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Critical Success Factors and Negative Effects of Development – The Boeing 787 Dreamliner

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Abstract
One of the most turbulent industries, which regards innovation as a necessity rather than a choice, is the airline industry. The paper presents the breakthrough innovation of the Boeing Company, its new aircraft model – the 787 Dreamliner. A number of innovations have been implemented within this new model. The concept of sustainable development and environmental protection has been applied as well in order to ensure positive effects on the whole society and the environment.
On the one hand, this type of innovations leads to a leadership position and the maintenance of a competitive advantage in the long run. On the other, a high level of the complexity of such innovations carries with itself a high degree of risk and uncertainty. Therefore, it is necessary to identify the critical success factors from the beginning of the innovation process, i.e. idea generation, to the end, i.e. the implementation of innovative products. All critical success factors should be taken as a complex system with constant redefinition and predicting even those, sometimes very hard to foresee, critical factors that can bring the process of innovation into question. Despite the fact that the critical success factors are known, the number of innovations that do not experience a market success is quite high.
Applying the criterion of significance, the paper identifies the list of the primary and the secondary critical success factors with respect to the new aircraft. After the identification, it can be concluded that the critical success factors regarding the new Boeing model had a negative impact on the innovation itself, which led to delays in the production process and the three-year prolongation of the delivery of the 787 Dreamliner. The failure to meet the planned objectives of the new aircraft model and the subsequent fall of the company's reputation, caused by the loss of its loyal customers and business partners, led to a distortion of the competitive position of the Boeing Company.

Keywords
Breakthrough innovation, critical success factors, the primary and secondary success factors, the effects of innovative activities.

Introduction

Assessing the factors that predict a new product success holds critical importance for companies, as research shows that despite a considerable new product investment, success rates are generally below 25%. (Evanschitzky, Eisend, Calantone, & Jiang, 2012) Therefore, with the purpose of minimizing the innovation failure, it is necessary to identify critical success factors of innovations. For approximately 30 years, conceptual and empirical research has been undertaken to identify the critical success factors of new products (Ernst, 2002).

In order to identify critical success factors of a new product and their impact on the product performance, the paper will present and analyze the breakthrough innovation of the Boeing Company, the new airplane model – the 787 Dreamliner. Based on the available data on the development process of the new airplane model – the 787 Dreamliner, the analysis of the innovation potential will be conducted, as well as the identification of critical success factors. The paper classifies the critical success factors into the primary and the secondary ones, in order to highlight the importance and priority of the identified critical success factors. Finally, the paper confirms a critical negative impact of the primary and the secondary critical success factors leading to the delay and prolongation of the market acceptance of an innovation. Therefore, the aim of this study is to identify the critical success factors, group them into the primary and the secondary factors and finally assess the implications of these factors.

1. Critical success factors of a new product

Modern enterprises are facing growing global competition, whose challenges can only be answered through launching new products. However, innovation, particularly in dynamic contexts, is widely recognized as being critical to the growth and competitiveness of organizations (Tellis, Prabhu, & Chandy, 2009). Therefore, to make a new product capable of achieving a competitive advantage, it is necessary to analyze all critical success factors before launching the product.

Therefore, it is essential to make a list of potential success factors as well as actions that will positively affect their impact or minimize their negative impact. On the basis of that understanding, the conditions under which organizational groups operate are basic for successfully managing innovation (Koch, 2012). There are different classifications of critical success factors. One of these is the division into the group of the primary and the secondary success factors, according to the criteria of significance.

Some of the primary critical success factors of a new product are:

- available internal resources,
- defining the concept of a new product,
- drawing up plans and the selection of a new product strategy,
- the production process.

A firm's internal capabilities are important in generating breakthrough innovations (Ahuja, & Katila, 2004; Ahuja, & Lampert, 2001). A firm's internal resources may be insufficient and even inappropriate for achieving a breakthrough innovation, requiring that they should acquire external resources and combine a wide variety of resources and capabilities (Ahuja, & Lampert, 2001). Innovation can be conceptualized as encompassing two different activities: the development of novel, useful ideas and their implementation (Baer, 2012). Therefore, the first step is to define the concept of a new product, which should be based on previously conducted analyses, such as a preliminary and detailed market analysis, a detailed technical and financial analysis. On the basis of the above-mentioned analyses, it is possible to make a positive decision on a new product development and its implementation or a decision on stopping the process of a new product development if the market is not as big as expected or production costs are too high. The following primary critical factor involves the preparation of plans and the selection of a new product strategy. Defining the new product strategy involves: formulating an attractive new product development process, defining the goals, aligning the established goal with the business strategy at the organizational level, explaining the role of the new product in the realization of the planned goals, defining long-term production efforts. Before proceeding to the process of implementing the new product strategy, what needs to be done is analyze the feasibility of the new product concept from the technical, production and business standpoints, demonstrate benefits, performance and business opportunities, created by the new product and ultimately rank the new product on the production scale (Laster, 1998).

Some of the secondary critical factors are:

- an innovative organizational culture and climate,
- the creation of cross-functional teams,
- the leadership of talented people,
- the experience of the company's management.

An innovative organizational culture should encourage individuals to innovate, through the creation of a general policy on the need for the development of innovations and long-term benefits for growth and development. The creation of a cross-functional team is driven by an ever-shorter product life cycle, as an imperative of rapid changes in global demand and the need for increasingly flexible organizational structure and effective communication with the market. Functioning on the basis of a cross-functional principle involves the creation of a team of experts from different functional areas who have the knowledge and experience whose joint action is necessary for the successful implementation of the process.

Therefore, a cross-functional team is akin to a matrix organization, in which the team consists of different functional members (Hirunyawipada, Beyerlein, & Blankson, 2010). The basic characteristics that distinguish cross-functional teams from conventional teams are: functional diversity, integration within the organizational structure, the competitive identity, expected performance. Through the implementation of cross-functional teams, positive effects are achieved, such as: the speed, the easier management of complex tasks, the stimulation of the entrepreneurial culture, the focus on consumers, an increased creativity and organizational learning, higher motivation and more reliable information (Holland, Gaston, & Gomes, 2000). The leadership of talented people, as one of the secondary success factors, should ensure the adequate management of creative and innovation-oriented employees. In order to achieve the greatest effects through talent management, it is necessary to implement the following elements: educational opportunities, through educational programs; recognition programs; advancement opportunities; frequent, open and honest communication; competitive compensation; challenging work assignments; job rotation; ethical values and leadership development and mentoring (Swain, 2007). In addition, special importance is attached to the industry experience of the company's management, especially in the field of marketing and the implementation of R&D activities. Industry experience refers to the experience of a firm's management team in related industries and markets (Song, Podoynitsyna, Van der Bij, & Halman, 2008). Furthermore, marketing experience and R&D experience refer to the experience of a firm's management team in marketing and R&D activities.

This list of the critical success factors of a new product is not final; on the contrary, it is subject to reformulation, depending on the activity and specificity of the company. Certain critical success factors can be eliminated and new specific success factors could be added.

2. The breakthrough innovation of the Boeing Company

Today, many organizations are faced with intense pressures to innovate in order for them to meet customer requirements and especially to produce radical innovations that will draw the market spotlight and the market share to them (Miron-Spectar, Erez, & Naveh, 2011). Radical innovations are those that cause marketing and technological discontinuities on both the micro and the macro levels (Garcia, & Calantone 2002). On the other hand, radical innovation is characterized as an ambiguous and risky process, relying on emergent or undeveloped knowledge, and operating in unfamiliar technology or business domains (Kelley, O'Connor, Neck, & Peters 2011). Therefore, the very process of developing a breakthrough innovation is a major challenge for companies, given its complex and multidisciplinary nature.

Today, one of the breakthrough innovations of the 21st century that will change the future of commercial aviation is the Boeing aircraft model – the 787 Dreamliner. The Boeing Company has a long tradition of the successful production of commercial aircraft models. The Boeing Company began an era of commercial aircraft production in 1957, when it first offered the model 707, which was dominant for two decades (Holzmann, & Shenhar, 2010). Today, however, the Boeing Company follows the vision that it should not wait for more than 10 years between the releases of two models so as not to lose continuity in the innovation process. The latest Boeing aircraft model, the 777, appeared in 1994, so that 2004 was the right year to start up a new project. On the other hand, waiting too long for perfect market conditions may result in a loss due to the non-implementation of innovations. Therefore, each innovative project should be approached with a certain level of risk. In order to minimize the risk of innovative project management, Boeing has developed and applied a new process for managing its enterprise-level research and development. This process, the Global Enterprise Technology System, provides a strategically-driven and systems-engineering-based approach to managing innovation (Lind, 2006). Therefore, in the course of innovation management, the Global Enterprise Technology System encourages a high level of research, as well as an efficient and effective implementation of R&D activities, multidisciplinarity and a systemic approach to the implementation of innovative projects.

The so-called breakthrough innovation of the 21st century offers a range of innovations within inputs, aerodynamics, systems, the engine that will increase the performance and capabilities of this aircraft model (Blake, 2010). Therefore, the focus is on system innovation, i.e. change in the architecture of the aircraft itself in order to achieve better effects. One of the radical changes within this innovation refers to the use of lighter materials in the process of making the fuselage and wings, such as aluminum or plastic (Smock, 2009). In addition, the unconventional methodology of fish-themed design was applied in the process of constructing the fuselage, on the one hand, and the bird-themed design in the process of constructing wings, on the other (Trimble, 2007). For the construction of this type of aircraft, 23 tons of Carbon fiber, which is a lighter material than the ones that had previously been used, was utilized. Carbon fiber was used for the construction of the wings, the fuselage and the interior. Using the above-mentioned material will shorten the production cycle, reduce waste and maintenance costs. In addition to this, in the course of the production process, an emphasis was placed on the use of composite materials associated with a number of positive features, such as a better mechanical performance, durability, a higher damage tolerance, corrosion resistance, a lower degree of wear and fatigue during their use, a lower weight and flexibility in the design. Moreover, composite materials allow for a greater efficiency, which results in lower direct operating costs (Ravi, Starners, Holzwarth, & 2001). At the same time, this type of material enables a simpler design and a more automated production process, which leads to lower variable costs. Therefore, the 787 Dreamliner production process involved a radical shift based on the principle of a large percentage share of composite materials in the overall structure of the aircraft. This was the first time in the history of the airline industry that a 50% share of composite materials was used in the production of such a large aircraft model. The following picture shows the chronological trend of using composite materials in the airline industry, as well as the percentage share of composite materials in each model.

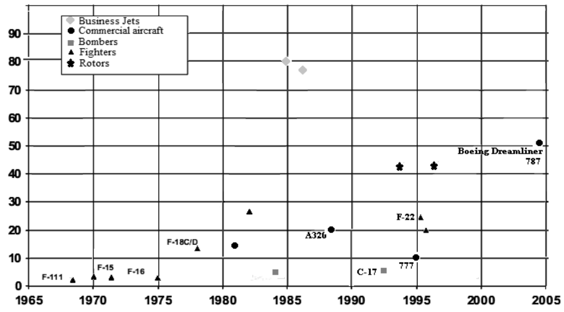

Figure 1 The trend of using composite materials in the airline industry
Source: Ravi, Starners, & Holzwarth, 2001

Furthermore, instead of using a large number of partial computers, the Common Core System (CCS) was implemented, which allowed for a larger display in the aircraft cabin (Holzmann, & Shenhar, 2010). The computer system CCS involved 30 partial computers, which is far less compared to the Boeing 777, which had 80 partial computers. This enabled the easier coordination and implementation of the functions of the partial computers in the system.

Apart from the above-mentioned innovations, the positive effects of these innovations should be pointed out, which are reflected in a reduced fuel consumption by 20% compared to other planes of the same size, a 45% higher load capacity due to the reduced weight of the entire airplane, which will result in less need for repairs and a higher speed by 20%.

In addition to the innovations intended for a more efficient production process, in this airplane model the focus was placed on the implementation of the innovations that would benefit passengers, such as, for example, the better interior design of the passenger compartment that would meet the needs and preferences of travelers. Some of these innovations are reflected in the 50% larger windows of the aircraft, which are 19 inches high and 11 inches wide, the wider seats that provide more space for each passenger, better lighting, a new air purification system, a better system of wing control and turbulence avoidance, which results in better comfort for passengers (Blake, 2010). In addition to satisfying the needs of passengers, the new Boeing airplane model is oriented towards positive effects for all members of the society, through applying the concept of sustainable development and environmental protection. Some of these positive effects are reflected in the reduction in carbon dioxide emissions by 20%, a reduction in noise, compared to the similar types of airplane models produced by competing airline companies, so that noise in the aircraft only exists on the territory of the airport, compliance with all new legal frameworks concerning environmental protection, the reduced separation of nitrous oxide into the atmosphere, which in the case of the Boeing 767 model ranged from 70 to 95% , whereas in the case of the Boeing 787 Dreamliner, it has been reduced to the range of 48 to 64%.

3. The primary and the secondary critical success factors of the development of the new aircraft model – the Boeing 787 Dreamliner

A series of innovations included in the new aircraft model – the Boeing 787 Dreamliner – resulted in major developments in the aviation industry, but simultaneously carried with itself the very demanding and complicated implementation process. In order to make the process of the realization of the revolutionary aircraft model successful, it is necessary that the critical success factors of the aforementioned innovation should be identified. On the basis of the analysis of the available data on the revolutionary innovation of the Boeing Company, the next segment of the paper will present the potential critical success factors.

The first primary critical success factor is the concept of the Boeing 787 Dreamliner model. The design of an adequate concept of the Boeing 787 Dreamliner model was preceded by a long process of research on the part of the Boeing Company's Research and Development Department, as well as the research involving passengers themselves, based on traditional quantitative techniques, collecting qualitative data, applying the method of the ideal design, so that passengers could express their own visions, as well as developing various studies in cooperation with universities. In this way, the traditional framework of thinking about the system of values and psychological and emotional needs of travelers was expanded. Therefore, the existing formulation of the new product concept, based on internal thoughts, experiences and goals, was expanded with the opinions of the participants in the process of innovation production, as well as the ones using the results of the innovation process. The result of the new formulation of the innovation concept was the output that would fully meet the goals and desires of all interested parties. However, the new innovation concept carried with itself a high degree of novelty and risk in the process of implementation, which resulted in the delayed implementation of the innovations. The delays in the delivery of the new aircraft model, the Boeing 787 Dreamliner, led to the inability to gain return on investment. The minimum of 16 billion dollars were trapped in the plans awaiting implementation and in the unfinished construction of the new aircraft model.

Therefore, the Boeing Company was too ambitious when it started the implementation of this program. It aimed at applying a lot of things at once. The combination of next-generation technologies, the revolutionary design and the application of the principles of global supply led to significant time deviations in the timetable implementation. Therefore, the next primary critical success factor was the preparation of the timetable. Judging by the timetable, the configuration of the 787-3 aircraft was scheduled for the beginning of 2008, the 787-9 model for mid-2008, whereas the last model, the 787-10, was preliminarily scheduled for the beginning of 2011. The next activity, the test flight for the 787-3 model, was planned for late 2009, whereas the test flight for the model 787-9 was planned for early 2010. The certification and delivery of the model 787-3 was planned for mid-2010, of the model 787-9 for the end of the same year, whereas the certification and delivery of the model 787-10 was scheduled for the end of 2013 (Domke, 2008). The time interval between the presentation of the first 787 Dreamliner model and the last model stood for an optimal time schedule period, in which the improvements of the new model in the range of 1% would be achieved based on the experiences of the base model. However, due to the planned specifications, the popular airplane model faced the delay of the first test flight, which was prolonged until the end of 2008. The end of 2008 was not the definite date. Another delay occurred, so that the test flight was prolonged until 15 December 2009, when the Boeing 787 Dreamliner took off for the first time for the duration of three hours (Ostrower, 2009). In addition, the certification was also delayed due to the deviations of the constructed aircraft from the original specification, which required redesigning and reassembling. Finally, in August 2011, the certificate of the European Aviation Safety Agency was obtained, which resulted in the possibility of delivering the first 787 Dreamliner, which was achieved in September 2011. Therefore, the delivery – the last activity within the project of constructing the new Boeing model, the 787 Dreamliner – was delayed for three and a half years. It can be concluded that the time schedule was too rigid and rigorous, with minimal deviation opportunities, leading to a domino effect and the prolongation of the last program activity due to an untimely problem solution.

The next primary critical success factor is the production process of the new aircraft model. Therefore, the main reason for the delay in the delivery of the new Boeing model, the 787 Dreamliner, was linked to the production process itself, which had experienced a number of delays due to the repeated performance of certain steps. The problems that arose in the production process are related to the implementation of the new production process based on the principle of the multi-partner supply chain that includes a large number of partners from different continents. The major driver for the involvement of suppliers is the pressing need to achieve target performances, quality characteristics and target prices for all systems, subsystems and airframe items of an aircraft (Wagner, & Hoegl, 2006). Also, for economic reasons, collaborations are growing in importance because of the rising cost of technology development, shortening product lifecycles and a difficulty in sustaining closed research and development models. (DeCusatis, 2008) This type of outsourcing is regarded as a vehicle for building the innovation capability by learning from and getting access to new competencies held by partners and suppliers. (Bengtsson, Von Haartman, & Dabhilkar, 2009) In this case, however, the negative effects of applying the multi-partner supply chain emerged, although the concept had previously been used within the Boeing Company, but to a lesser extent. In the course of the production of the aircraft model 727, out of the total suppliers, the foreign suppliers accounted for only 2%. After that, in 1990, the formulation of the program of the production of the Boeing 777 accounted for 30% of the foreign suppliers, whereas in the case of the Boeing 787 Dreamliner, their percentage was as high as 70% (Holzmann, & Shenhar, 2010). The increasing percentage of the foreign suppliers led to the greater dependence of the Boeing Company on sub-suppliers, an uncertainty whether the procurement function would be synchronized among all partners, whether it would be implemented on time and according to the principle of a high quality in order to meet the earliest and therefore most challenging demand. The multi-partner supply chain carries with itself a high level of risk and, therefore, requires continuous managerial assistance in the process of planning, specification, evaluation, transport, implementation, control and improvement. In addition to inadequate functional management within the supply chain due to poor coordination and communication, many partners faced the problem of an insufficient capacity to meet excess demand, which led to delays in the delivery of their parts and halted the activities in the process of the construction of the aircraft. Another flaw in the implementation of this supply chain was reflected in the mistaken assumption that the supply chain should be linear. In addition, the inclusion of a large number of suppliers leads to a need for the parallel execution of certain activities and frequent returning to previous activities. Moreover, the application of the multi-partner supply chain can lead to a future risk, due to the transfer of the know-how of the Boeing employees to the employees of all members of the supply chain, since the key function of the design is implemented within the Boeing department, whereas the planned design of all the parts of the aircraft is still sent to its contractors.

Another problem within the production process emerged for the reason of using the Exostar Supply Chain Management Solution, which uses the E2 server to monitor the entire process of procurement, the implementation of the planned schedule, the consumption, inventory management, information sharing among the partners, following the expectations of all partners and to assess achievements etc. (Smock, 2009). The Exostar Supply Chain Management Solution could not fully control the multi-partner supply chain, since it is a global web network difficult to control. Therefore, in December 2008, The Boeing Company opened the operating production center, with the aim of monitoring the global production of all suppliers in the supply chain as well as solutions to unexpected problems, with the purpose of conducting the timely elimination of delays.

In addition, design problems emerged within the production process. The central wing box and the internal installations failed the test, which had a negative impact on the production process itself. Furthermore, the fastener, whose production lasts for 60 weeks, had to be redesigned, which additionally prolonged the production process. The result of the redesign was reflected in the extension of the wingspan by 63.3m. Moreover, the fuselage of the produced initial 787-8 model lacked several passenger windows on the left and the right sides of the cabin. The solution to this design problem was very complex and required significant funds (Domke, 2008).

Another problem in the production process that had a critical impact on the success of the process itself was the use of composite materials, which are characterized by higher costs compared to conventional materials. Moreover, the use of these new inputs led to the extended testing of the production process in comparison to what had been envisaged in the initial plan. Despite the initially conducted testing, problems arose in the course of using these materials. On the surface of the aircraft wings, bubbles appeared due to the entry of the air, which led to the easier breakage of the protective part of the material and required additional resolution.

The aforementioned primary critical success factors and the identified problems within them directly influenced the difficult production process of the Boeing 787 Dreamliner aircraft.

In addition to the presented list of the primary critical success factors, it is necessary that the secondary critical success factors be mentioned as well. The first secondary critical factor relates to the establishment of an innovative organizational culture and climate in the Boeing Company. The innovative culture of the Boeing Company promotes values such as leadership, integrity, quality, customer satisfaction, team work etc. Some of these values that underpin the innovative culture of the Boeing Company were not followed, which led to the negative effects in the production of the new Boeing model – the 787 Dreamliner. The next secondary critical success factor is the creation of the cross-functional team, which the Boeing Company implemented by using the multi-partner supply chain, with each partner performing a specific function. The above-mentioned secondary factor was also one of the causes of untimely production, due to the mismatch of the partners' tasks in terms of time, the design and the quality. One of the mistakes of the partners in the supply chain referred to the low-quality production and poor design of the electrical panel in the aircraft cabin, which led to the forced landing of the aircraft during the test flight.

4. The negative effects of the critical success factors and their consequences

The negative effects and problems during the production of the new aircraft model, the Boeing 787 Dreamliner, are related to ignoring the critical success factors. It can be concluded that the defined timetable was too rigorous and elusive, causing constant delays in the implementation of the planned activities.

The first delay led to the postponement of the first flight, which was scheduled for 27 August 2007. The reason for the delay lay in the multiple problems within the production process, such as the final assembly, which was supposed to be implemented by assembling 1200 individual parts of the model. However, the supplier delivered 30,000 parts that had to be incorporated into one whole. The other problems were reflected in the unfinished software, hydraulics, power systems and the other systems.

The next delay was related to the problems that had arisen within the domestic and the foreign supply chains, primarily due to the shipment delays and the incomplete supplier documentation. The third delay built on the previous one because not all problems in the global supply chain could be solved.

In addition to the technical problems in the production process of the Boeing 787 Dreamliner, the Boeing Company faced the problems within the organization due to the workers who were dissatisfied with their contracts. This led to a strike lasting for 56 days, starting in December 2008, which caused the fourth delay. The workers were against the global supply chain that directly affected the reduction in the work within the Boeing Company by 50%. Long-time employees of the company were threatened by mass layoffs. The erosion of working skills within the Boeing Company led to a fall in the attractiveness of this company in the eyes of new specialists and young workers who had just entered the labor market. The overall working atmosphere in the Boeing Company led to the formation of an unhealthy environment that demoralized workers and reduced their productivity. Once the strike of the dissatisfied workers was over, the negative effects were still felt and reflected in constant delays.

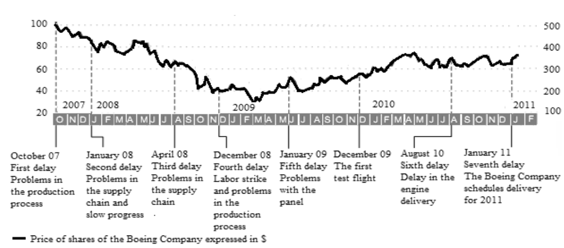

Figure 2 The movement of the stock prices of the Boeing Company
Source: Peterson, 2011

The constant delays resulting from the series of problems explained in the previous part of the paper led to a fall in the stock prices of the Boeing Company, which is shown in Figure 2. The process of the delay in the delivery of the first Boeing 787 Dreamliner was reflected in the prolongation of obtaining return on investment. Large funds invested in this project are related to the research activities and the very production process of the 787 Dreamliner. According to the report published by The Seattle Times, the costs of the Boeing 787 exceeded the planned expenditures, because only the research and development activities from 2004 to mid-2011 cost about 15 billion dollars. In addition to this, the capital expenditures, which included the costs of building plants and purchasing the necessary equipment, amounted to 3 billion dollars, the direct costs of the first 40 aircrafts amounted to 16.3 billion dollars, the inventory amounted to 12.7 billion dollars and other costs to about 2 billion dollars. On the other hand, according to the estimates by Joe Campbell and Carter Copeland, the Boeing Company invested 300 million dollars in the construction of a single aircraft of this type. Moreover, it is estimated that the return on investment per one delivered aircraft would amount to 50 million dollars (Cochennec, 2007). It is believed that financial recovery, i.e. a positive cash flow, can be expected in 2020, which means that Boeing will achieve a 20% margin per delivered aircraft after 1000 deliveries (Gates, 2011). Therefore, the profitability of the Boeing 787 Dreamliner and the speed of covering the costs of the development of this innovation and its production will depend on demand for this type of model. According to the current data, 821 models of the Boeing 787 Dreamliner have been ordered by 56 customers from six continents, with 20% of the largest customers accounting for 50% of purchase.

The Boeing 787 Dreamliner is the fastest-ordered commercial aircraft in history. In 2004, when the R&D activities related to this aircraft model first started, 52 initial aircrafts were ordered. Highly innovative airline companies that focus on the environment, customers and the latest technology were the first buyers of the new aircraft model that offered the right combination of the aforementioned and promised a revolution in the airline industry. After the first year of research and development, over the next three years a growing interest in this airplane model was recorded. Therefore, it can be concluded that the Boeing Company offered the right airplane model at the right time. However, due to the failure to meet the promised delivery date, the interest in this model started rapidly decreasing in 2008. After the deep recession in 2009, demand for this model began to recover.

Despite the three-year delay, the carrier All Nippon Airways (ANA) expects 53 aircraft models by March 2018. In September 2011, the first Boeing 787 Dreamliner was delivered to All Nippon Airways. With 53 ordered 787 Dreamliner aircrafts, All Nippon Airways will replace the existing aircrafts and achieve positive effects reflected in cost reduction. Their goal was to receive the shipment in 2008 in order to meet excessive demand at the extended Tokyo airport. Although the goal could not have been achieved within the planned period of time, the airline company ANA is still a loyal customer of the Boeing Company's aircrafts. In addition to the great loyalty of the ANA carrier, there are instances of disloyal customers who cancelled orders.

All orders since 2004, when the program of the construction of the Boeing 787 Dreamliner was started, up to this day, are shown in Chart 1.

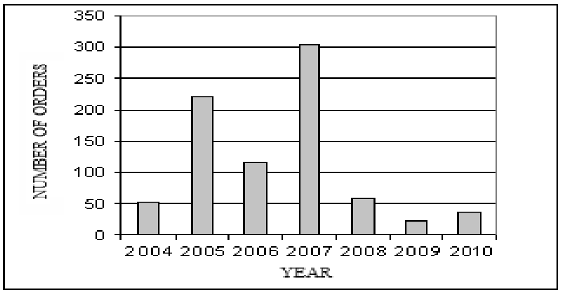

Chart 1 The number of the orders of the Boeing 787 Dreamliner by year
Source: Ray, 2011

What must be taken into account is the share of the orders of the Boeing 787 Dreamliner in the total annual orders of the Boeing aircraft models (Chart 2.).

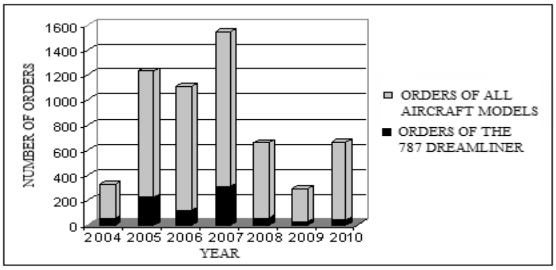

Chart 2 The share of the orders of the 787 Boeing Dreamliner in the total annual orders in the period from 2004 to 2010
Source: Ray, 2011

In percentage terms, the share of the 787 Dreamliner orders in the total orders in 2004 was 19.12%, after which it rose to 24.61% in 2007, after which a large decline of 9.86% was recorded. However, the decline in the 787 Dreamliner orders did not stop at this percentage, but fell to just 5.92% in 2010. Despite a series of unintended consequences that have emerged over time and led to a domino effect, the 787 Dreamliner aircraft remains the plane that led to a revolution in the airline industry.

Conclusion

Identifying the critical success factors of a new product is a prerequisite for managing changes occurring on the market, with the aim of successful development in step with the latest trends. In order to achieve a competitive advantage by offering innovative products, it is necessary to define them in a timely manner, both in terms of the environment in which the company operates and in terms of companies interested in the successful launch and commercialization of new products. Disrespect for these can lead to adverse effects and certain weaknesses in the implementation of a new product. It happened to the Boeing Company in the process of designing and implementing its new model, the 787 Dreamliner.

On the basis of the conducted analysis, the paper defined the primary group of the critical success factors that were ignored by the Boeing Company, which led to a slowdown in the production process of Boeing's innovative boom. Some of the reasons for the delays in the process of the production of the new model were reflected in the ambitious time schedule that included a series of activities and tasks supposed to be carried out all at once within the Boeing Company. About 50% of the composite materials and the new generation technologies, such as powerful engines and the central computer system inside the cabin, were for the first time used in the construction of an aircraft. In addition to this, the revolutionary design and the implementation of the principles of global supply were just some of the reasons that led to difficulties in the production of the planned model, the Boeing 787 Dreamliner. The parallel implementation of a large number of breakthrough innovations led to an increase in costs of making the final product and reduced the competitive advantage of this innovative product.

In addition to the failures in the production process, the Boeing Company faced difficulties in the management and coordination of its global partners in the multi-partner supply chain, which led to the problems with the synchronization of its operations and time lags. Moreover, the inadequate creation of cross-functional teams and the teams' non-adherence to the myths and values promoted by the innovative culture of the Boeing Company led to a non-innovative and demotivating working atmosphere.

The stated omissions and disregard for the critical success factors influenced the financial difficulties of the Boeing Company, as well as the decline in reputation due to the three-year delay in the delivery of the first Boeing aircraft model, the 787 Dreamliner.

However, in addition to the known critical success factors, in the course of the realization of an innovative product concept, companies often face unpredictable critical factors. Therefore, once identified, the critical success factors related to the methodological approach should constantly be the subject of consideration in order to minimize or avoid their unpredictability that would lead to adverse effects. SM

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