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RISK MANAGEMENT HT2018
Assignment 4

Word count: 1642

Financial risk management: Space Shuttle Challenger case study

Introduction

The content and the analysis of this paper is guided by Sweeting and his book *Financial Enterprise Risk Management* (2011). The aim of the work is to investigate one of the study cases in the Chapter 20 of that book, apply and criticize a thorough financial risk management process to the problem. In agreement with the principles of the book, the most part of the case studies are related to financial institutions. However, I think it is more interesting to choose a non-financial example, since it highlights risk management issues that face all organisations. Moreover, the organisational failures described can exist in many organisations and can lead to high financial impact, requiring financial risk management.

In this paper I present, discuss and use the Space Shuttle Challenger case study in order to apply the ideas contained in Sweeting's book.

Background: Space Shuttle Challenger

On 28 January 1986, the NASA shuttle orbiter mission STS-51-L launch the Space Shuttle Challenger and 73 seconds after the take-off, it broke apart killing all seven crew members. The disintegration of the vehicle was caused by the failure of O-ring seals used in the joint in one of the solid booster rockets. The lack of success was determined by the unusual cold conditions of the weather before the launch. Therefore, this had made the O-ring less elastic producing the detriment of the shuttle.

Sweeting (2011) describes some major organisational failures. Firstly, it seems that there was a different perception in estimating the risks of failure between NASA engineers and managers. Secondly, any minor risk which could add up and provide a different threat to the operation, but not an accident, were not considered as failures. So, the definition of failure was also flawed. Thirdly, managers acted under high pressure to perform and probably put the impact of reputational losses higher than the impact of a failure of safety.

Establish the context

As a first step, it is important to understand and separate the context in which risks exist. The internal context for NASA consists in the organisation and the people working there in addition to partners of the shuttle orbiter mission STS-51-L. NASA is an independent agency of United States of America responsible for the civilian space program, as well as aeronautics and aerospace research. For this fact the external context includes the American public and the other government agencies. It is also amplified by public opinion, so that all the citizens were involved mentally in the failure.

This aspects are really affected by the will of success: managers were under pressure and probably they became forced by both the internal and the external context in acting with simplification of the problem.

Risk identification

It is important to be aware of the range of risks involved. For identify and list the risks in the STS-51-L failure, Table 1 is completed in according to Sweeting's analysis as starting point. In this paper, the risk identification method is based on the individual study conforming to literature, so it not representing a complete and true analysis of the failure but just a theoretical one.

•1	Different perception in risks of failure between managers and engineers
•2	Flawed definition of failure
•3	Inconsistent tips from the O-ring
•4	High public expectation for the space shuttle Challenger launch
•5	Public and political disappointment in NASA for delays, worries for hypothetical cancellation
•6	Cold weather conditions unexpected

Table 1 – Risk identification

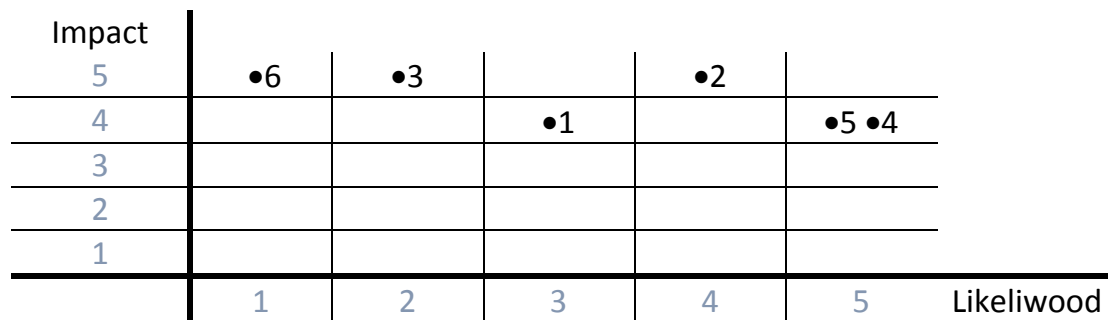
Risk assessment

Once risks have been identify, the results need to be assessed. In order to determine the measures of risk, and the risks to which actions should be applied, a decision of the level of risk that can be tolerated must be taken. This is related to the concept of risk appetite (tolerance and capacity).

Risk tolerance is a cultural issue, part of the organisation's internal risk management context, and is about the subjective decision a firm has taken on where it would like to be in the risk spectrum (Sweeting, 2011). In the other hand, an organization temper the risk tolerance by its capacity that takes on risk. Infact, risk capacity depends by the resources that are available: it could be function of regulatory and legislative limits and in the same time belongs to the external context. Anyway, the organization should consider the risks to which they believe they are exposed as well as just considering the risks that they are obliged

to manage – just because there are no regulatory limits in a particular area, it does not mean that risks should develop unchecked (Sweeting, 2011).

Even though it is very important to measure and quantify risks, it is appropriate to note that many risks are hardly quantifiable. In this case many types of operational risks fall into this category, so a qualitative risk map is used. This is a diagram which maps the likelihood and impact in a bidimensional diagram, in this way the relative importance between risks could be assessed. The features are both scored from 1 (unlikely – low impact) to 5 (very likely – high impact) and the Graphic 1 shows the calculation.



Graphic 1 – Risk map (Likelihood and Impact)

The risks defined are those that actually affected the Space Shuttle Challenger failure, this validates the high impact measure (all the risks are estimated with a Impact equal to 4 or to 5). Since the most part of the risks identified are correlated, the calculation of the measures of impact and likelihood needs to be done carefully.

The highest impact-likelihood risk is the risk of compromise the definition of failure (•2): in particular, if a component did not behave as it was designed to, but the behaviour did not cause an accident, then this behaviour was not deemed a failure. The flawed definition brought a high impact for the correlation to the real physical cause. In fact the O-ring leaks fell into this category of components. This failure was compounded by the fact that each launch that did not result in the loss of a craft was regarded as an argument in favour of the safety of components (Sweeting, 2011). In this sense, it is shown the relation with the risks (•3) and (•6) too. A better definition and approach to failure would bring a resolution or a different awareness to O-ring problems. In the other hand, risks (•4) and (•5) are related to the external context and as consequence to risk (•1): managers acted under high pressure to perform and probably put the impact of reputational losses higher than the impact of a failure of safety.

Risk response

Responses to the risks are generally divided in four categories: reduce, remove, transfer and accept. This approach is similar to the 4T method that sets the four categories as treat, transfer, tolerate and terminate according to Hopkin (2017).

Risk reduction means to limit the impact of the risk and need to involve the creation of more robust systems and process (Sweeting, 2011). In this case, NASA should provide a decision support system program in order to avoid the different perception between managers and

engineers and prevent misinterpretations. In the same way, it is better to improve and clarify the definition of failure.

The weather conditions prior the launch is something that need to be accepted since, except changing the day, there is no way in which is possible to change the environment. In the other hand what is possible to improve is the O-ring seat and his wrong tips: upgrading the seat before the launch would have removed damages related to the actual Space Shuttle failure. Sweeting states that if the size of the loss is great enough, action should be taken no matter how unlikely the risk is.

The external context is affected by the public opinion and political expectation, this fact is something that is hardly to change. Actions for a different approach should be done by managers and the NASA internal context in order to mitigate the effects in making decisions. Table 2 shows hypothetical approaches to the risks.

•1	Different perception in risks of failure between managers and engineers	Reduce
•2	Flawed definition of failure	Reduce
•3	Inconsistent tips from the O-ring	Remove
•4	High public expectation for the space shuttle Challenger launch	Accept
•5	Public and political disappointment in NASA for delays, worries for hypothetical cancellation	Accept
•6	Cold weather conditions unexpected	Accept

Table 2 – Risk response

Conclusion

Sweeting's literature approach of risk identification, measuring, assessment and response is straightly related to financial risk management. In this case study the application is non-financial example, since it highlights risk management issues that face all organisations. Thinking to the Space Shuttle Challenger disaster, the result of the risk management process seems to be very similar to the approach guided by Hopkin (2017). The focus of the risk assessment becomes qualitative and the risk response reflects the 4T classification. This method is an easy way to understand the problem, but in the same time seems to be simplified.

Measuring the risk likeliwood and the risk impact becomes difficult: firstly, it reflects a number that is hardly quantifiable and secondly risks are strongly correlated in a way that the measure of one affects the measure of another. The correlation between risks could bring weakness in identification, assessments and responses too.

In conclusion this paper scarcely analyzed a financial risk management process, in the other hand investigate a case study related to the rocket science with a focus in the specific Space Shuttle Challenger disaster.

References

- Sweeting P., *Financial Enterprise Risk Management (International Series on Actuarial Science)*. Cambridge: Cambridge University Press, 2011.
- Hopkin P., *Fundamentals of risk management : understanding evaluating and implementing effective risk management*. Kogan Page, 2017.