacturer (**Honda**) and country (**USA**)
 - **CM826**: Vehicle attributes (**model, body style, engine**)
 - **3**: **Check digit** for verifying the VIN's validity
 - **A**: **Model year (2003)**
 - **123456**: **Serial number unique to this vehicle**

Production and Quality Control

BMW Assembly Videos

https://www.youtube.com/watch?v=TYP_sEaqoic

36 min

<https://www.youtube.com/watch?v=0YtrCEG118w>

17 min

4 Series

https://www.youtube.com/watch?v=T3LRYBC_7vo

17 min

M3

Production and Quality Control

Assembly Videos

https://video.search.yahoo.com/yhs/search?fr=yhs-iba-3&ei=UTF-8&hsimp=yhs-3&hspart=iba&p=Frame+toyota+car+production+videos&type=teff_10019_FFW_ZZ#id=1&vid=bb5268e5ce5f3aabb0b84542448af27a&action=click

RAV 4 17 min

<https://www.youtube.com/watch?v=eb3yTKljLsM&t=541s>

Skoda 10 min

1

https://video.search.yahoo.com/video/play;_ylt=AwrEaYTnl1lmdssUF2Q0nllQ;_ylu=c2VjA3NyBHNSawN2aWQEZ3BvcwMx?p=automotive+manufacturing+process+pdf&vid=dbeace79d4e43fb5a8abc04d2c8dcab9&turl=https%3A%2F%2Ftse1.mm.bing.net%2Fth%3Fid%3DOVP.FY0QZw9Y8EAhluaxuT4pBwEsDh%26pid%3DApi%26h%3D225%26w%3D300%26c%3D7%26rs%3D1&rurl=https%3A%2F%2Fwww.youtube.com%2Fwatch%3Fv%3D8DYshlj0xqU&tit=Car+%3Cb%3EManufacturing%3C%2Fb%3E+%3Cb%3EProcess%3C%2Fb%3E+-+explained+by+UpSkul&c=0&sigr=Al0ehOddsZqh&sig=E9XFuuXwyWcl&sigi=hQQ1tkEDtviT&fr=p%3As%2Cv%3Av&h=225&w=300&l=550&age=1625304637&fr=yhs-iba-3&hsimp=yhs-3&hspart=iba&type=teff_10019_FFW_ZZ&tt=b

Car Assy Line

9 min

Steps in Bringing a New Car to Market

Introduction

A little history

Automobile industry

Product Planning-Market Analysis & Identification of Opportunities

Understand market trends, consumer preferences, emerging technologies and government regulations

Analyze competitors - identify gaps in the market for new car

Concept and Design

Translate market insights into conceptual ideas for a new car

Collaborate with design teams and engineers to develop innovative and appealing vehicle concepts

Engineering and Development

Design the vehicle - safety, performance, and efficiency

Extensive testing - prototype testing, crash testing, emissions testing and performance testing

Address any design or engineering challenges that arise during the development phase

Regulatory Compliance

Demonstrate safety , emissions, mileage compliance

Certify models' configurations

BEV mandates

Manufacturing Planning:

Manufacturing plan - consider production volume, assembly processes, and quality control

Identify component suppliers establish partnerships

Set up manufacturing facilities and production lines

Production and Quality Control:

Begin production - ensure adherence to quality standards and specifications

Implement quality control measures - identify and address manufacturing defects

Launch and Distribution

Marketing campaigns to generate excitement and drive sales

Coordinate with dealerships and distributors to ensure a smooth rollout

Monitor customer feedback - address post-launch issues