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The Black Swan – Knowing the unknown in projects

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Abstract

A "Black Swan" is produced when the gap between what we know and what we think we know becomes dangerously wide (Taleb, 2007). This concept is closely related to uncertainty and learning. A Black Swan event is usually a surprise, at least to the observer. However the Black Swan event very much depends on the observer. What may be a Black Swan surprise for a turkey is not a Black Swan surprise to its butcher; so the main objective is to "avoid being the turkey" by exploring and identifying areas of vulnerability in order to avoid surprises. In projects, while some may disagree, almost all failures, even catastrophic ones, are not really Black Swan events but a series of failures that alone may have a negative impact on project outcomes but combined lead to catastrophic failure. However it is surprising how often experienced project teams ignore the early warning signs and move forward into the project lifecycle despite serious problems in many areas that are keys to project success. This will ultimately lead to the Black Swan event materializing. That is when it is too late to take any preventive actions. This paper will characterize the Black Swan concept in projects and describe its nature and identify organizational mechanisms that can be useful in dealing with Black Swan surprises in projects. This study is mainly based on literature study, however carries out an assessment on examples of Black Swan events in order to better clarify the concept under study

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Keywords: Black Swan; Project; Early warning signs; Uncertainty; Knowledge management

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1. Introduction

Taleb (2007) defines a Black Swan as an event meeting three criteria: 1. It is an outlier as it lies outside the realm of regular expectations, 2. It carries extreme impact and 3. Human nature makes us concoct explanations for its occurrence, after the fact, making it seem explainable and predictable. Black Swans are "unknown unknowns" which despite all the plans and precautions that might have been made still take the organization by surprise and lead to catastrophic consequences (Green, 2011). Some people associate "Black Swan" with "crisis", while that may not be true. Not all crises are black swans. For example a normal hurricane is a crisis but only a hurricane like "Hurricane Katrina" is a Black Swan. That was because no one could have anticipated the size and scope of the disaster. A Black Swan event is a game-changer for those going through it or that are impacted by it. For them, and for the audience who may have witnessed this situation unfold, the world never will look the same again. Taleb (2007) makes a case that the 9/11 incident was a Black Swan event. Other Black Swan events can be the 2008 credit crisis, the Lehman Brothers' bankruptcy in 2008, the 2010 BP gulf oil spill and the 2011 Japanese earthquake and tsunami. Projects are not exceptions in case of being subjected to Black Swan type of events. For example, a $5 million IT project that leads to an almost $200 million loss could be a Black Swan.

There is not a consensus among researchers on the level of predictability of a Black Swan event. Taleb (2007) believes that Black Swan events are unpredictable and highly improbable events which are inevitable in our world. And the only way for managing these types of incidents is to become ant-fragile and robust in order to become immune to prediction errors and protected from adverse events. Green (2011) partly supports this idea by stating that although these types of events are not predictable, organizations should prepare to be mounting an effective response while simultaneously dealing with the psychological impact of being shocked by an inconceivable event of staggering proportions. However there are other researches which claim that Black Swan events can to a certain extent be predicted and they suggest various approaches for dealing with them (Murphy and Conner, 2012; Kenett, 2013; KPMG, 2013; Werther, 2013).

This study deals with Black Swan events specifically within the project management area. It suggests that by early identification of early warning signs indicating that some type of "Black Swan" event is likely to happen in the future and by proactively managing the knowledge obtained from those indicators, it can help to prevent or lessen the drastic consequences of those events or in extreme cases prepare for the impact of the Black Swan event. The first section includes a literature review on the Black Swan concept in general and specifically within the project management area, the research which has already been done on management of Black Swans and the phenomenon of early warning. Secondly, the research methodology will be briefly discussed. The subsequent sections include a brief description of an example of a Black Swan event in the project management area and the conditions under which the project ended in a disastrous situation as well as a discussion on the possibility to predict and proactively manage Black Swan types of events in projects by applying the EW procedure and knowledge management. Finally the conclusions and suggestions for further research are presented.

2. Literature review

2.1. Black Swan events in projects

According to Taleb (2007), a Black Swan event is an unpredictable event that defies prediction. It's an event that can kill an organization if not managed properly.The following is a list of some common characteristics of many of the Black Swan events that have occurred (Green, 2011):

1. Emergency response and a solution to the scenario are totally different aspects. It's not just about responding to the crisis, it's also about finding ways for fixing the problem.
2. Solutions to the problem should often be created. They are novel solutions which cannot be repeated based on best practices. The cause of the problems is not always obvious and it might demand extra effort for the leadership to find the true cause. Also the organization might need to go through several solutions before finding the one that suits best.
3. Productivity might be negatively impacted as employees can be concerned, uncertain and distracted.

As earlier mentioned, a Black Swan event is a game-changer for those going through it or are impacted by it. For them, and for the audience who may have witnessed this situation unfold, the world never will look the same again. Taleb (2007) makes a case that the 9/11 incident was a Black Swan event. Other Black Swan events can be the 2008 credit crisis, the Lehman Brothers' bankruptcy in 2008, the 2010 BP gulf oil spill and the 2011 Japanese earthquake and tsunami.

Projects are not exceptions in case of being subjected to Black Swan type of events. The following are some examples of occurrence of Black Swans in projects:

- A $5 million project that led to an almost $200 million loss in Levi Strauss & co. in 2008 (Flyvberg and Budzier, 2011).
- A huge and complex oil and gas production project at Sakhalin Island (off the east coast of Siberia), the project was sanctioned in 2003 at $10 billion (a value that exceeded Shell's net income for the prior year). Two years later, with the project well into construction, Shell issued a 6K report announcing the cost had doubled to $20 billion (today it is $22 billion) (Dodson and Westney, 2014).
- The Boston Big Dig project went more than 100% over budget (from $2.6 billion to $14.6) in 2007 (KPMG, 2013; Dodson and Westney, 2014).
- The NASA challenger shuttle, on its 10th launch, on Jan. 28. 1986, exploded 73 seconds after liftoff, killing the seven crewmembers. The accident changed the space program forever (Rose, 2003).Numerous researchers have suggested different approaches for managing Black Swan events in projects. This will be discussed in the following section.

2.2. Possible approaches for managing Black Swans in projects

Is it possible to predict Black Swan or is it just luck or fate that determines which organization will survive and which will fail? Is there a way for doing well in a Black Swan event? According to Taleb (2007) one of the attributes of a Black Swan event is that it is an outlier, as it lies outside the realm of regular expectations, since nothing in the past can convincingly point to its possibility. However, in spite of its outlier status, human nature creates a tendency to formulate explanation after the fact, making it explainable and predictable.

Different researchers have suggested different approaches for managing the Black Swan event. The KPMG white paper (2013) states that by ensuring the flow of independent and transparent information within the project, management and project stakeholders will have the opportunity to obtain independent project information and avoid catastrophic project failure no matter how complex or challenging a project is. Nevertheless, those who attempt to evaluate the risk in order to predict the Black Swan event must understand that these types of events cannot be predicted reliably using current risk analysis tools. Lessons learnt from previous Black Swan events should be considered. According to Murphy and Conner (2012), who have done a study on Black Swan events within the process safety area, Black Swan events have warning signs and if we can identify and protect against minor events, perhaps we can ward off the Black Swan.

Werther (2013) states that crisis event forecasters actually do correctly foresee and forecast emergencies, including events that Taleb (2007) labels as unpredictable Black Swans. He argues that mainstream model and analyst failure dynamics can help to develop a way to better recognize and time large scale, large impact rare event emergence.

Dodson and Westney (2014) state that the Black Swan concepts provide a useful way to address what may be the fundamental cause of lost predictability in major projects; the lack of processes and governance to identify strategic risks. They suggest a five step process which might aid project stakeholders to get the perspective needed to identify and proactively manage the Black Swans that threaten project outcomes. The steps include:

1. Risk framing (hunting the Black Swans): frame risk scenarios and their potential impacts.
2. Risk strategies (caging the Black Swans): developing strategies that avoid, mitigate the impact if it should occur, or provide the funding for risk coverage.

3. Risk assessment (understanding the Black Swans): develop a probabilistic analysis of capital cost and schedule, reflecting both tactical and strategic risks.
4. Risk brokering (feeding the caged Black Swans): independently allocating risks or risk cover.
5. Risk Validation (taming the Black Swans): ensuring that the known Black Swan risks are being managed in accordance with the plan, as well as in monitoring conditions for periodic updating of Risk Scenarios and exposure.

Flyvberg and Budzier (2011) suggest that any company which is considering carrying out a large technology project should take a stress test designed to assess its readiness against Black Swan types of events, for example if the company is strong enough to absorb the hit if its biggest technology project going over budget by 400% or more and if only 25% to 50% of the projected benefits are realized, or if the company can take the hit if 15% of its medium-sized tech projects (not the ones that get all the executive attention but the secondary ones that are often overlooked) exceed cost estimates by 200%. However they state that Even if companies pass the stress test, smart managers take other steps to avoid IT black swans. They break big projects down into ones of limited size, complexity, and duration; recognize and make contingency plans to deal with unavoidable risks; and avail themselves of the best possible forecasting techniques—for example, "reference class forecasting," a method based on the Nobel Prize–winning work of Kahneman and Tversky (1979). These techniques, which take into account the outcomes of similar projects conducted in other organizations, are now widely used in business, government, and consulting and have become mandatory for big public projects in the UK and Denmark.

Kenett (2013) suggests that the proper exploitation of organizational data can help prevent some of the hugely disruptive, largely unexpected events, referred to as Black Swan events. In practical terms, that involves acquiring and merging data, as well as building data-driven risk management decision-support systems that complement and reinforce the more traditional methods used today.

Never the less there are other researchers which believe that Green (2011) suggests that the nature of the Black Swan event is unpredictable so the only way to deal with it is to prepare for the impact even if the event itself cannot be predicted. The key to addressing a Black Swan event is not just providing an effective response but it is mounting that response while simultaneously dealing with the psychological impact of being shocked by an unperceivable event of astonishing proportions. This is referred to as the "survivor psychology". But in order to prepare for the impact, it is important to anticipate the extensiveness of the event and how devastating the impact can be. This requires a clear understanding of the nature of the Black Swan event. In addition to the survivor psychology other approaches include: Assembling a Black Swan response team, pursuing R&D vs. engineering perspectives, improving risk agility and optimizing communication.

Taleb (2012), who has developed the concept of Black Swan, tends to have a more general view on these types of events and suggests that antifragility is a blueprint for living in a black swan world. He believes that uncertainty is desirable and even necessary without tending to predict or prevent it.

Based on the discussed approaches, we see that in general there are two types of perspectives towards Black Swan events. They are either managed through prediction or through dealing with their circumstances. In the following sections we will shed light on another view on management of Black Swan events by applying the early warning procedure and knowledge management as tools for proactively managing these types of projects. These aspects will be described in the subsequent sections.

2.3. Early warnings of undesired events in projects

Early warning (EW) is a broad concept. It applies to almost any area where it is important to obtain early indications of developments that will become manifest in the future, and that are usually negative. The concept of EW in a management context was first discussed by Ansoff (1975) and was later supported by Nikander (2002) in his doctoral dissertation. Ansoff stated that strategic surprises do not appear out of the blue; rather, it is possible to predict their occurrence with the aid of signs called "weak signals," which he defined as "imprecise early indications about impending impactful events" (Ansoff and McDonnell, 1990, p. 20). All that is known is that some threats and opportunities will undoubtedly arise, but their shape and nature and source are not yet known" (Ansoff and McDonnell, 1990, P.385).

Nikander (2002, p. 49) stated: “an EW is an observation, a signal, a message or some other item that is or can be seen as an expression, an indication, a proof, or a sign of the existence of some future or incipient positive or negative issue. It is a signal, omen, or indication of future developments.” He devised a preliminary model illustrating the character of the EWs observations (Figure 1), which sees project events as a time-bound consecutive stream of events.

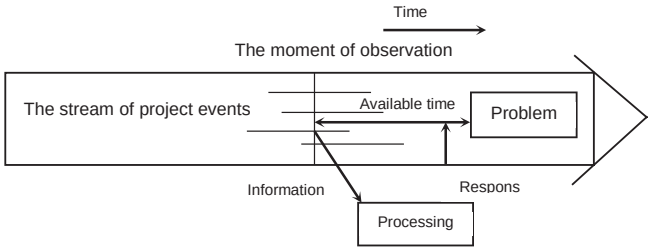

Fig. 1. Preliminary Model Illustrating the Character of the Phenomenon of EW (Nikander, 2002)

Information about the stream can be obtained at any given time (e.g., EWs of potential future project problems). Such information can then be processed and responses will be required in order to influence the flow of the project. According to Ansoff, a crucial factor in choosing a response appears to be the time available for responses before the potential problem significantly impacts the project. Clearly, the challenge lies in the possibility of detecting the EW signs and their level of reliability. This challenge becomes more severe in case of Black Swan events due to the high level of uncertainty and unpredictability of the events and the devastating consequences of it in case it actualizes. This calls for extra concentration on obtaining the necessary data and information from the project in order for the project managers and project participants to gain the essential knowledge for dealing with the Black Swan event.

2.4. Learning and knowledge management

According to Ackoff (1989), the content of the human mind can be classified into five categories: Data: symbols,

Information: data that are processed to be useful; provides answers to "who", "what", "where", and "when" , questions, Knowledge: application of data and information; answers "how" questions, Understanding: appreciation of "why" and Wisdom: evaluated understanding. Bellinger et al. (2004) have presented a model which illustrates transitions from data, to information, to knowledge, and finally to wisdom, and it is “understanding” that support the transition from each stage to the next.

Although there is a consensus among researchers on this general framework, these elements are defined differently by different researchers some of which explained below.

Van der Spek and Spijkervet (1997) state that Data are symbols which have not yet been interpreted. Information is data which has been assigned a meaning and is built upon the interpretation of the receiver of the data Information is always linked to a specific situation and has only a limited validity. On the other hand, Knowledge is what enables people to assign meaning to data and thereby generate information. It is the whole set of insights, experiences and procedures which are considered correct and true, and which therefore guide people's thoughts, behavior and communication. Knowledge is always applicable in several situations and over a relatively long period of time (Van der Spek and Spijkervet, 1997, p.13).

This statement suggests that different people can assign different meaning to the same set of data, based on their knowledge.

According to Davenport et al. (1998), data is “a set of discrete, objective facts about events”, and information is “a message, usually in the form of a document or an audible or visible communication”. Finally, Knowledge is a fluid mix of framed experience, values, contextual information and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices and norms.

Clearly, the knowledge obtained through the above mentioned processes should be effectively managed in order to create value for the individuals or organizations. Knowledge management efforts basically focus on organizational objectives such as improved performance, competitive advantage, innovation, the sharing of lessons learned, integration and continuous improvement of the organization (Gupta et al., 2004). The authors believe that the exploitation of available data which form the foundation for information and knowledge gained by the actors within a project organization can strongly contribute to proactive management of undesired situations. This will be further elaborated on in section 5.

3. Research methodology

As mentioned earlier, this study investigates on the concept of Black Swan events in projects and evaluates the possible approaches for preventing or lessening the impact of the event before it is too late. This paper is mainly based on literature study on the research previously done on the concept of Black Swan events in general and specifically within the project management area. In addition it considers different approaches suggested in the literature on approaches to manage these types of events. This type of literature review is referred to as "theory evaluation". According to Baumeister and Leary (1997), in this type of review, the author does not provide new theoretical perspectives but rather reviews the literature relevant to the validity of an existing theory or often two or more contradictory theories. The study leads to suggestions on other possible approaches for dealing with Black Swan events in projects in particular. An example of a Black Swan project will be described in order to better clarify the concept and the suggested approach within this study.

4. The NASA Challenger disaster; an example

The Space Shuttle Challenger disaster occurred on January 28, 1986, when the NASA Space Shuttle orbiter Challenger (OV-099) (mission STS-51-L) broke apart 73 seconds into its flight, leading to the deaths of its seven crew members, which included five NASA astronauts and two payload specialists. This accident changed the space program forever (Howell, 2012). There is an abundance number of case studies done on this project (Mahler, 2009; Rose, 2003; Vaughan, 1997; Gouran, 1995; Moore, 1992; Winsor, 1990) some of which refer to this event as a Black Swan event within the aerospace industry.

The case of the Challenger disaster to a large extent matches the criteria which make an event a Black Swan event. However many of the post-mortem analysis done on this case claim that the catastrophe could have been predicted and thus prevented.

Winsor (1990) states that communication failures contributed to the Challenger's explosion and indicates why although various people in the organizations involved knew about the faulty O-rings, but failed to pass on the information to decision makers, resulting to the catastrophe. Rose (2003) declares that Former top NASA engineering and safety staff said that the accident was preventable. Deep cuts in the shuttle's budget when the Bush Administration took office deprived it of essential upgrades, leaving safety and inspection procedures outmoded and inadequate. Based on his analysis on the case, obvious warning signs were ignored before disaster shuttle's launch. However, the magnitude and effect of the disaster, like the other Black Swan type of events, was in no means predictable for anyone.

In the next section, we will discuss how application of an EW procedure along with effective knowledge management can possibly contribute to proactive management of Black Swan projects.

5. Discussion

As mentioned in section 2.2, there are generally two types of perspectives towards Black Swan events. They are either managed through prediction of the event or through dealing with the circumstances in case it actualizes. This is based on the two different perspectives among researchers towards the concept of Black Swan events. While some believe that a Black Swan event is unpredictable, others believe that there are specific approaches which enable project managers and stakeholders to proactively manage the potential Black Swan events. The paradox among these approaches indicates the high impact of the observers' perspective towards a Black Swan event which is

aligned with Taleb's (2007) findings. According to Taleb (2007), a Black Swan events depends on the observer. What might be a Black Swan to a turkey is not a Black Swan to its butcher. So the ultimate goal should be to avoid being the turkey by identifying areas of vulnerability to avoid surprises (KPMG, 2013).

We believe that identification of areas of vulnerability can be done through identification of EW signs of potential aspects which can over time lead to occurrence of a Black Swan event. We will look at this situation from the perspective of learning and knowledge management. As we presented earlier, the knowledge that an individual has, is essential for that individual to interpret data and generate useful information. The new understanding that results from the interpretation will create the existing knowledge. In order to manage Black Swan events, the first step is to attempt to identify EW signs of its occurrence. This requires knowledge of, among other things, the tasks at hand, disciplines that are involved, the context and the interconnection between the tasks and the potential changes within the system. In other words, the knowledge required can be characterized in terms of systems thinking. Systems thinking looks at a system (for example, a project), not only as a collection of all the parts of the system, but also the interconnection between the parts (Senge 2006).

This holistic understanding (along with the detailed knowledge) is important for identifying EW signs. Another aspect that is vital for identifying EW signs is reflection. Specifically, critical reflection (including out-of-the-box-thinking) is necessary for creating the knowledge that contributes to identification of EW signs. According to Schön (1988), a practitioner's reflection can serve as a corrective to over-learning. Through reflection, he can surface and criticize the tacit understanding that have grown up around the repetitive experiences of specialized practice, and can make new sense of the situation of uncertainty or uniqueness which he may allow himself to experience (Schön, 1988, P.61).

Once the EW signs are identified, the "signs" (data) should be interpreted or transferred to the right individuals in the organization for interpreting the data. This will provide a new understanding of the current situation and of possible alternative scenarios of future situations or events. The new understanding can be a result of reflecting on and making sense of a complex constellation of different aspects.

Once the knowledge is created, then possible solutions for dealing with the identified EW signs can be found. Once again, a holistic understanding is needed to design possible responses to the identified EW signs. The solutions then should be shared with relevant individuals in order to ensure organizational readiness to cope with various eventualities that may occur in the future. If the predictable occurrence that the EW signs suggested takes place, this result can be assessed individually and collectively in order to learn from it. This knowledge can then be used to manage situations which might to possible Black Swan events effectively through the whole process in the future. Hence, a positive cycle of learning is created within the organization. The connection between EW signs identification and knowledge management is illustrated in Figure 2.

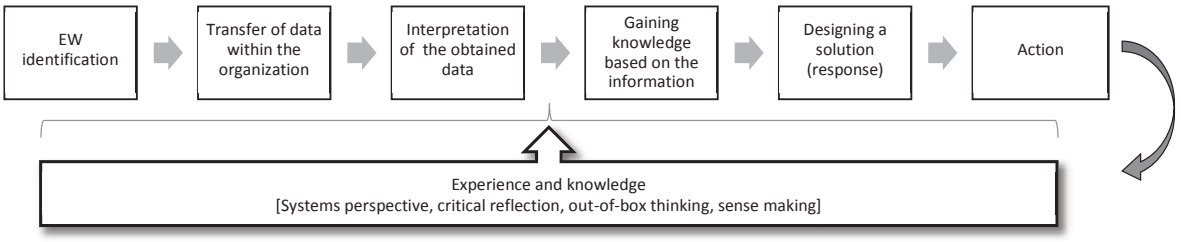

Fig. 2. The suggested process for managing Black Swans in projects

The experience and knowledge gained through having a systems perspective towards the project, critical reflection, out of the box thinking and sense making can to a great extent affect the elements within this procedure, creating the foundation needed for an organization to effectively manage Black Swan types of events.

Continuous learning, including learning from failures is important for developing learning organizations that are important for obtaining sustainable competitive advantage (Senge 2006). Developing knowledge and ability to effectively manage the changes contributes significantly to ensuring the organizations' success. It is relevant to

present a well-known quote from Charles Darwin: "It is not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is most adaptable to change."

Dealing effectively with changes and uncertainty is important for projects and organizations. This means that projects should be able not only to react to changes, but also to pro-act. Managing EW signs with a systematic focus on learning and knowledge management is a way to pro-act to possible changes, including black Swan events.

6. Conclusions and further work

In this paper we have described the possible approaches for dealing with Black Swan types of events. The case of the NASA Challenger project was used as an example of a Black Swan event. We proposed that applying an EW procedure with a focus on learning and effective management of knowledge can to a great extent contribute to proactive management of Black Swan events. The effectiveness of this approach is certainly dependent on the type of event and the extent to which the project organization succeeds in effectively carrying out the process. The challenge lies in the high level of uncertainty involved with these types of events. However the higher the level of maturity of the project organization in carrying out this process, the higher the chances for better proactive management of such situations. We plan to move forward our future research by carrying out more detailed investigation of the characteristics of Black Swan events in projects and the process which leads to actualization of these types of incidents. This may be done through performing a thorough cause and effect analysis.

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