

Using the Design to Cost (DTC) as a Strategy to Control Product Cost in Industrial Companies – Case Study at Dacia – Renault Group -

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Abstract:

In light of the intense competition that characterizes the modern manufacturing environment, this has led many industrial companies to use the Design to Cost strategy as one of the most important cost engineering techniques that help companies to determine the ideal designs to control the project life cycle starting from the design phase. Given the nature of the study, we used the descriptive approach and the analytical approach. By applying the case study to Dacia-Renault Group, the study concluded that the Design to Cost enables companies to balance Cost/Quality/Price in line with changing and increasing customer requirements, while achieving significant profits and controlling product costs more precisely from the design phase.

Keywords: Design to Cost; Cost Controlling; Target Costing.

Jel Classification Codes: D24, D91, L11

1. INTRODUCTION

Product development and design activities have witnessed significant strategic and organizational changes in recent years, especially in the complex industries sector (automotive, aircraft, aerospace, military industry,...). Therefore, the design element is a key factor at the beginning of development. Although the initial design cost ranges from only 10% to 15% of project expenses, approximately 80% of these costs will be incurred in the future. Developing cost-effective products also includes taking into account materials, manufacturing methods, transportation, energy consumption, product quality, number of parts and design concept. In addition, the designer must have sufficient knowledge of expenses, cost concepts, and how to estimate and evaluate them. As a result, the designer can actually begin to evaluate differences in the product concept based on expected costs at an early stage and choose cost-effective concepts that can be examined in more detail later.

It has become necessary for designers to look not only at the production costs and overhead of the product, but at all the life cycle costs, including removing the product from the market. Michaels Wood argues that: Design versus cost explores the full scope of a project from concept selection to final use. It embodies the basics of planning, designing and implementing activities or producing outputs within certain financial constraints, and comprehensively provides all the tools, techniques and data necessary to successfully set and adhere to cost targets. It embodies the essential aspects of both Concurrent engineering and total quality management.

Therefore, the disciplines of value engineering, cost estimation, cost control, and quality design are used to set realistic and achievable cost objectives, and means of implementing projects without exceeding these set objectives. Perry argues that: Design to cost is the name given to managing the total cost of a product throughout its entire life cycle. Additionally, Design to Cost (DTC) is the solid face of all Design for Excellence (DfX) disciplines. Because the cost impact will be determined by each design task in each area. An important foundation of design to cost is efficient cost

estimation so that the designer can use it for the fast verification cost when (making) a decision.

Based on the above, the problem can be raised as follow:

What mechanisms are used in a design to cost strategy to reduce costs, and increase profits in industrial companies?

Study Hypotheses:

- **H 1:** Design to cost relies on designing a cercle (cost/design/development/evaluation) that balances design options, costs and value objectives for the customer.
- **H 2:** Dacia relies design to cost strategy to improve vehicle design with the best possible, low-cost technical solutions and design to deliver vehicles to customers at the right price and required quality.

2. The Concept of Design to Cost (DTC)

2.1 Definition of Design to Cost

In 1973, the Department of Defense (DoD) issued a study on the concept of Design to Cost, which focused on linking the concept of DTC to the product life cycle cost approach, by establishing cost standards that take into account “Design to” requirements, such as: acquisition and ownership cost, unit production cost, operating cost., with the necessity of continuous evaluation of development processes according to design requirements and technical requirements. In addition to logistical support, which is one of the most important criteria that must be taken into consideration early in the design process due to its significant impact on the readiness, capacity or cost of Weapon system (P.Warren & M, 1973, pp. 6-7).

According to the Design to Cost Handbook of DoD issued in 1990, DTC is:

- Managerial technique for controlling cost by designing to specific goals.
- Focuses on Encouraging creativity among developers under design and covering development costs by providing financial incentives when they achieve contractual goals.

The elements of DTC include: Design to Unit Production Cost, Design to Operating and Support Cost (WARREN, JR, & Kolkmeier, 1990, p. 01).

According to Gauthier, design to cost can be defined in two cases:

- Case 01 (One Company): Focus on the extent to which design decisions affect other costs of the product. In this case, Design to Cost targets the product development process.
- Case 02 (Customer and Supplier): Design to Cost works to achieve a win-win principle between the two parties, and thus the focus will be on designing a product that achieves the cost goal that the customer set at the beginning of product development (Angéniol, Gardoni, Yannou, & Chamerois, 2005, pp. 2-3).

2.2 The difference between Cost Of Design and Design To Cost

A- Cost of Design: Specifies based on customer needs and competing offers. Then comes the cost price based on the product specifications.

In this context, the technical part (specifications) is linked to the market. However, when excellence strategies are implemented by some economic agents in the market, it may have an inflationary nature, as customer requirements regularly increase with new features offered by suppliers. (Equipment such as air conditioning, central door closing or even electric windows were premium options for high-end cars in the past...). This may leave room at the bottom of the market for economic agents who may use the « **design to cost** » method

Therefore, care must be taken not to direct the project by meeting specifications only (prioritizing quality over cost). Risks here can be exacerbated by the fact that specifications appear to take precedence over costs. Whereas, if the price is initially stoked, there is a risk of derailing not only the cost of producing the final product, but also project costs and deadlines. For that, the triangle Q – CD (quality – costs – deadlines) must be taken into account mainly.

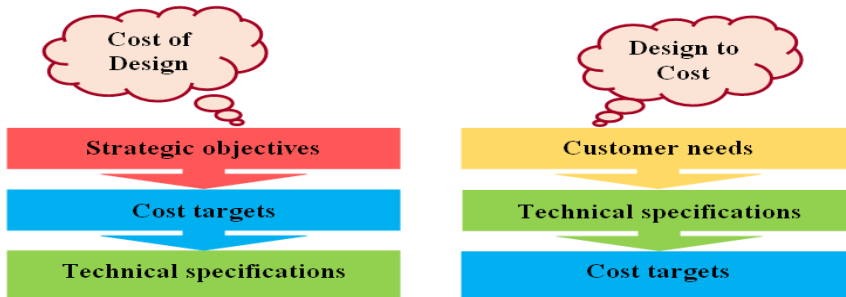
B- Design to Cost: It is an alternative approach to Cost of Design, in which the cost price is capped before specifications by removing non-essential features to reduce the cost of a product or service.

In this method, any development that may affect the cost price of the product and the cost of the development project must be monitored. To achieve the ultimate goal (obtaining a price advantage in the market), it is not enough to reduce production and distribution costs. The design process

must also be well mastered. Accordingly, the ceiling initially set relates to the cost price of the product and the amount allocated to the project (Arnold & Corbel, 2022, pp. 3-4).

Thus, we find that DTC focuses on the customer's voice in developing the product or service. Therefore, technical solutions must be used to meet market expectations, cost determination based on technical specifications, and a joint development process between design engineers and accountants.

Fig.1. The Hierarchy of Design To Cost and Cost Of Design

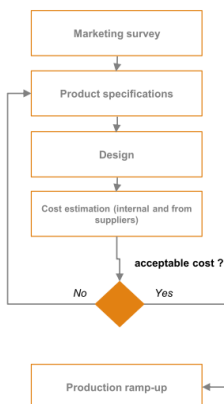


Source: (Arnold & Corbel, 2022, pp. 3-4)

From Figure 2, we find that the target cost in DTC is determined by the difference between the selling price and the profit margin. In contrast, in traditional approaches, the selling price is determined by combining the production cost and the profit margin, which indicates the effectiveness of DTC in controlling costs.

Fig.2. Cost Determination between DTC and Traditional Approaches

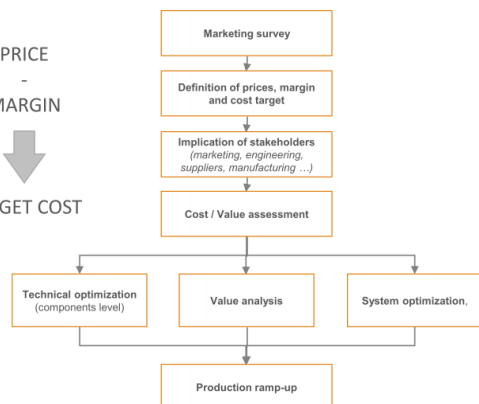
Standard development projects



$\text{COST} + \text{MARGIN}$
↓
 PRICE

"Design to Cost"

$\text{PRICE} - \text{MARGIN}$
↓
 TARGET COST



Source: (Pivret, 2022, p. 4)

2.3 Concepts associated with the Design to Cost Approach

The global economic environment is characterized by intense competition, as the world has become more integrated through the expansion of trade, investment and communications, due to the accelerating and increasing requirements of the market. This has had a continuous impact on project life cycles; low profit margins also make it necessary for new plants to quickly transition into operational mode. This trend requires a change in how cost engineering is handled for potential new projects. To succeed, industrial companies need to be able to identify economically viable projects as close to the design process as possible, thus reducing the time and money spent on potentially unprofitable endeavors. In order to maintain competitiveness and maximize business performance, optimal process designs must be identified quickly with minimal rework risk because additional design changes in the project development cycle come at the expense of higher cost and more effort. Concurrently, the concept of Design to Cost has been developed to include the entire product life cycle and market requirements. We explain this as follows:

Table 1. Evolution of Design to Cost Concept

Concepts	Definition
Cost As an Independent Variable (CAIV)	In 1996, the DoD introduced a new method, called the CAIV (Cost As an Independent Variable) methodology, which was a result of the failure of the DTC technique. This method was used only in the defense sector. The name of the method comes from the premise that cost should be treated as an independent variable (input data for the design and not a result of the design). CAIV is defined as an acquisition management method in which cost objectives are achieved by balancing requirements and performance. The updates of this method compared to the DTC technique are the creation of teams responsible for both costs and performance (called «Integrated Product Team»), user engagement, risk analysis and the ability to challenge requirements. The principles of this method have improved cost control in design, but this

method has not spread outside the United States.

**Design to
Life Cycle
Cost:**

Towards the «Design to life Cycle Cost» (DtLCC). Increasingly, Design to Cost takes into account all the costs over the life cycle, we then talk about Design for a Global cost (of the LCC type) on the military plan and DOC (Direct Operating Cost) on the civil level, particularly in aeronautics where product use cycles are long and maintenance costs represent a significant cost for customers.

In 2010, DoD developed a design-to-cost technique, By creating a new technique known as BBP. DoD published a document entitled: **Better Buying Power : Guidance for Obtaining Greater Efficiency and Productivity in Defense Spending**. It includes 23 basic efficiency improvement measures divided into 5 main fields, with the aim of controlling cost growth

**Better
Buying
Power (BBP)**

BBP consists of developing a set of effective measures to enhance the purchasing power of the Ministry of Defense, improve industrial productivity, and provide value-added and affordable military capacity to Warfighter. Created in 2010, BBP includes a set of core acquisition principles to improve efficiency through affordability, cost control, eliminate unproductive and bureaucratic processes, and promote competition. BBP initiatives are also designed to encourage productivity and innovation in industry and government, and improve business access to services.

**Should Cost
Management
(SCM)**

SCM is linked to the concept of BBP through the principal of promoting productivity growth. SCM is a strategy used by program managers (PMs) to investigate and dissolve low-value-added components of program cost through various actions. Considering that Should Cost (SC) is an essential component of BBP, it imposes on program managers the necessity of SC to ensure that all cost elements and look for the possibility of reducing each cost element compared to the previous year, while analyzing overhead expenses and indirect costs with the aim of reducing the cost and achieving profit

Design To Cost 2.0 (Set-Based-To-Cost) The set-based-to-cost is a design-to-cost method equipped to produce maximum value in minimum time. It is a method that knows how to represent all the points of view of the professions and stakeholders

Redesign To Cost (RDTC) Redesign to cost is a method that combines functional analysis and value analysis, allowing to prioritize the functions of a product (or service) for the client, and to identify the functions that cost the most and are least valued by the user. It is about eliminating "over-quality", and focusing the cost price on what matters most to the client.

Source: Prepared by the Researcher based on: - (Angeniol, 2006, pp. 20-21)

- (Office of the Under Secretary of Defense, 2010, pp. 2-3), - (Serbu, 2017)

- (Office of the Assistant Secretary, 2016, p. 04), - (Holley, 2007, p. 29), - (Fournier, 2018)

3. Implementation steps of Design to Cost

Design to Cost method works to find a balance between **cost** (direct costs, full costs, total costs of ownership TCO, recurring costs/non-recurring costs) and **value** (functions, performance, safety, brand, selling price, features), and this is done through the following phases:

3.1 Determine target costing and analyze costs

The life cycle Product analysis (LCA), generally based on a target total costing (TTC) and its associated specifications. This aims to eliminate inputs that do not directly contribute to the functions of the product or service designed (Boissin, 2021, p. 7), this is done by:

A- Define the objective selling price: calculate the price that consumers will be ready to pay or that competition will be able to offer at the time of marketing the future product

B- Determine the objective profit of the product: the margin of a product varies depending on the will of the company, the age of the product, its sales volumes... it is therefore necessary to set what the desired profit will be for each product

C-Target cost: selling price – target profit margin

D- calculate the estimated cost of the product: take into account variable production costs (raw material, machine, labor with satisfaction levels on

quality, assembly,...) and indirect production costs (marketing, production, logistics, marketing,...)

E- Reduce the gap (objective cost/estimated cost): the company then has two possibilities:

- either it increases its objective cost by adding value to the product (more differentiation, better after-sales service, etc.) but this does not match the targeted customer.
- either it reduces its estimated cost by playing on the product's functions, components, production process, equipment,... (Clavel, Bounfouf, & Saintoyant, 2012, pp. 17-18)

For example, a basic level will only contain the basics to meet expectations, while a higher level will add better features and characteristics. This approach is also known as **Design to Value**. Determining the target costing from the design phase is an essential step on the path to production profitability (Installux Extrusion Services, 2023).

From the above, we find that the process of analyzing and evaluating each cost element and determining the target costing with analyzing the functions of the product components (value analysis) will help the design team to identify and evaluate alternatives to choose the optimal one in terms of low cost without compromising the quality and performance of the product.

3.2. Strategic Cost Analysis (Strategic Management Accounting)

Strategic cost analysis (strategic management accounting) identify and analyze long-term costs determinants (economies of scale of experience...etc.) and its impact on the: level of costs, structure of costs and costing behavior model, and begins during the research, development and design phase of the product, with the aim of avoiding initial costs in the product life cycle (Ashvine & Nagpal, 2011, p. 121).

Therefore, this is considered a crucial step, because the team determines the different cost drivers to take into account during the product design phase, as they will have a strong influence on the final price of the product. Actually, the design engineer can influence 70% of the final cost of a product (Installux Extrusion Services, 2023).

3.3 Cost Drivers Control

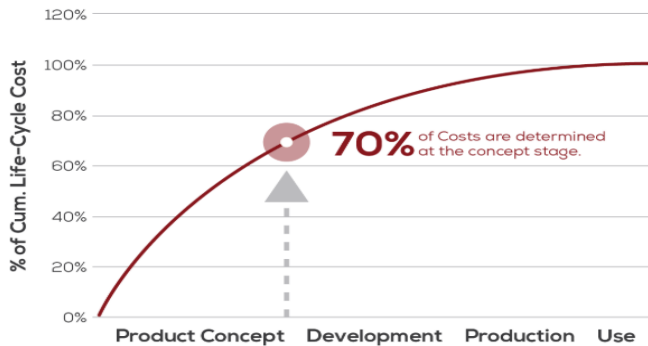
DTC involves specific techniques to determine cost drivers in: product design, raw materials, the manufacturing process, and components, and then systematically reduce those costs, as early in the design process as possible. Companies employ various approaches to model product costs, however those techniques can vary in speed and accuracy (PWC, 2015, p. 10).

3.4 Analysis of results

The process of analyzing and evaluating the results of the design target costing using value measurement techniques (cash-flow analysis and break-even point) to measure the value of the best alternatives is carried out by conducting an examination of the grade of functional accomplishment and economic analysis of those alternatives that provide the highest value, where the team involved in the value analysis conducts an objective analysis of the ideas resulting from the innovation and design phase (Dhouchak & Biban, 2017, p. 237).

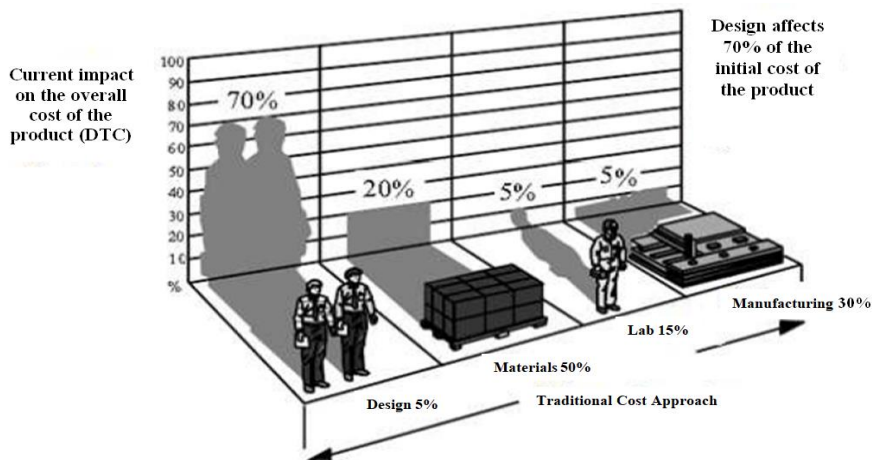
4. The Role of DTC in Reducing Cost

- control of production costs.
- Quality improvement: Design to Cost encourages designers to look for creative solutions to achieve cost targets without sacrificing quality.
- Improving efficiency: by setting a cost target and working in this direction, designers with the help of buyers and suppliers can find ways to simplify and improve the production process.
- Greater customer satisfaction, as it allows for the creation of well-positioned products on the market.
- Improvement of the company's profitability and performance in the market (Installux Extrusion Services, 2023).
- The design engineer helps influence the total cost of the product by 70%, which indicates that DTC strategies are very effective in reducing costs.

Fig 3. The Role of Design to Cost in Reducing 70% of Product Costs

Source: (McDermaid, 2024)

Fig 4 indicates that the transition from the traditional method of calculating design to cost the DTC cost design method is based on the importance of design in achieving the organization's objectives, based on the possibility of charging the actual costs of the product to the design cost, and it can also be held responsible for reducing these costs.

Fig 4. Comparison between DTC and Traditional Cost Approaches to Controlling and Reducing Product Costs

Source: (Ciambrone, 2008, p. 49)

In Table 2, we explain the difference between the design to cost approach and traditional approaches to influencing product cost.

Table 2. The effect of Design To Cost and Cost of Design on product cost

Standards	Traditional Approach	Design to Cost
Moment of cost optimization	After the design phase	From the beginning of the design
Main Focus	Maximum technical performance	Balancing cost and value
Team Involvement	Focus primarily on the R&D team	Multi-skill team: Design Engineers, Cost Engineers, Accountants, purchasing, Cost Controlling, Suppliers, Customers/Marketing, Project manager (all stakeholders must be involved from start)
Potential Cost Reduction	5% - 15 %	Up to 70%
Impact on innovation	Limited	High (innovative and sustainable solutions)
Cost Drivers	Unknown and undetermined	Determine, multiple and controllable from the start

Source: Prepared by the Researcher based on the Above.

The DTC method has proven its effectiveness in many complex industries as shown in Table 3.

Table 3. Design to Cost Examples

	Program / Process	Situation	Method / Solution	Result
Program Level	Joint Direct Attack Munitions (JDAM) 	- Simple design - High volume - Steep learning curve	- Willing to trade performance to achieve low cost - Limited performance requirements	Successful in controlling costs and achieving performance
	Crusader Howitzer 	- Contractor estimate unaffordable - Rate of fire requirement - cost driver (12 rounds / min)	- Cost/Performance analysis - Recommended 10 rounds per min (slightly reducing performance)	- Eliminated costly barrel cooling and complex shell loading, reducing cost - Still too expensive - Program cancelled
	Commercial Airplane 	Requirement for parking brake to hold for 12 hours cost driver	- Trade studies on time requirement - Negotiated with customer	- Parking brake never used for 12 hrs - Reduced requirement performance and hence cost
Component	Electronics Part Count Reduction 	Goal to reduce manufacturing costs of electronic parts	- DTC - DFMA – Design for Manufacturing & Assembly	- Reduce part count & assembly time - Eliminated fasteners & clamps - Consolidated parts by 30%+
	Design Details (Aerospace Company) 	Non-structural parts exceeded cost targets by 10%	- DTC - DFM – Design for Manufacturing	- Identified “cosmetic” details increasing complexity - Simplified design & reduced cost

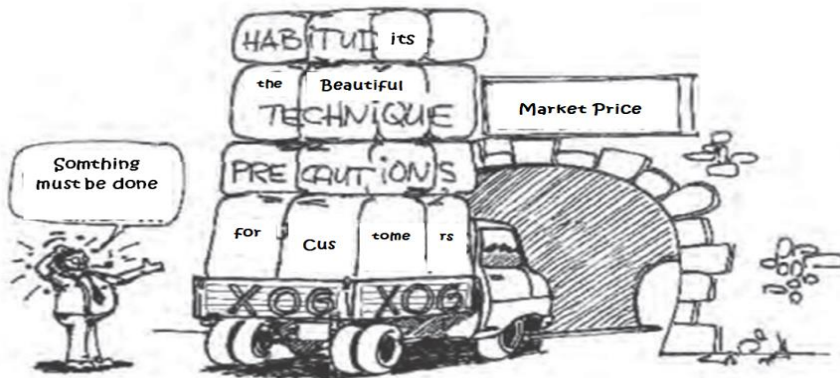
Source: (Apgar, Colabella, & Mourikas, 2023, p. 11)

5. Renault Group Cost Reduction Strategy - Design to Cost -

5.1 Applying Design to Cost through a Project-Based Management Approach at Renault Group

Since the mid-1970s, Renault had been wondering about the possibility of manufacturing a second, lower-cost car along with the R5 line, whose code name was the more innovative and exotic VBG (low-cost car). However, the idea was abandoned. After many improvements were made through Patrick Le Quément's design, a model very close to the Twingo 1 drawing was presented at the beginning of December 1988. It was decided to give this project a chance, as Yves Dubreil (project manager as: Chief Trouble Maker) was appointed to embody it and find solutions to make it profitable. Therefore, he presented a special drawing of the tunnel to show how to implement the design according to cost (Dubreil, 2020, p. 247).

Fig 5. Example of a drawing used by Yves Dubreil to pass on the project team the message about design to cost, essential for success with the Twingo in 1989



Source: (Dubreil, 2020, p. 248)

Through this figure, we find that Yves Dubreil wanted to show engineers and sales representatives that the accumulation of restrictions they impose does not fit with the project's budget objectives, so some of these restrictions must be abandoned, otherwise this will lead to its disruption. To achieve this, Yves Dubreil has assembled an independent team of enthusiasts, directly linked to Renault's general management. This

atypical organization facilitated the decision-making process and allowed for the very rapid development of a completely new model: less than three years. The project was not intended to replace an existing model (ensure efficiency), and there was no pressure associated with the requirements of the result, but rather suitable conditions for creativity, which led to the creation of radically innovative technical and organizational solutions, which helped the success of the project and sources of savings for other manufacturer models (Autoscope, 2016).

To embody the project management approach through the innovative Twingo 1 product, which features a well-moving-dynamic design with its wheels at four corners, and the rolling model of the future Twingo car, management tools were formulated for the following reasons:

A- Design to Cost: Cost is the absolute constraint, not the technical, industrial and commercial constraints. The company's three suppliers were contacted and told that all estimates put the operating cost at between 250 and 255 francs. So the project manager (Yves Dubreil) took a 200 franc note out of his pocket and asked them what could be done for this amount and everything was negotiable. It worked.

B- Facing the cost of each job: A very simple system was created that gave each job a project, in two columns, on the one hand the cost target and on the other hand the potential cost, correcting the expected cost through potential risks and opportunities. Project management involved finding solutions so that the potential cost remained below the cost target. Each week, each functional group prepares its reports, so the project team can prioritize its actions on the functions that encountered the biggest amount of problems.

C- Any problem is solved on site: all project participants were able to be placed on a common platform by bringing together all professions involved in each job and the support of the public administration was crucial in convincing the rebels. Field meetings (factories, suppliers, business network, etc.) with local actors have also been doubled.

D- Supporting research in the social sciences: In the early 1990s, Christophe Midler's expertise was drawn from the Centre for Management

Research (CRG), with the aim of monitoring and participating in team decisions. He was forced not to publish anything before Twingo was released to the market in 1993, but he was widely rewarded with the publication of his best-selling book in 1993, *L'auto qui n'existait pas*. The Twingo project is the first low-cost innovation project before the epic Logan 11 in 2004, and then in 2015, the idea of "upside down innovation" for the economic design of the Kwid model, which was initially intended for the Indian market. These three projects share the practice of "simultaneous engineering," that is, mobilizing all professions from start to finish, with the goal of keeping the machine running as long as possible in finding gaps.

E- Internationalizing good practices with the Montreal Club: On the advice of the company's human resources manager, Learning Expedition was launched in Montreal and a club was created that aims to bring together leaders of innovative and atypical projects to discuss good and bad practices. Among the features of this club is the absence of structure and hierarchy (everyone is president and there is no budget) as each person manages his own company or resources. The club's fame was very great and attracted the attention of the company's competitors.

F- Adherence to deadlines as a priority: Reducing delays is essential to the progress process, and this is achieved by combining all skills and decision-making ability.

G- Get marketing to reduce marketing costs: Project management shows that innovation can be frugal and come from below, unlike other innovations, i.e. those designed by design offices disconnected from reality and concerned only with sophisticated and explosive content, complexity and costs (Dubreil, 2020, pp. 249-250).

5.2 Implementing a Design to Cost strategy at Dacia- Renault Group

A- Company Establishment

Dacia was founded in 1966 in Romania. In 1999, the Renault Group acquired Dacia, and the brand underwent a change in its strategy without abandoning its roots and the Logan was released as the first step (Dacia). Currently Renault Group owns 99.43% of the company's assets, and Dacia

has 6,901 employees as of December 31, 2024 (Renault Group, 2025). It now has four leading models in the European market representing its brand (Sandero, Duster, Spring and Jogger), meeting customer needs while maintaining the fundamental principle of quality versus affordability. In 2024, the Bigster was launched (Renault Group, 2025, p. 23).

Dacia has more than 8 million customers in 44 countries, mostly in Europe and the Mediterranean, and its sales exceeded 9 million cars during the period 2004-2024, which indicates the company's continuous development by continuing to meet future market expectations and reinventing the automotive sector. (Dacia)

B- The Role of Design to Cost in Reducing the Cost of the Dacia-Renault Group Vihecls

The Dacia brand is considered a leader in the field of low-cost cars, as it relies on a design-for-cost strategy (cost efficiency) that aims to design the right product at the right price for customers (a guiding principle for the company) instead of a "low-cost" strategy (Renault Group, 2002). This is done by determining the design and technical solution based on the exact cost followed, improving the vehicles to achieve the cheapest technical solutions, and producing the best cars with fewer resources. This embodies the concept of economic engineering, as Dacia works to meet the basic needs of its customers and not to meet the desires of internal engineering that wants to enter the race for technology (Cottrel, 2022).

- **Dacia's approach:** is to reverse the logic from the standard product development method where cost is the result to the design method to cost and cost is the entry point.

- **Dacia's Objective to be achieved through Design to Cost:** Currently, Dacia's goal is to achieve a cost advantage of around -15% over the competition by focusing on what really matters to customers, the "basics," and leveraging the group's assets and the expertise of its 3,000 engineers. Standard platform and upper body reuse are key to efficiency in terms of capital expenditures and manpower, while reducing entry ticket and variable costs thanks to the size effect. In doing so, Dacia will continue to reduce its costs and benefit from doubling the size of the standard CMF-B

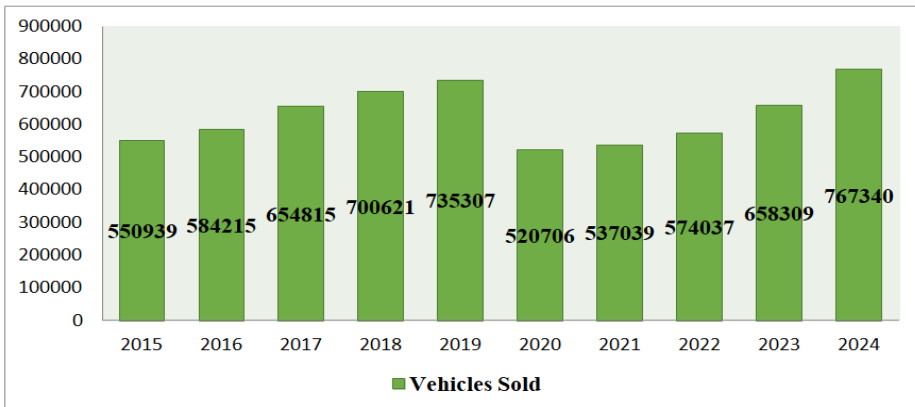
platform (all brands combined), which will reach 2 million units by 2030. Meanwhile, Dacia will keep capital expenditures and R&D expenses below the group average thanks to high migration rates between vehicles, ranging from at least 40% to 80% (Billancourt, 2024).

- Adopting a new strategy that complements the design to cost strategy: Entering a new era in January 2021 with the renovation plan (**Renaulution**), Dacia clearly played its role as the group's full brand with the arrival of the New Sandero, the new Spring electric city car, and more recently the New Dacia Jogger and its planned camping version. A new range of vehicles that are more modern and more technological yet still available on the market. Although it makes sense for prices to rise slightly to be able to incorporate new equipment, Dacia has been able to maintain its position, thanks to a design-for-cost strategy of returning to customers' basic needs. This points to Dacia's policy of not exaggerating or bringing in "useless" equipment, and the idea here is to offer its customers a simple car, with an unbeatable quality/price ratio, thanks to various well-kept secrets in model design (Renault Group, 2002).

C- Performance Efficiency Dacia – Renault Group

- Vehicles sold

Fig 6. Number of Vehicles sold by Dacia for the period 2015-2024 (Units)



Source: Prepared by the Researcher based on annual report of Renault Group 2015-2024.

From Fig 6, we find that Dacia's sales for the period 2015-2019 increased significantly, with an increase of 25.07% at 2019 compared to 2015.

In 2020, the company's sales declined due to the Corona pandemic, which negatively affected the global economy, and the decline rate was estimated at: 29.18% during the year 2020 compared to the year 2019. However, the company, thanks to the Renaissance strategy that the Renault Group began implementing at the beginning of 2021, contributed significantly to the company regaining its activity, stabilizing the financial situation and restoring competitiveness by improving efficiency in engineering and production and simplifying cost structures. The number of vehicles sold by Dacia in 2024 reached 767,340 vehicles, exceeding the sales of 2019 (735,307 vehicles), indicating the effectiveness of the strategy followed by Dacia and the entire group.

Given Renault's 2021 reinvention plan, which includes a new brand organization, this has given each Renault Group business unit, including Dacia, greater autonomy and flexibility. The focus has been refocused on products, with the best selection of vehicles in 30 years, attractive and competitive models, as well as continuous improvements in the environmental footprint.

- **Dacia Returns Efficiency:** In addition to the above, we find that Dacia's business model and product approach ensure strong growth and profitability that translates into significant returns. The efficiency of Dacia's returns is due to the following factors:

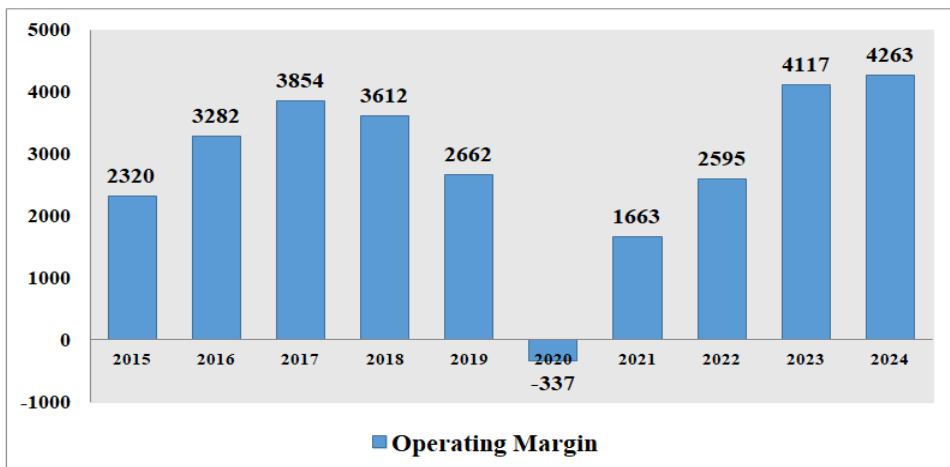
- High plant utilization rate (>130% - port), where a new vehicle is produced every 30 seconds, highly competitive ecosystems in Romania, Morocco and Turkey, with strong local integration of its supplier base.
- Dacia plans to double its sales volume between 2022 and 2030, i.e. half volume, half mix and price, while fixed costs are expected to rise slightly over the same period.
- Dacia already has a strong double-digit operating margin and aims to reach 15% before 2030.

- Dacia plans to consolidate its position as a champion in terms of performance with a return on invested capital higher than the Renault Group target (group target > 30% as of 2025) which is supposed to double between 2022 and 2030 (Billancourt, 2024).

-Renault Group Operating Margin:

Referring to the financial and annual reports of the Renault Group, we did not find details about Dacia separately, but rather we found data and statistics that include all the companies acquired by the group (Dacia, Renault, Alpine,...), so we will analyze the evolution of the operating margin while highlighting the contribution of lower manufacturing costs to achieving a significant operating margin

Fig 7. Evolution of Operating Margin 2015-2024 (Million €)



Source : Prepared by the Researcher based on Activity Reports of Renault Group 2015-2024.

- **2015-2017:** From the figure, we find that the operating margin increased significantly during this period, as the value of the increase reached 1,534 million (2017 compared to 2015), and this increase is due to a decrease in manufacturing costs and general costs by 572 million euros (2015) as shown in Table 5, and 788 million euros (2017), In addition to increasing research and development costs to address the technological and regulatory challenges existing in the automotive sector.

- **2018-2020:** We notice a decline in the operating margin, as the value of the decline reached 950 million (2019 compared to 2018), reaching -337

million euros during the year 2020, mainly due to the unsuitable environment, as: The negative impact of currencies, whose impact reached - 572 million and -445 million euros during the years 2018 and 2020, respectively, was due to the decline in the value of the Argentine peso The negative impact of the Corona pandemic on the global economy, and the significant rise in steel prices, as evidenced by the negative impact of raw materials, which amounted to (- 356, - 324 and - 131 million euros) during the years (2018, 2019, 2020) respectively (as shown in the table). To counter these negative effects, the Group continued its cost containment policy through the positive impact of lower manufacturing costs (€362, €668, €208 million) over the three years (2018, 2019, 2020), with price increases in emerging countries and in Europe leading to positive price enrichment (+€261 million in 2018 compared to 2017, +€172 million in 2020 compared to 2019).

- **2021-2024:** During this period, the Renault Group implemented the Remanufacturing Strategy (Renawlutution), which aims to reduce the vehicle development period from 3 years to 2 years, in order to reduce its costs and accelerate the renewal of the Renault, Dacia and Alpine groups. Through this strategy, it was able to achieve its goals 3 years ahead of schedule, as evidenced by the increasing development of the operating margin, which reached 4,263 million euros in 2024, an increase estimated at about 61% Compared to 2021 (€1,663 million), the target was for the operating margin contribution to the Group's revenues to be >3% in 2023 and >5% in 2025. However, this target was reached during 2021 and 2022, respectively, indicating that the Group has achieved the fastest recovery in the history of the automotive industry, by continuing to accelerate the digitization of its industrial system Enhancing the skills of its teams, it also relied on the Metaverse platform, which brings together its workstations and the workstations of its suppliers and allows detailed analysis of production data. The Renault Group confirmed that this saved the group 270 million euros in 2023, especially through predictive maintenance of facilities.

**Table 4. Analysis of the Operating Margin Evolution of the Renault Group
2015-2020 (Million €)**

Variation Period	Operating Margin	Reduction of Costs	Raw Materials	Price Enrich	Growth	Currencies
2015 vs 2014	+ 711	+ 572	+ 61	- 379	+ 480	+ 22
2018 vs 2017	- 391	+ 362	- 356	+ 261	- 86	- 572
2019 vs 2018	- 901	+ 668	- 324	- 587	- 656	- 2
2020 vs 2019	- 2975	+ 208	- 131	+ 172	- 2779	- 445

Source : Prepared by the Researcher based on Conferences of Renault Group (Investor Relations : Financial Results) 2015-2020.

6. CONCLUSION

Design to Cost is a set of principles, methods, and tools that aim at taking design choices, customer value objectives, and costs into account as much as possible since It offers an integrated vision of a competitive, organized and creative approach that aims to meet user needs through a specific, functional, economical and multidisciplinary design approach. Therefore, we find that many industrial companies rely on this strategy, for example:

Toyota uses a « group-based design » approach, which refers to the design to cost approach that is based on 04 basic elements in building its strategy (cost, design, development, evaluation) that works to improve the effectiveness and efficiency of development through good control of resources in parallel with Alternative design solutions to meet production needs and customer requirements at the same time, while maintaining the goal of low cost and quality. **This confirms the validity of the first hypothesis.**

Dacia – Renault Group is one of the most important companies in the

frugal automotive industry, producing cars with low-cost designs using resources that meet clients requirements in terms of quality, price, and duration of use. It also improves vehicles using designs with low-value technical solutions, which embodies the concept of economic engineering founded by former Renault-Nissan President Carlos Ghosn Which was implemented with the development of Dacia vehicles and the launch of the Logan car, which is the first product produced by Dacia within the framework of implementing a design to cost strategy, and this confirms the validity of **the second hypothesis**.

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