Failure Learning Modes of Manufacturing Enterprises

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Abstract

Through exploring the specific failure learning mode of manufacturing enterprises' cases of learning from failure, comparing the distinctions between different learning modes, proposing the applicable scenario, this paper made suggestions for manufacturing enterprises. Based on the analysis of the two manufacturing enterprises, this study summarized two kinds of failure learning modes: under comprehensively systematic failure learning mode, organization will experience temporary learning stage and systemic learning stage for the dual-purpose of problem solving and organizational optimization; under case-oriented failure learning, organization will learn from the current failure temporarily, only experience the temporary learning stage for the single purpose of problem solving. Each failure learning modes has its applicable situation.

Keywords

Manufacturing enterprise; Failure learning; Learning mode.

1. Introduction

Manufacturing companies are developing rapidly in technological innovation, but facing challenges such as the local economic slowdown and rising labor costs. In addition, due to the complex and competitive market environment, manufacturing companies may fail in production, distribution and service. Failure will bring losses to the enterprises, but is an important source of organizational learning [1]. Failure can provide companies with a wealth of information [2], such as potential deficiencies in internal processes, and the organization's shortcomings in coping with risks [3]. Through failure learning, enterprise performance especially organizational innovation performance can be improved [4]. Failure learning is an important part of organizational learning. Failure can provide important learning opportunities and has a positive effect on corporations. Manufacturing companies can not only acquire more knowledge, but also accumulate more experience If learn from failure. It can also reduce the possibility of failing and enhance the ability of enterprises to withstand risks [5], thereby enhancing the competitiveness of manufacturing enterprises and upgrading the entire manufacturing industry.

The purpose of this paper is to discuss what learning modes manufacturing enterprises have in the process of failure learning, characteristics of each learning mode, differences among learning modes and the applicable scenarios of different failure learning modes. This paper offers proposals for manufacturing enterprises to carry out failure learning to solve the current problems faced by manufacturing enterprises...

2. Literature Review

2.1. Purpose of Failure Learning

Enterprises learn from failure for different purposes. One is for solving problem, trying to alleviate the situation of failure and reduce the losses caused by failure as soon as possible.

Another purpose is to explore the internal factors causing problems, summarize the root of failure, and avoid encountering similar failure in the long run. Under the guidance of two different purposes, there are also some differences in learning behaviors [6]..

2.2. Reaction Speed to Failure

The reaction speed of an organization to failure is how quickly it identify failure and takes corresponding actions to cope with it. When organizational performance is lower than expected, the adoption of failure learning action needs a driving process [7], which is influenced by the organization's ability to identify failure. Organizations do not have access to all information about failure [8], which largely delays the identification of failure and the contributing factors of failure.

2.3. Sources of Failure Learning

The sources of failure learning are mainly organization's own failures and others' failures which can be called internal failure and external failure. Madsen and Desai [9] believe that organization's own failure experience will affect its ability to learn from others' failure. Organizations lacking internal failure experience can hardly learn from others' failure. Learning from internal failures is mainly to improve performance, enhance innovation. learning from external failures is to avoid similar failures and promote remote search [9].

2.4. Scope of Failure Learning

The scope of failure learning refers to the breadth and depth of organizational knowledge search. Desai[4] puts forward the concept of failure concentration. When failures are relatively concentrated in origin, meaning that failures typically involve a particular unit or even a specific individual, compared to when failures are more broadly dispersed, the breadth and depth of knowledge search will be greater. Organizations will search knowledge more extensively and find out the factors leading to failure, and consider adjusting potential problems such as process, technology and structure if the inducement of failure comes from departments more dispersed.

2.5. Failure Learning Process

According to the characteristics of failure learning, the process of failure learning can be divided into two stages: temporary learning and systematic learning. Temporary learning is to take measures to reduce the loss and impact of existing failures basing on the direct contributing factors of failure, relieve the situation as quickly as possible. Systematic learning is to search for the root causes of failure. Through targeted learning for specific internal factors leading to failure, organizations can summarize the experience of failure, avoid similar failures in the future, and improve the enterprise's ability to resist risks, so as to enhance the competitiveness of enterprises.

2.6. Result of Failure Learning

Failure learning should have a positive impact on enterprises. whether the result of failure learning achieves the expected goal reflects whether failure learning is effective or not. In the short term, the effect of failure learning is that the current problems should be solved. In the long run, there are three aspects of learning effect that need to be achieved in order to ultimately optimize and improve the whole organization: preventing potential crises [10]; organization's reaction speed and efficiency in dealing with problems when it encounters future failures [11]; ability of enterprises to adapt to turbulent external environment [12]; avoiding the similar failure which has encountered[7].

3. Methods

3.1. Sample

This paper selects the case study method to explore what kind of learning mode the manufacturing enterprises use when they fail. Because this paper needs to compare the differences between different modes and applicable scenarios, it is necessary to select multiple cases for research. The research first summarizes the failure learning mode of the enterprise through single case analysis, and then discusses the specific differences and applicable scenarios of the failed learning mode through case comparison. We selected two manufacturing companies to conduct research: European aircraft manufacturing, research and development company - Airbus, the current independent brand production and sales of the first vehicle manufacturing company – Chang'an Automobile Group.

3.2. Data Collection

This paper mainly uses second-hand information as search source, we collected relevant reports and research literature on enterprise websites, networks and newspapers. After collecting and comparing the failure cases of manufacturing enterprises, we chose the following two cases to study: the delays in the development of Airbus A380 and two recalls of Chang'an Automobile in a short period of time.

4. Analysis

4.1. Airbus

Airbus formally launched the development plan of A380 in December 2000. Airbus had planned to complete the design and production of the A380 in five and a half years and deliver its first aircraft in April 2006. Without successful integration of the aircraft system, the first A380 was handed over to Singapore Airlines customers on October 15, 2007, nearly 18 months late, during which development costs rose by billions of dollars. Not only that, two years later, only 23 planes were delivered to prospective customers, far from the 57 planes planned in advance.

The main reason for the failure is that after the merger, companies still adhere to their own organizational structure, culture and process. The design software used by units in different countries is incompatible, and the quality control link is neglected or delayed. In addition, due to the prevailing phrase "no bad news to management" among employees, negative performance feedback is basically suppressed in the process of upward transmission from the organizational hierarchy, resulting in Airbus unable to take early and appropriate action against the foreseeable crisis.

In June 2005, six months after Airbus delayed the delivery of the A380, Airbus realized that the organization had suffered serious failures and began a comprehensive solution search. Airbus decided to redesign the fuselage after finding that it could not deliver in time. To this end, Airbus announced an extension of delivery time to one year later. According to past experience, Airbus developed a reporting system from production workshop to CEO to ensure that senior personnel can confirm that the assembly workshop's behavior conforms to the production process at any time. A year later, Airbus completed the delivery of its first A380.

To dig deeply into the causes of the failure and identify potential problems more systematically, Airbus mobilized more human and material resources to learn from the failure. Airbus formed an interdisciplinary team of former planning engineers, which systematically assesses design and production processes, as well as all transnational processes, and proposes adjustments and better integration solutions. Comparing with other organizations, Airbus finds that internal communication may also be one of the factors leading to failure. For this reason, Airbus conducts a comprehensive employee survey to understand the distrust of employees in the

organization. To this end, Airbus has taken measures to increase the trust of employees, while reducing the reporting requirements to superiors, in order to improve the confidence of regulators and employees.

Finally, Airbus completed the development of A380, improved and optimized the aircraft development process, and improved the psychological security of employees. The later development of A350 also inherits and further expands the advanced technology of A380. Eventually, Airbus not only successfully completed the delivery of the A350, but also significantly improved the maintenance and operational efficiency of the aircraft. Summarized behaviors are shown in Table 1.

Table 1. Behaviors of Airbus

Airbus	Behaviors
direct cause of failure	failing to integrate aircraft systems
internal factors leading to failure	organizational defects: different branches have different structural processes and improper management of design and production links communication and reporting culture: overreporting causes blockage of information transfer
reaction time to failure	nearly one year
purpose of learning	solving problems and finding the root causes of failure
sources of learning	internal and external
process and content of failure learning	**temporary learning stage:** establishing strict reporting system, introducing stricter performance appraisal indicators, mobilizing more human resources to a380 projects, replacing development processes and tools **systematic learning stage:** systematic evaluation of design and production processes; standardization of key development processes, development process and quality assurance mechanism; increasing trust in employees, reducing excessive report and monitor, and enhancing staff's psychological security
learning outcomes	development of A380 had been completed; subsequent product effectively avoided the same type of problems, and the product performance had been steadily improved.

4.2. Chang'an Automobile

In June 2014, Chang'an Automobile decided to recall a total of 37,861 automobiles manufactured from February 3, 2013 to April 20, 2014, starting from June 13, 2014. Shortly two months later, Chang'an Automobile decided again to recall 15360 cars produced between December 28, 2011 and June 26, 2013.

The reason for the two recalls is that the control of product quality is not strict enough, resulting in potential safety hazards. Although the automobile recall caused by parts has become normal, and the cost of replacement parts in the two recalls was not high, two recalls in a short time inevitably led to customers' doubts about the quality of Chang'an automobile products. With rapid rise in sales, Chang'an automobile chose to complete orders rapidly under the situation that the product supply exceeds the demand, resulting in some defects in the automobile. At the same time, because its R&D was still on the rise, technical problems were also unavoidable. Due to the limitation of funds and time, enterprises would reduce certain costs and time in the stage of auditing, testing, confirming and re-testing after mass production. Moreover, in some core part technology, independent brands Chang'an still relies on foreign-funded parts enterprises.

After the second recall, Chang'an automobile realized the problem of product quality, to improve its vehicle quality, then analyzed and summarized the experience of organization's previous recalls, focused on the study of product parts and quality control, and took corresponding measures to solve the problem.

In order to strengthen the quality management of suppliers' parts, Chang'an established a collaborative development platform with suppliers, which refined the quality objectives of each spare part and decomposed them into each supplier. Through the platform, the latest market problems were transmitted and decomposed to suppliers immediately to promote the rapid solution of the problems. Chang'an also trained staff on basic and grass-roots management level to ensure that defects would not flow out of factories, made strict examination system with more than 4500 test standards. the quality of each product was strictly checked, and the possible quality problems were avoided in the process of product development. At the same time, to recover the image of enterprises to customers after the recall. Chang'an Automobile established a multi-dimensional market monitoring and rapid-response mechanism, which had improved technical services and part support capabilities and enhanced the one-time repair rate. Self-driving experience camp, clubs and other activities increased customer loyalty and satisfaction.

Through vigorous promotion of quality improvement, Chang'an automobile quality had improved significantly, and had mitigated the impact by the recalls on brand building. But Chang'an automobile recalled their products a few months later unfortunately. Summarized behaviors are shown in Table 2.

Table 2. Behaviors of Chang'an Automobile

Chang'an Automobile	Behaviors
direct cause of failure	potential safety hazard exists in product quality disqualification
internal factors leading to failure	rapid development, insufficient technology research and development and quality control
reaction time to failure	2 months
purpose of learning	solving problems
sources of learning	internal
process and content of failure learning	**temporary learning stage**: establishing collaborative development platform with suppliers; optimizing production system; issue quality verification system; recovering impact of recall events on its brand.
learning outcomes	product quality had been improved but defective products were still exist.

4.3. Cross-Case Analysis

In the above two cases, there are significant differences in learning purpose, reaction speed to failure, learning source, learning scope, learning process and learning effect between the two manufacturing enterprises. Based on the characteristics of the two enterprises in the above six aspects, this paper summarizes them into the following two failure learning modes.

4.3.1. Comprehensively systematic failure learning

Comprehensively systematic failure learning mode are implemented to respond to current failures generally after failures attracted the attention of senior management and even the whole organization. Because of mobilization of substantial resources for learning, there is a long time between failure exposure and comprehensive learning, which causes slow reaction speed of this mode to failure. In the case of Airbus, due to its large scale, the failure occurred

nearly a year before it attracted the attention of the whole organization. The company took measures involving all levels to explore and try to learn about the current failure. Under this failure learning mode, the organization has gone through a complete learning stage - temporary learning and systematic learning. The organization not only learns from other people's failure experience to solve the main problems that lead to failure, but also evaluates and summarizes the current failure, finds out the root causes, so as to carry out systematic learning, optimize the organizational structure and even carry out necessary reforms. Airbus initially made various explorations and attempts within the organization, then acquired knowledge about development process, quality control and other aspects from the outside, and conducted an internal investigation of the causes of failure, found the defects and shortcomings of the organization and made improvements. However, due to the long time lag from idenytifing failure to failure learning, sometimes the best time to solve the problem will be missed, which will bring great losses to enterprises.

4.3.2. Case-oriented failure learning

Under the case-oriented failure learning mode, enterprises will quickly take action to search solutions according to the specific situation of failure when they perceive that failure begins to appear, because the main purpose of the case-oriented failure learning mode is to solve the current problems, when choosing the source of learning, enterprises can choose ways acquiring resources more quickly or at lower cost according to their own needs, but its study is not comprehensive enough. Case-oriented failure learning mode is flexible, which can reverse the failure situation more quickly than comprehensively systematic failure learning. However, because of the single learning purpose of this mode, it does not experience the systematic learning stage, which leads to short process and ignorance of organization defects. The content of learning can only be used to solve the current problems, which can not guarantee that similar problems will not occur in the future, and it has little effect on improving the ability of organizations to resist risks.

4.4. Applicable Scenarios

When the failure concentration is high and the severity is low, the organization does not need to spend too much resources to learn from this failure, case-oriented failure learning mode is more applicable. When the failure concentration is low and the severity is high, enterprises should not only to mitigate the crisis, but also to systematically and comprehensively analyze the internal factors leading to failure to avoid the recurrence of similar failures. Therefore, the comprehensively systematic failure learning mode is more suitable in the case of serious failure.

5. Conclusion

Through case studies, this paper conducts a single case study of Airbus and Chang'an respectively, sums up two learning modes of manufacturing enterprises in failure learning, and then conducts cross-case analysis to compare the differences between the two modes, and makes a preliminary discussion on the applicable scenarios of the two failure learning modes. The research finds that: there are two modes of failure learning for manufacturing enterprises: comprehensively systematic failure learning mode and case-oriented failure learning mode; because of differences between the two modes in the degree of demand for resources, each mode has its own applicable scenario. When serious failure happens and is broadly dispersed in units, comprehensively systematic learning mode is more applicable. When failure involves a particular unit or even specific individuals, especially in shortage of learning resources, case-oriented failure learning mode is more suitable.

The applicable scenarios of different failure learning modes are put forward, which enriches the relevant theories of failure learning to a certain extent. Although existing studies have proposed failure learning models, most of them are from the perspective of organizational

learning, and few of them have been explored for specific industries. This research takes manufacturing industry as the research background, which gives the research conclusion a higher practical significance to a certain extent.

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