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# THE ROLE OF THE CONCURRENT ENGINEERING IN REDUCING PRODUCT DEVELOPMENT COSTS: AIRBUS CASE STUDY

**Soumeya Toumi**
Chadli Bendjdid El-Tarf, El-Tarf, Algeria
https://orcid.org/0009-0006-2375-2581

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ABSTRACT

*This study aims to identify the concurrent engineering (CE) technique and examine its role in reducing costs during product development phases by leveraging functional and technological practices that support cost reduction. Given the nature of the study, we adopt a descriptive and analytical approach. Based on a case study of Airbus, which is considered one of the most powerful companies in the global aeronautical sector, and which has adopted concurrent engineering technique through its project ACE (Airbus Concurrent Engineering), the findings indicate that concurrent engineering reduces the product's overall cost by lowering design costs through the elimination of design errors and by reducing the number of engineering changes required during product design. Additionally, it reduces labor inputs by utilizing cross-functional teams. By incorporating supply chain requirements early in the development process, the overall cost decreases while maintaining a strong focus on quality improvement, thereby enhancing flexibility and responsiveness to market demands.*

## 1 INTRODUCTION

Rapid and successive developments in the modern global manufacturing environment—including the information and communications technology revolution, expanding and increasingly open markets, intensified competition, and advances in technologies related to product design and production processes—have placed significant pressures and challenges on firms. These pressures require organizations to keep pace with such changes, respond effectively, improve efficiency and effectiveness, and build competitive capabilities that enable them to achieve their objectives and ensure growth and continuity. Achieving these outcomes has required a high degree of flexibility in product development and a stronger focus on cost management.

Accordingly, firms have increasingly emphasized strategic cost management and sought alternative methodological approaches that combine higher production rates with improved efficiency in the shortest possible time, while also improving quality, reducing production time, and

*Address of the author:*
***Soumeya Toumi***
*toumi-soumaya@univ-eltarf.dz*

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strengthening integration between design and manufacturing. In this context, many companies in complex and innovative industries—such as automotive, aerospace, electronics, pharmaceuticals, and defense—have adopted concurrent engineering as a long-term business strategy. This approach promotes an integrated development system aimed at enhancing flexibility and responsiveness while reducing costs and time and improving product quality.

Considering the preceding discussion, this study addresses the following research question:

**RQ**: What is the role of concurrent engineering in reducing costs across all stages of product development?

## 1.1 Research Hypotheses

From the main research question, we formulate the following hypotheses to guide our study:

**H1:** Concurrent engineering reduces product development costs from the design phase through delivery to the customer.

**H2:** Concurrent engineering helps companies improve products already in the market.

## 1.2 Objectives and Significance of Research

This research highlights the importance of concurrent engineering as a contemporary technique for reducing the costs of developing complex and innovative products through simultaneous work—considered the core principle of this approach—and the use of cross-functional teams. Airbus, a leading commercial aircraft manufacturer, was among the first companies to adopt and further develop concurrent engineering. Airbus has reportedly achieved cost savings, generated significant revenues, and increased its market share through this approach. Concurrent engineering is also used to monitor aircraft throughout their life cycles and implement necessary enhancements, thereby improving product quality.

# 2 THE CONCEPT OF CONCURRENT ENGINEERING (CE)

## 2.1 Definition of CE

In 1988, CE was introduced in a report submitted by the Institute for Defense Analyses (IDA) titled *The Role of Concurrent Engineering in Weapons System Acquisition*. The report described concurrent engineering as a systematic approach to the integrated, concurrent design of products and their associated processes, including manufacturing and support. This approach encourages producers, from the outset, to consider all elements of the product life cycle—from concept to sale—including quality, cost, scheduling, and customer requirements (Salamn Daoud & Mazen, 2016).

Accordingly, concurrent engineering can be understood as a cross-functional and systematic approach that integrates design and supports the concurrent development of complex products and their related operations. It involves multiple functions, such as marketing, manufacturing, service, sales, customer support, and product disposal. The objective is to increase productivity, decrease costs, and reduce product development time, thereby shortening time to market. In this approach, stakeholders consider life-cycle requirements early in the process—from conception through disposal—including cost, quality, and time (Amr, 2021).

Based on these definitions, concurrent engineering is a technique that integrates design, development, and assembly activities simultaneously throughout the product development cycle. It relies on cross-functional and multidisciplinary teams that develop an appropriate business plan and ensure the availability of necessary information across the value chain, thus achieving cost and time savings while improving quality.

## 2.2 CE and Sequential Engineering (SE)

In sequential engineering (SE), key functions—such as design, manufacturing, and customer service—are separated, and information flows linearly from one phase to the next. For example, after a prototype is verified through simulation, physical prototyping, or both, the design is reviewed for manufacturability, quality, and serviceability. Following this review, modifications are typically proposed.

– If the proposed design changes are implemented, product development costs and time will increase. That can delay market launch.

- If changes cannot be implemented because of market pressure to launch quickly or because the design is behind schedule, specialists in other functional areas—as well as manufacturing, quality, and service managers—must adapt to the design as delivered.

Accordingly, in SE, a department does not begin work on a project (or a component of it) until the preceding department has completed its tasks. Because information flows primarily in one direction, feedback and iterative replanning are limited.

By contrast, in CE, functional areas are integrated into the design process, and information flows continuously in both directions across functions. Decision-making occurs throughout each phase while accounting for the constraints and objectives of the entire product's life cycle. As a result, issues that would otherwise be discovered later can be identified and addressed earlier, improving the likelihood of reaching an optimal solution. Integrating additional functional areas into the design process facilitates early detection of problems that are difficult to resolve after design completion. Therefore, when the final design is validated, it is more likely to be manufacturable, testable, operable, and aligned with high-quality standards (Amr, 2021).

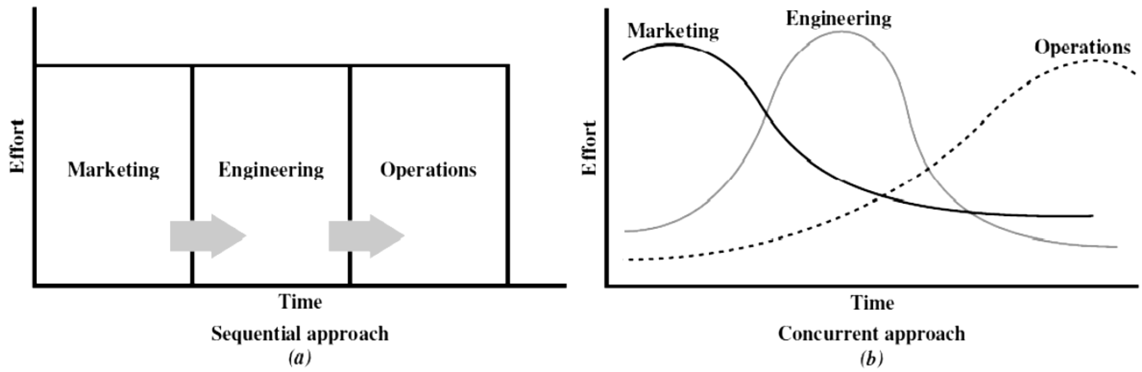


***Figure 1.*** *Difference Between Concurrent Engineering and Sequential Engineering*
*Source: (Deherieb & Abdullah Yaqoub, 2020)*

## 2.3 Importance of CE

The importance of CE in achieving corporate objectives (reducing costs, maintaining product quality, increasing sales, and achieving competitive advantage) can be explained as follows:

- *Reducing product development costs:* by decreasing the number of redesigned cycles and incorporating customer requirements from the outset of design planning for product development.
- *Improving product quality:* by producing products with engineering and technical specifications aligned with customer requirements.
- *Enhancing and sustaining competitive advantage:* Concurrent engineering integrates customer requirements and after-sales service considerations during product planning.
- *Reducing product testing (trial-run) costs:* Product complexity can increase trial-run costs; however, concurrent engineering can reduce these costs through supportive tools such as Design for Assembly (DFA), which optimizes the number of assembled parts and the materials and processes required to produce each part, thereby reducing complexity.
- *Increasing sales* through the introduction of new products and cost reductions can increase profit margins (Alkawaz & Ali, 2020).

# 3 CE – PRODUCT DEVELOPMENT CYCLE – COST REDUCTION

## 3.1 Cost Reduction

Cost reduction refers to prioritizing cost-improvement initiatives by focusing on short-term cash savings; through such prioritization, costs are rationalized and reduced (Obuamamh & Al-Hamdani, 2021).

The primary goal of cost reduction is to make optimal use of available resources in an economical manner by reducing waste and misuse and directing expenditures toward necessary value-adding activities. A central objective is to achieve customer satisfaction by providing quality products with the required specifications at the lowest possible cost. Cost reduction should also address the sources of costs, enabling reductions not only in internal activities and operations but also in areas beyond the firm's boundaries, such as after-sales services (Al-Samarrai & Al-Zamili, 2017).

## 3.2 Ways to Reduce Costs Through CE

Concurrent engineering reduces production costs in several ways, including:

- *Reducing design-phase errors:* minimizing errors early in design prevents downstream rework, shortens the product life cycle, and lowers production costs.
- *Enabling simultaneous manufacturing and assembly planning:* parallel work across manufacturing and assembly helps firms reduce the total product cost by eliminating non-value-added time.
- *Improving cost control and resource utilization:* concurrent engineering supports tighter control of costs, reduces unnecessary expenditures, and promotes more effective use of available resources.
- *Reducing waiting time:* reported benefits include reducing setup time by 30%–70% and reducing time to market by 20%–90% (Obuamamh & Al-Hamdani, 2021).
- *Supporting target costing decisions:* to ensure cost reduction, the total product cost should be less than or equal to the target cost; on this basis, the proposed design is accepted or rejected (Ali Husam & Mohameed, 2021).

## 3.3 Product Development

The product development process refers to creating concepts, designs, and programs (or plans) for products that an industrial organization intends to introduce to the market. This process includes analyzing the market to identify needs, designing the product to meet those needs, and designing and planning the production process, as well as product planning (Daoud & Nouri, 2008).

Product development requires attention to four basic aspects:

- *Operational aspects:* such as information systems management, planning and scheduling, energy planning, and workforce training and management.
- *Social and living aspects.*
- *Engineering aspects: including:*
  - Production capacity: how a specific product is manufactured.
  - Support: market policies, financing, manufacturing, and maintenance activities across upper and lower organizational levels.
  - Material resources: the product's material resources and the degree of interdependence among them.
  - Maintenance capacity: design quality; the ability to repair and replace components; and the degree of interdependence among components.
  - Availability: time to market and the ability to deliver expected orders on time.
- *Administrative aspects*: including time management (scheduling), cost management (e.g., total operating cost), and the integrated management of time and cost across the engineering aspects listed above (Shokr, 2022).

## 3.4 CE - Product Development Phases – Reducing Costs

A fundamental principle of product development and design is to keep the product as simple as possible to facilitate both production and use. Product simplification can reduce assembly waiting time and, in turn, improve productivity—through stronger alignment between product design and production system design—while also enhancing quality, flexibility, and the ability to meet consumer demand. The product development process includes a set of activities such as production design, design and redesign, interchangeable parts, standardization, simplification, modeling, modular design, specification development, and quality engineering (Daoud & Nouri, 2008). These activities can be grouped into three main phases:

- *Setup and preparation phase:* In this phase, the firm's capabilities and resources are identified; system functions and the specialists responsible for each function are defined; appropriate tools for implementing concurrent engineering are selected; relevant participants are identified; and a business plan aligned with the firm's strategic vision is developed.

- *Design phase:* In this phase, concurrent engineering is implemented according to the established plan. A shared database is created to support coordination and communication among members of a cross-functional team. This phase is central to concurrent engineering because it enables real integration between the concurrent engineering team environment and the expertise of the firm's specialists. In addition, an "open office" concept—adopted by some Japanese companies—may be used to create an environment that encourages open discussion and rapid problem-solving. Such an integrated workspace helps address urgent questions and resolve new issues that may arise during the design phase (Obuamamh & Al-Hamdani, 2021).

## 3.5 Importance of CE in Reducing Costs – Design Phase

During the design phase, CE aims to ensure that decisions made in product design lead to the lowest possible total cost over the product life cycle. It is widely argued that approximately 60%–90% of a product's total cost is determined during this phase. Accordingly, concurrent engineering is often considered a foundational approach to product development: although its application during product design may account for less than 5% of total development cost, it can reduce the final product cost by more than 70%.

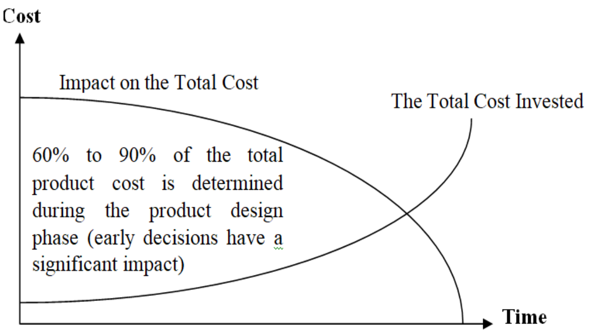


*Figure 2. Effect of CE on cost reduction during the product design phase*
*Source: (Amr, 2021)*

Once a product has been designed and developed, at least 80% of its cost, quality, and life-cycle characteristics are effectively determined, which reduces the likelihood of product failure (Amr, 2021).

### 3.5.1 Transition to the Production Phase

After the final design is established and implemented, the process transitions to production. In this phase, manufacturing and assembly activities are carried out in parallel while ensuring adherence to the proposed product design, process plan, and processing chain in order to achieve target outcomes related to cost, quality, time, and flexibility. Continuous improvement and ongoing development of production processes are emphasized (Obuamamh & Al-Hamdani, 2021).

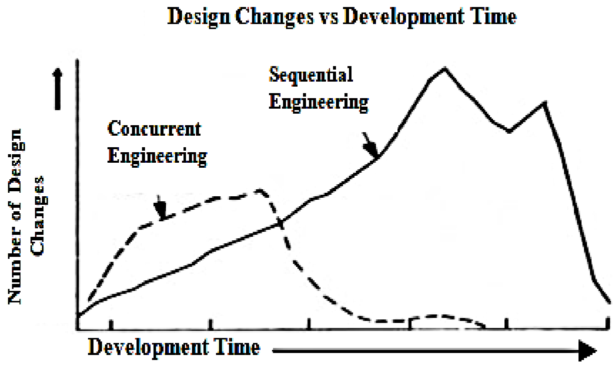


*Figure 3. Comparison of costs under Concurrent and Sequential Engineering across the product development and design phase*
*Source: (MFGRobots – Industrial Manufacturing, 2025)*

### 3.5.2 Cost Patterns Under CE vs SE

Under concurrent engineering, product design costs tend to be relatively high and increase rapidly during the early stages of product development, when multiple design iterations are performed to reach an appropriate final design. This pattern reflects intensive early-stage activity and substantial involvement of cross-functional teams. Afterward, design-related costs typically decline and may become minimal during assembly and manufacturing because iterative loops are shorter and fewer downstream problems arise.

By contrast, under sequential engineering—where work is transferred from one department to the next—design costs are often lower during the initial design phase and rise more gradually. However, costs may increase substantially during assembly and manufacturing due to a higher number of change requests and longer iteration loops. In practice, change management becomes more complex because revisions must be communicated back across departments.

Overall, a comparison of the two approaches suggests that total costs under concurrent engineering are lower than under sequential engineering, supporting the conclusion that concurrent engineering reduces costs throughout product development and can significantly lower overall cost relative to sequential processes (Morenton, n. d.).

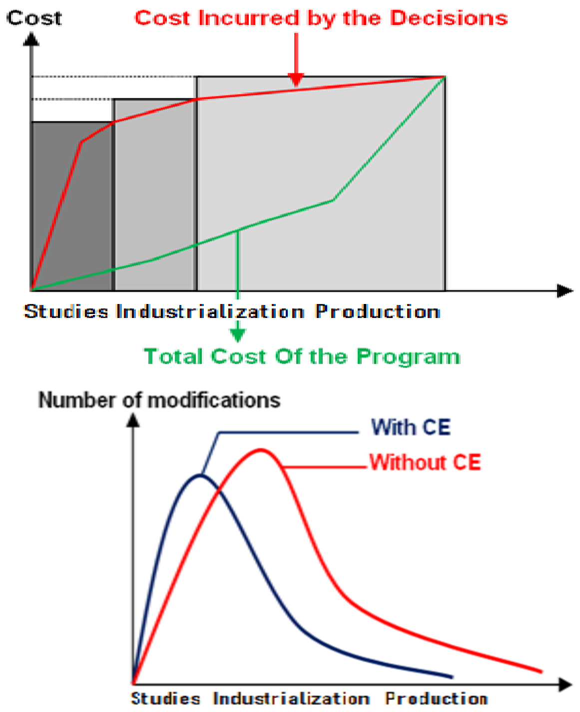


***Figure 4.*** *Product Development Costs under CE*
*Source: ( Morenton, n. d.)*

To reorganize development of the same product with minimal additional resources, firms can adopt a simultaneous (concurrent) engineering workflow in which departments consult one another—or relevant personnel—before completing their tasks. The firm can also jointly define the Product Design Specification (PDS) after consulting manufacturing and production teams to evaluate design feasibility and manufacturability.

## 4 CE TOOLS AND CHALLENGES OF APPLICATION

To achieve the "trilogy" of cost reduction, quality improvement, and shorter product development cycles, concurrent engineering relies on several supporting tools. Among the most important is Quality Function Deployment (QFD), which integrates customer requirements with the product's functional and technical requirements early in the development cycle. Other widely used tools include Design for Assembly (DFA), Design for Manufacturing (DFM), and Design for Manufacturing and Assembly (DFMA). These tools can also support sustainability by enabling the design, development, and production of products that meet sustainability standards and strengthen the firm's competitive position.

### 4.1 Quality Function Deployment (QFD)

Quality Function Deployment (QFD) originates from the Japanese phrase hin shitsu ki no ten kai, where: hin shitsu refers to quality (attributes or characteristics), ki no refers to function, and ten kai refers to deployment (diffusion or development). In this sense, QFD involves deploying customer-desired product or service attributes across all relevant organizational components (Elomri et al., 2021).

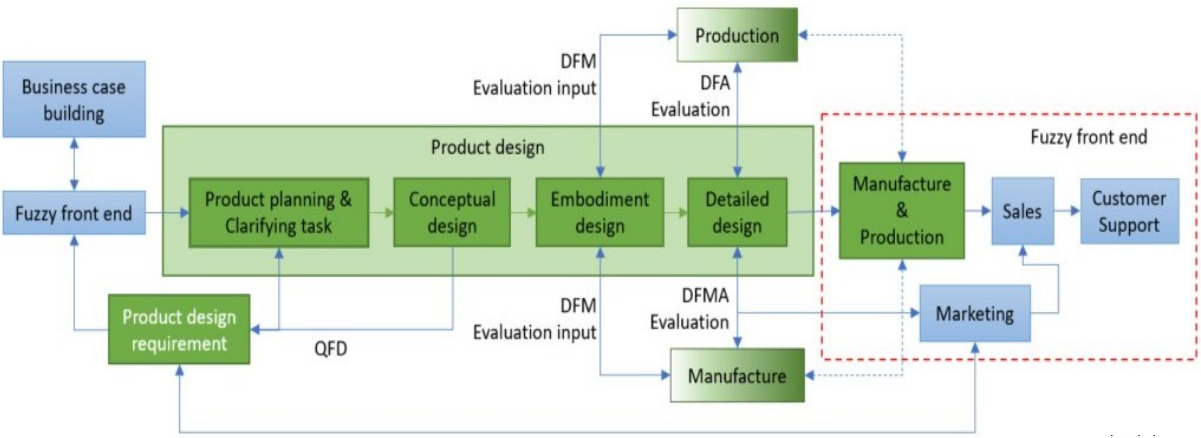


***Figure 5.*** *Role of CE in enhancing the product development cycle*
*Source: (MFGRobots – Industrial Manufacturing, 2025)*

According to Akao, QFD is a comprehensive methodology for new product design because it provides specific methods to ensure quality at every phase of product development, beginning with design. In other words, QFD introduces quality from the design stage in order to satisfy the customer and then translates customer requirements into design objectives and key characteristics that become critical during production. QFD, therefore, represents a structured approach to quality planning that incorporates technological considerations, reliability, and costs when designing and developing new products (Gautier, 2009).

## 4.2 Design for Manufacturing and Assembly (DFMA)

DFMA combines two techniques, Design for Assembly (DFA) and Design for Manufacturing (DFM), as follows:

- *DFA:* a design approach that emphasizes ease of assembly by reducing the number of parts. Fewer parts typically reduce assembly time and can lower the total cost of components required for assembly. Although DFA improves assimilability, it may be less effective for generating design concepts that reduce costs during the functional modeling stage. Because formal functional modeling standards and cost benchmarks may not be available at this stage, designers often rely on experience and engineering judgment when developing functional models (Abd El-aleem Fateh, 2019).
- *DFM:* a design approach focused on manufacturability. It supports the development of designs aligned with manufacturing and assembly requirements, including the selection of raw materials and processes that simplify production as much as possible, thereby reducing cost, development time, and time to market (Alkawaz & Ali, 2020).

Taken together, DFA and DFM both aim to reduce part count by integrating multiple functions into fewer components. However, excessive part integration can complicate manufacturing and substantially increase costs; automated handling of such parts may also become difficult. To mitigate these trade-offs, DFA and DFM are integrated into DFMA, which provides a more balanced framework for concurrent consideration of manufacturing and assembly during new product development (Abd El-aleem Fateh, 2019). This integration is often described as a “structured methodology” because DFMA involves systematic evaluation of manufacturability and assemblability when creating a new product (Al-Samarrai & Al-Zamili, 2017). In this sense, DFMA operationalizes concurrent engineering by emphasizing alternative design evaluation and quantitative assessment of manufacturing and assembly difficulty. As a result, it requires designers to have substantial knowledge of manufacturing methods and product life-cycle considerations.

## 4.3 Requirements for successful CE to reduce cost

The successful implementation of CE requires a combination of factors related to: the concurrent flow of work; the early inclusion of stakeholders involved in product development, including representatives of the supply chain and work teams. Therefore, these factors can be divided into organizational factors and technological auxiliary factors.

### 4.3.1 Organizational Factors

Organizational factors can be divided into factors related to the design team and factors related to the activities necessary to implement CE, which we explain as follows:

#### A. Multi-functional Team: Design – development of a product

The team includes individuals representing internal functions (e.g., purchasing, production, marketing, and warehousing) as well as external stakeholders (e.g., customers, suppliers, and distributors). To ensure effective concurrent work and facilitate team performance, several conditions are important, including senior management support, a strong teamwork culture, and active information sharing. The team should be cross-functional and multidisciplinary, supported by effective communication and training that builds skills for synchronized work. Early involvement of customers and suppliers can also support early problem identification and resolution.

### B. Activities required to implement CE

These are commonly grouped into three categories:

- *Activities required for product design and development:* market research, defining initial design specifications, conceptual design, detailed design, and supply chain design activities aligned with the product.
- *Activities required for simultaneous work:* training and practices related to communication, organization, relationship-building, and mechanisms for information flow and cooperation among individuals.
- *Decision-making activities:* early problem detection and early decision-making (Amr, 2020).

### 4.3.2 Supporting Technologies Factors

Supporting technologies include QFD; Design for X (DFX) systems; Flexible Manufacturing Systems (FMS); Design for Cost Reduction (DFCR); Design-to-Cost (DTC); Computer-Aided Design (CAD); Computer-Aided Manufacturing (CAM); and Failure Mode and Effects Analysis (FMEA). More recently, concurrent engineering has increasingly depended on digital tools and software that enable multidisciplinary teams to collaborate more effectively, share information in real time, and make data-driven decisions. Examples include Product Lifecycle Management (PLM) systems and tools such as MCAD, CAE (often used instead of “CAO”), and BIM, among others.

## 5 CONCURRENT ENGINEERING AT AIRBUS

Airbus is a leading company in the aviation industry. In the early 1990s, it adopted concurrent engineering as a strategic approach to aircraft development, integrating design, manufacturing, and engineering functions in parallel. This approach significantly reduces development time, lowers costs, and enhances product quality by enabling early identification of design-related issues.

### 5.1 The project of Airbus Concurrent Engineering (ACE)

At the beginning of the 1990s, the adoption of PDM (Product Data Management) and 3D solid design allowed Airbus to begin constructing a DMU (Digital Mock-up) prototype, with the aim of verifying functional design overlaps. This led to the adoption of concurrent engineering within the company and the launch of a project, ACE (Airbus Concurrent Engineering), to develop and deploy methods, processes, and tools across all functional design disciplines (Mas et al., 2013).

Airbus has deployed concurrent engineering capabilities at all Airbus sites. About 1800 workstations fully equipped with CAD/PDM capabilities are deployed in the company.

To facilitate the exchange of DMUs across different sites, dedicated processes have been established. Because DMU Exchange (DEX) contributes to development team performance, it is supported by performance indicators and is therefore closely monitored (Pardessus, 2004).

### 5.2 Application of CE in the aircraft development cycle

Concurrent engineering was implemented at Airbus during the development of the A340-500/600, with the purpose of reducing costs by 30%, removing physical models and replacing them with the DMU digital model, and reducing time by 25% in the product development cycle and 50% in the Focus cycle (Morenton, n. d.).

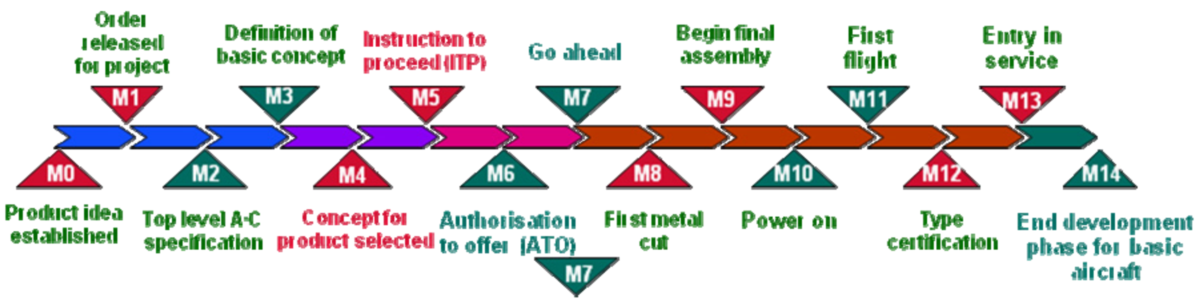


***Figure 6.*** *Product Development Cycle at Airbus*

*Source: (Mas et al., 2013)*

CE bridges the gap between functional design and industrial design and feeds functional design with manufacturing information to facilitate work with DFM and DFA techniques. The functional design model, DMU, is a basic component in the early stages of the product development cycle.

The DMU model helps Airbus determine the aircraft's key geometry and locate systems and equipment. In addition, it enables the teams responsible for design support to evaluate the ease of performing maintenance operations once the aircraft enters service.

Recently, the company has been using techniques of Model-Based Systems Engineering (MBSE) to ensure a consistent path that enables tracking of development stages from tasks and processes to customizing functions for components. The many interconnections are evaluated using multidisciplinary analysis and optimization capabilities to explore the design space and find the best solution (**Airbus**, 2024**a**).

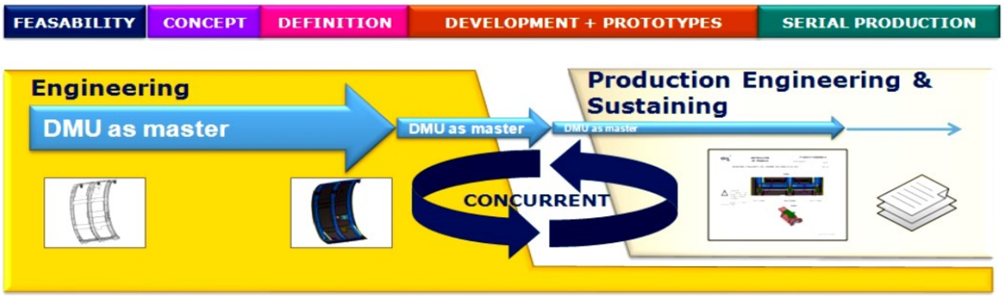


***Figure 7.*** *Use of the DMU Model in CE at Airbus*

*Source: (Mas et al., 2013)*

***Table 1. Product Development Cycle at Airbus***

| No. | Phases | Statement |
|---|---|---|
| 1 | Design | Aircraft's development process follows several phases to ensure that Aircraft software meets market needs including performance, timely market access, maturity upon entry into service and increased production. The stages are:<br>– **Feasibility and concept:** Market expectations and requirements are determined, and the latest technologies, structural concepts and systems engineering are used to determine the initial design model and detailed specifications of parts and equipment suppliers.<br>– **Engineering in action:** At this phase, Concurrent Engineering technique is adopted with an emphasis on the use of DMU digital model and MSBE techniques.<br>**Design:** During this phase, the dimensions of all initial parts and their optimized interfaces, equipment, enclosures, engines and landing gear developed through the supply chain are determined. |
| 2 | Test and Certification | Before starting the serial production process, Airbus subjects all its Aircraft to complex and rigorous flight tests. For example, the company has subjected the A350 to a comprehensive test since it entered service. Five A350-900 Aircrafts were tested by preparing a flight that lasted for more than 14 months, for a total of 2,600 hours. After that, it obtained the validity certificate from the European EASA Agency and the FAA Agency in the United States of America. |
| 3 | Production | The simultaneous process in manufacturing creates a flow system that seamlessly brings together millions of pieces of Airbus Aircraft, while providing flexibility and agility to adjust production outputs that meet market needs. |
| 4 | Delivery | When Airbus completes production, and before officially signing the transfer of ownership and delivering the Aircraft to the customer, the latter conducts a complete and detailed inspection of the Aircraft with the assistance of delivery experts and external experts to ensure that the aircraft conforms to contractual specifications through a very precise and specific process. |
| 5 | Operating Life | Airbus adopts a long-term strategy, by accompanying all its Aircraft throughout their lifespan (30 years), which helps maximize performance, reduce costs and achieve overall sustainability of Air transport. During this phase, Airbus is investing in research and development, focusing on improving the product life cycle, adopting innovative services to ensure more efficient flights from take-off to landing, maintenance, and broader commercialization of sustainable fuels. |

*Source: Prepared by the author based on: (Airbus, 2024b)*

## 5.3 Airbus R&D Costs and Production Pace (2015-2024)

By relying on the CE technique as a long-term strategy, Airbus has achieved many accomplishments, reflected in diversifying its products characterized by sophistication, quality, and good design, reducing production costs, and achieving comprehensive sustainability of aeronautical transport, meeting market requirements, etc. This is due to the focus on research and development processes, as shown in Figure 8. In contrast, its sales and production pace have increased due to the increasing global demand for its aircraft (Table 2), which indicates the company's strong performance. We illustrate this by analyzing research and development costs, production pace, and revenue development during the period 2015-2024.

### 5.3.1 Airbus R&D Costs (2015-2024)

Figure 8 ilustrates the costs of research and development for the period 2015–2024.

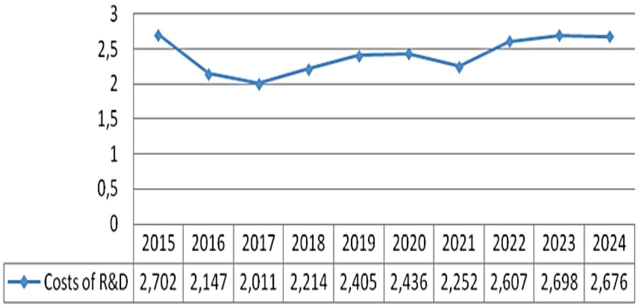


**Figure 8.** Airbus R&D Costs (2015-2024) (million€)

*Source: Prepared by the author based on: (Investors | Annual Reports, 2025)*

- 2015–2017: We note that R&D costs are declining, moving from 2,702 to 2,011 million €. This is due to research and development activities in the A350 XWB program at Airbus Commercial Aircraft. In addition, €311 million in development costs were capitalized during 2016, primarily related to the H160 and A350 XWB programs. Development costs of €219 million were capitalized during 2017, primarily related to the A330 Neo and H160 programs.
- 2018–2019: We note that R&D costs are constantly increasing during the years 2018 and 2019. This is due to research and development activities in the A320 and A350 programs. Development costs of €133 million, primarily related to Airbus programs, were also capitalized in 2019. Development costs of €91 million, primarily related to Airbus helicopter programs, were capitalized in 2018.
- 2020–2021: We note a decline in R&D expenditures due to cash containment measures in response to the COVID-19 pandemic, which affected the performance of development activities. The company continued its development activities toward achieving the revised capabilities roadmap. Updates' activities have progressed closely with the client.
- 2022–2024: We find that R&D expenditures are increasing, mainly due to the intensification of activities to prepare future technologies. In addition, the company focused primarily on developing the latest generation of commercial aircraft software, including the A321 XLR and A350 cargo aircraft.

### 5.3.2 Airbus Revenues and Production Pace (2015-2024)

***Table 2.*** *Product Development Cycle at Airbus*

| Statement / Years | Revenues* | Delivery Revenues** | Number of deliveries of commercial aircraft |
|---|---|---|---|
| 2015 | 45,854 | - | 635 |
| 2016 | 49,237 | - | 688 |
| 2017 | 43,486 | 39,950 | 718 |
| 2018 | 47,970 | 44,157 | 800 |
| 2019 | 54,775 | 50,577 | 863 |
| 2020 | 34,250 | 31,331 | 566 |
| 2021 | 36,164 | 33,455 | 611 |
| 2022 | 41,428 | 37,681 | 661 |
| 2023 | 47,763 | 42,756 | 735 |
| 2024 | 50,646 | 44,630 | 766 |

*Source: Prepared by the author based on: (Investors | Annual Reports, 2025)*

* Revenues are mainly comprised of sales of goods and services, as well as revenues associated with construction contracts accounted for under the PoC method, contracted research and development, and customer financing.
** Revenue from the sale of commercial aircraft is recognized at a point in time (i.e., at delivery of the aircraft). The Company estimates the amount of price concessions granted by the Company's engine suppliers to their customers as a reduction of both revenue and cost of sales.

In Table 2, we find that:

– 2015–2019: A significant increase in the company's revenues indicates an increase in the pace of production, especially since the number of orders for Airbus aircraft is constantly increasing, as the number of aircraft delivered to customers reached 863 aircraft compared to 2015, in which the number of aircraft delivered reached 635 aircraft, an increase estimated at 26%. This is due to the conclusion of new agreements with Emirates Airlines and Rolls-Royce to transfer six deliveries from 2017 to 2018 and from 2018 to 2019.
– 2020–2024: During 2020, we noticed a significant decline in the company's revenues and the number of aircraft delivered due to the repercussions of the COVID-19 pandemic, which impacted the performance of development, production, flight testing, aircraft delivery, and software upgrades. During the period 2021–2024, we notice an increase in revenues due to the company's intensive commercial activities and an increase in the number of deliveries, especially during the year 2024, by 200 aircraft compared to 2020. This indicates strong performance across programs and growth in services.

# 6 CONCLUSIONS

Concurrent engineering is one of the most important techniques for ensuring effective development processes across all phases of the product life cycle. It also supports sustainability from the stage until the product reaches the market by reducing cost and time and improving quality. This is due to the simultaneous integration of design, development, and manufacturing processes, supported by cross-functional and multidisciplinary teams. This confirms the validity of the first hypothesis, as demonstrated by the following:

– Concurrent engineering provides an integrated framework throughout the product development cycle, which contributes to companies achieving competitive advantage and keeping pace with rapid technological changes and developments in the modern manufacturing environment, thereby meeting customer requirements.
– Concurrent engineering can be considered a long-term strategy that supports cost management by controlling costs and providing appropriate resources to complete product design, development, and manufacturing processes successfully and efficiently.
– Airbus has invested in concurrent engineering and further developed it by adopting digital solutions and new techniques such as DMU and the MBSE model. This has helped strengthen performance, increase productivity—especially at the design stage—and achieve sustainability through its research and development programs. It has also enabled Airbus to monitor its aircraft throughout their life cycle and implement necessary improvements. This confirms the validity of the second hypothesis.

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