

THE INFLUENCE OF MAJOR EXTERNAL AND INTERNAL EVENTS ON THE CULTURE OF AN ENGINEERING ORGANISATION

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Abstract: A Case study company that was set up as a project where the technical focus, activities and behaviour set the initial culture is considered in this research. Over a period of 11 years the Case study engineering organisation was exposed to many influences in the electrical utility industry that now give lead to questions such as: How did events influence the engineering culture and how did the culture change over time? Engineering organisations are subjected to external and internal events which are not always within their control. These include technological changes, economical changes or new competition, change in ownership, business focus or technical leadership. The ability to absorb such events is not only a function of the organisation's technology infrastructure, availability of funding or skills, but also of the organisational culture prevailing at the time. The objective of the research is to determine how eight events impacted the culture of an engineering organisation over a period of six years. The results show that the culture is indeed influenced by events, with an indication that the different work areas within the organisation experienced the cultural changes differently. The employees that worked for the organisation six years or longer also experienced the changes differently from those that were only employed for the last five years of the organisation's life. These results may assist the understanding of the impact that events may have on an organisation and allow early risk mitigation to counter undesirable culture forming.

Keywords: organisational culture, change management, event impact, engineering organisation.

1. INTRODUCTION

All engineering organisations are subjected to external and internal events, which are not always within their control. External events can include technological changes, global or local financial impacts, market shifts or new competition entering the market. Some of these events may be initiated by a black swan event as defined by Taleb [1]. On the other hand internal events can include critical skills shortages, change in ownership, and change in business focus or change in technical leadership. These events will all test the resilience of the organisation. The ability to absorb such events is not only a function of the organisation's technology infrastructure, knowledge management or availability of funding or skills, but is also driven by the culture prevailing in the organisation at the time.

Understanding how a major event may impact the culture of an engineering organisation, may make it possible to prepare the organisation in advance of the event with the intent to stay on course or to adjust course to be able to absorb the event.

1.1 Theory and research review

The research topic implies that organisational culture is investigated as part of the research. Schein [2] offers the following definition for organisational culture: "A pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems".

Brown as quoted by Manetje et al [3] defines organisational culture as: "the pattern of beliefs, values, and learned ways of coping with experience that have developed during the course of an organisation's history, and which tend to be manifested in its managerial arrangements and in the behaviours of its members".

Both these definitions suggest that culture is developed over time, but do not imply how an organisation may behave should an event be imposed on the organisation. A large number of change management models have been developed, but when approaching change management

within an organisation it cannot be based on a model produced “from elsewhere” as shown by Oxtoby [4]. Therefore the question can be asked how effective changes or events can be managed within a new organisation when no clear culture has been established on how events can be absorbed and managed.

According to O'Reilly [5] organisational commitment from a motivational perspective is the “individual’s psychological bond to the organisation, including the sense of job involvement, loyalty and belief in the values of the organisation”. These levels of individual motivation were explored as part of the research to determine the impact the major events had on the organisation’s commitment level.

The attitudinal definition of organisational commitment according to the attitude-behaviour model of Eagerly and Chaiken as quoted by Solinger et al [6] indicates that organisational commitment is a combination of an employee’s attitude and response toward the work experiences and perceptions regarding the organisation, and the employee’s attitudes and personal traits that lead to a positive or negative emotion and behaviour (e.g. leaving or staying). On the other hand the definition of organisational commitment by Storm et al [7] indicates that the individuals, through their own actions, develop a commitment by involving themselves in commitment behaviour.

1.2 Problem statement

The definition of organisational culture implies that a pattern of going about doing business is established over time and will continue to be used as long as it is regarded as being valid. However, it is not clear how an event will influence an organisation’s culture and indirectly influence the operational outcome.

When reading and talking about engineering achievements, practise or the role of engineering in society, words such as innovation, team work, product delivery, product improvement and related terminologies are used. It is widely accepted that the achievements of an engineering organisation depends on all of these and many more. However, engineering organisations prefer predictability in outcome (minimum risk) and therefore huge effort is spent on ensuring processes are in place, rigorous project plans are established, teams are “aligned” and good governance is used to ensure progress continues as planned. The role that engineering culture may play in the predictability of outcome is not clear. Furthermore, can the culture be managed to improve the outcome? Is the culture merely a reflection of the-way-we-did-the-project-to-date status?

The definition of organisational culture by Brown as quoted in [3] implies that a pattern of going about doing business is established over time and will continue to be used as long as it is regarded as being valid.

The preliminary investigation suggests that it is not clear if it can be proactively determined that an event will influence an organisation’s culture and how it will influence the operational outcome.

The following questions support the problem statement:

- Which organisational culture characteristics were present in the case study project?
- How did the external factors and events influence the engineering culture?
- How did the engineering culture change over time?
- What was the impact of the major events on the cultural characteristics of the Case study company?
- To what extent did teams or individuals disassociate or associate themselves from the “new” organisation culture that was established after each event?

1.3 Research objective

The research objective in this paper is to determine what influence an event may have on an organisation’s culture. The study uses the history of the Case study engineering organisation to explore the cultures that existed over an 11 year period and how these were shaped by external and internal events. The intent of the research is not to determine whether the culture could have been manipulated to reach a different outcome, neither to develop a new model, but rather to measure the outcome of the events in terms of the impact if had on the engineering organisation’s culture.

1.4 Importance of the research problem

According to Ries [8], start-up endeavours rely on valid learning experiences, experimentation with possibilities, short iterative product releases, measuring progress, and obtaining customer feedback as soon as possible. Schein [9] reports that the founder in a start-up endeavour embeds the culture not necessarily by explicit actions and that the embedment process to establish a culture is mainly via a “teaching” process. This “teaching/learning” process of culture formation takes place when, in its simplest form, someone must propose a solution to a problem the group faces.

Without a strong established culture any major event (or even not so major) may pose a risk to the project that can influence the outcome of the project. The results from this research may benefit new start-up organisations on how to approach the change management process when they are exposed to major external events.

2. CURRENT MODELS AND DISCUSSION

2.1 Current models

The literature survey suggests that there may be knowledge gaps not yet addressed in the socio-cultural

aspects of organisational behaviour, in particular the cultural change mechanisms present when an organisation is subjected to an external event.

The organisational life cycle model (Mintzberg as quoted in [10]) describes the four phases of an organisation's life as follows: formation, development, maturity and decline. The model suggests that the culture grows from the initial start of the organisation with the behaviour of the key role players setting the initial culture in place, but that over time the culture as described by the senior management can differ from the culture as described by the lower levels in the workforce. The model further suggests that organisation demise is suffered once politics play the most important role in the organisation, unless renewal efforts are made to enable continuation.

Three distinct cultures are identified in an organisation, i.e. the corporate culture, the professional culture and the social culture [10]. The model suggests that the social culture will determine how conflict between the managers and professionals will be approached and resolved. The social culture includes the common values within the organisation.

The culture of a professional organisation is the essence of its competitive advantage [10]. The model indicates that when the vision of an organisation is changed then risk may be induced that reduces the competitive advantage of the organisation. When the deep-seated organisational culture is disturbed then either culture drag or culture precession takes place [11], and the change may take a totally different and unexpected route than initially intended, therefore having the risk of impacting the competitive advantage.

The control theory model for the organisational transfer function implies that should any of the areas that define organisational culture be subject to change, then culture is influenced. The model further implies that culture can be measured and managed indirectly via these four areas, i.e. People, Management Systems, Technology and Organisational Structure [12]. The diversity of the make-up of these areas will have an impact on the common language available to facilitate change and have an implication for the stability or instability of the organisation during and after this change.

According to Denison et al [13] a strong organisational culture can be associated with increased organisational effectiveness. They further indicated that the aspects of organisational culture most critical to success included: empowering employees; having a team orientation; having a clear strategic direction and intent; and possessing a strong and recognizable vision.

2.2 Discussion on models

The current models as reported address the following aspects of organisational culture:

- The formation of organisational culture,
- The composition of organisational culture,
- The life cycle of organisational culture,
- The possible impact of a changed vision on competitive advantage due to the reaction of the existing organisational culture towards the change.
- The lack of a universal language within an organisation may result in instability during organisational changes or events.
- The culture of an organisation can be used to strengthen its agility and resiliency.

The models indicate that when an event or change is imposed on an organisation, the ability of the organisation to absorb the event can be influenced by its culture. It is not clear from the models whether the outcome of an event on the organisation can be predicted.

The following hypothesis is put forward for testing:

Major events do impact the culture of an engineering organisation.

The models suggest that as organisations mature and are subject to events, the culture of an organisation can change. It is hoped that some indicators from the research can be used in similar engineering endeavours to manage culture proactively for success.

3. RESEARCH METHODOLOGY

The selected research design and methodology are discussed in this section. The strategy is provided. The rationale for the choice of design tools is presented and a critical analysis of the tools as selected is done.

3.1 Research strategy

According to Welman et al [14] professional groups such as market researchers have established explicit codes of conduct to which members should adhere. Although some practices can be considered ethical, it may still offend the respondents and the data collected may still generate unpleasant repercussions. Therefore participants should take part freely and prior consent obtained, in particular for interviews.

It is generally accepted that there is more confidence in causal relationships from true experimental research, than would be the case from non-experimental research [14]. If the phenomena being studied are orderly or regular then it would be possible to deduce some relationships between the variables in a non-experimental approach. During this research the intent is to study the behaviours of engineering staff over a period of time, and in particular when the organisation was subjected to a number of events. All the events were experienced by all staff at the same time within the engineering organisation and would therefore comply with the requirement of 'orderly and regular'.

The purpose of the research was to uncover facts, relationships and causations. Therefore the selection of the tools should preferably not support subjective information and specific care should be taken to obtain objective facts. The research strategy is based on a non-experimental hypothesis testing approach, and more specifically a field research approach consisting of a survey.

The target group for the survey should include responses from not only a few work areas within the engineering group but as many work areas as possible, including other entities related to the Case study company.

3.2 Choice of tools argued

A survey questionnaire can be used to obtain biographical details, typical behaviour, attitudes, opinions, beliefs and convictions from respondents [14].

The target group consisted of ex-Case study company staff members and members of other organisations closely involved with the company, such as the local electrical utility Client Office. Since it was not possible to determine the probability that any specific respondent would be included in the target group, a non-probability sampling method was used. Early warnings were sent to the target group to provide them with the purpose of the research and to identify their desire to take part in the research [14]. This sampling method has the advantage that the respondents with specific feelings and opinions about the research will then take part in the survey.

The target group can be regarded as a special target group if they may have a common loyalty [14]. Furthermore, if the target group is offered the opportunity to “tell their story”, as experienced at the Case study company, it will bolster the response rate.

The survey considered the attitudes and responses of the respondents towards the events as experienced in the engineering organisation. A list of questions was provided to the respondents on which they responded on a five point Likert Scale. The aspects of organisational culture as reported by Denison et al [13] were used to formulate the survey questions to determine the change in culture as perceived by the respondents. The dimensions address an organisation’s adaptability, mission, consistency and involvement. The semantic differential scale as developed by Osgood, Suci and Tannenbaum as reported in [14] was used in the survey. In addition to the survey questions the respondents were requested to provide limited biographical information, their qualifications, position at the Case study company, date when employment started and departure from the organisation.

A free text section was added to the survey questionnaire in which each respondent was requested to add feedback

related to the events as experienced. With the ability to provide feedback in private and on their own time, it was expected that the respondents would express their true feelings and opinions without concern that censure might be placed on information provided.

3.3 Critical analysis of tool selected

The risk in using a survey tool is that it lends itself to deliberate deception and the with-holding of information from the respondents [14]. Deliberate deception is difficult to detect, but the responses from an individual can be compared with others in the same organisational or peer group to assist with the detection of deception. With-holding of information can be addressed by forcing the respondents to respond to all questions.

Measurement reactivity may also occur where respondents remember their previous responses and wittingly alter these or unwittingly respond differently to follow-up questions based on the new questions put to them. The potential effect of measurement reactivity cannot be determined by speculation and should be measured empirically [14].

3.4 Questionnaire design

The questionnaire used eight events that occurred over a six year period and fourteen questions per event were formulated for evaluation by the respondents. The questionnaire ends with a request to the respondents to provide comments and personal observations on how they have experienced these and any other events that influenced the Case study organisation’s culture. The introduction to the questionnaire requires the respondents to position themselves in terms of skills, knowledge and work area within the organisation.

List of case events: The Case study organisation was subjected to many external and internal events over the period 1999 to 2010. The sample group that could still report on events prior to 2005 was very small, and had the additional risk that it could be regarded as a selective sample. Therefore the events prior to 2005 were excluded from the survey. Other events that were excluded were those that impacted only smaller areas and not the bigger group; and events and decisions that took place at levels beyond the visibility of the staff, typical at board and governmental level.

The purpose of the study was explained to the respondents as: to investigate the impact that events had on the culture of the organisation in general and the engineering organisation in particular.

The following eight events as listed in Table 1 were selected and regarded as being prominent enough to allow most respondents to recollect their related experience:

Table 1: List of Events

Event number	Year	Description of the Event
1	2005	Until early 2005 all staff was employed as contractors / consultants to work on the project. By April 2005 all staff was appointed as permanent employees with permanent employee benefits but with less flexibility in terms of working hours.
2	2005	Appointment of the CEO. The focus shifted from an engineering project to building a new energy development organisation, in particular expanding the staff functions and the non technical activities.
3	2006	Appointment of the Project Director. A project team and structures were formed, with a distinct style of project management.
4	2006	Appointment of an EPCM. The EPCM started to work on Balance of Plant designs and provided some of the project management services.
5	2006	Stop Work Order issued by the National Nuclear Regulator in October. The Stop Work Order was only lifted in early 2008.
6	2007	Departure of the General Manager: Engineering in November.
7	2008	Appointment of the new General Manager: Engineering in mid 2008 and the adoption of the Indirect Cycle plant in Oct/Nov 2008 as prime product offering.
8	2009	Announcement is made in November 2009 that no further funding will be received from government and restructuring may be on the cards.

Table 2: Organisational Traits and Survey Questions

Organisational Trait	Survey question
Involvement is defined as the building of human capability, ownership and responsibility.	<ul style="list-style-type: none"> • How did the event impact your ability to be in control of your work output? • How did the event impact your sense of loyalty to the organisation? • How did the event impact your sense of loyalty to your own team?
Consistency provides a central source of integration, coordination and control, and helps organisations develop a set of systems that create an internal system of governance based on consensual support	<ul style="list-style-type: none"> • How did the event impact the commonality in techno speak / techno language in your work environment? • How did the event impact interpersonal conflict? • How did the event impact interdepartmental conflict? • Was the vision(s) clearly communicated (verbal and walk the talk) by management? • To what extent did the event contribute to the organisation becoming a political organisation?
Adaptability is the ability to perceive and respond to the environment, customers, and restructure behaviours and processes that allow them to adapt.	<ul style="list-style-type: none"> • How did the event impact your ability to make or influence work related decisions? • Did the event change the participative climate in the areas where you were involved?
Mission relates to the defining of a meaningful long-term direction for the organisation. The mission tells employees why they are doing the work they do, and how the work they do each day contributes to the why	<ul style="list-style-type: none"> • Did the event have an impact on the sub-cultures (silos)? • How did the event impact the company values?

Formulation of the questions: According to Denison et al [13] a strong organisational culture can be associated with increased organisational effectiveness. The study by Denison et al [13] indicates that the aspects of organisational culture most critical to success included: empowering employees; having a team orientation; having a clear strategic direction and intent; and possessing a strong and recognizable vision. The

questions presented in Table 2 were also formulated to reflect the four organisational culture traits as defined in [15].

The events were evaluated by the respondents by indicating their preference on the questions on a five point Likert Scale, graded between two opposites. Not all the questions were applicable to all the events and only

the questions applicable to a particular event were put forward to the respondents.

Two questions were used as additional indicators whether there was a change in culture or not. These questions asked the respondent to make an assessment whether a change has taken place or not. The one question asked whether culture change had taken place after the event, and the other asked whether an important item related to culture had changed after the event, in this case the vision of the organisation.

Free text section: The questionnaire ended with a request to the respondents to provide comments and personal observations on how they experienced these and any other events that influenced the Case study organisation culture, and in hindsight what they thought could have been done to direct the culture. Since six of the eight events included in the questionnaire occurred prior to the end of 2007, the free text section allowed those respondents that became involved with the Case organisation only after 2007 with the opportunity to reflect on the culture they expected prior to appointment and their actual experience after being appointed.

4. RESULTS

When the Case organisation indicated in January 2010 that restructuring was imminent, a contact list was created by the organisation on which staff that either took early voluntary retrenchment packages starting in March 2010 or were eventually laid off by October 2010 could add their contact details. This list contained 391 names of which 252 provided e-mail addresses. A further 70 e-mail addresses were obtained via discussion groups on internet, making up the total of 322 to whom the survey questions were distributed on 8 August 2012. The mail delivery system reported a permanent failure on 12 of the 322 addresses and it is not known how many of the remainder of the 310 e-mail messages as sent actually reached the intended recipients. A total of 76 completed questionnaires were received between 9 and 31 August 2012. Results received after this date were not included due to time restrictions placed on the completion of the research. The results received on all questions are assumed to be random, unbiased and approximately normally distributed.

The respondents were grouped into staff that was employed for 5 years or less and staff that was employed for longer than 5 years. The following two durations of employment groups were identified:

- The staff employed for 5 years or less, identified as **L5 Group**.
- The staff employed for more than 5 years, identified as **M5 Group**.

The **All Group** includes the responses received from both the L5 and M5 Groups, combined into one group. Refer

to Table 3 for a summary of the employment information of the respondents.

Table 3: Employment Information of the Groups

Characteristic	Group Identifier		
	L5	M5	All
Percentage of total	47.4	52.6	100%
Average Duration of Employment	3.8	8.5	6.2
Standard Deviation on Duration of Employment	1.0	2.1	2.9
* Average Start Date	2006.2	2000.8	2003.4
Standard Deviation on Start Date	1.1	0.6	3.2
* Average Departure Date	2010.0	2009.3	2009.6
Standard Deviation on Departure Date	0.6	1.2	1.0

* The questionnaire did not allow the respondents to add a specific month on which their employment started or ceased, only the year value. Therefore the year fractions as provided in the results do not imply a specific month of the year.

4.1 Summary of results

The results for the three groups are provided in Tables 4, 5 and 6 and are interpreted as follows:

Column A: "Cultural change as indicated by adjectives". Note that these results only indicate whether a change in culture has taken place or not.

- "Yes" – a cultural change has taken place after the event.
- "Inconclusive" – it is not clear from the results whether a cultural change has taken place after the event or not.

Column B: "Cultural change as indicated by high scoring". Note that these results indicate whether there was a strong or a weak change in culture.

- "Yes" – a strong indication that a cultural change was experienced by the group after the event.
- "Low" – a weak indication that a cultural change was experienced by the group after the event.

Column C: "Positive / Negative Counts". Note that these results indicate whether the culture was strengthened or weakened by an event.

- "Positive" – the number of positive counts indicate that the culture has strengthened (positive) after the event.
- "Negative" – the number of negative counts indicate that the culture has weakened (negative) after the event.

- “Inconclusive – the number of positive and negative counts are equal and it is not clear from the results whether the culture has weakened (negative) or strengthened (positive) after the event.

Table 4: Summary of Results – All Respondents Combined (All Group)

Event	Cultural change as indicated by adjectives A	Cultural change as indicated by high scoring B	Positive / Negative Counts C
1	Yes	Yes	Negative
2	Inconclusive	Yes	Inconclusive
3	Inconclusive	Yes	Negative
4	Yes	Yes	Negative
5	Yes	Yes	Negative
6	Yes	Yes	Negative
7	Yes	Yes	Negative
8	Yes	Yes	Negative

With reference to the All Group, Table 4, the results based on measured adjectives indicate that only events 2 and 3 were inconclusive regarding cultural change. The experience as indicated by the high scoring indicated that every event resulted in a cultural change. The group indicated that organisational culture was weakened by all the events, except for event 2, as shown by the positive/negative counts. Event 2 was inconclusive on whether it strengthened or weakened the culture.

Table 5: Summary of Results for Respondents Employed for 5 Years or Less (L5 Group)

Event	Cultural change as indicated by adjectives A	Cultural change as indicated by high scoring B	Positive / Negative Counts C
1	Events 1 and 2 sample sizes too small		
2	Events 1 and 2 sample sizes too small		
3	Inconclusive	Low	Negative
4	Yes	Low	Negative
5	Yes	Yes	Negative
6	Inconclusive	Yes	Negative
7	Inconclusive	Yes	Inconclusive
8	Yes	Yes	Negative

With reference to the L5 Group, Table 5, the sample sizes of events 1 and 2 were too small and were excluded from the results. The results for L5 based on measured adjectives indicate that events 3, 6 and 7 were inconclusive regarding cultural change. The experience as indicated by the high scoring indicated that the events resulted in a cultural change. The group indicated that organisational culture was weakened by all the events, except for Event 7, as shown by the positive/negative

counts. Event 7 was inconclusive on whether it strengthened or weakened the culture.

Table 6: Summary of Results for Respondents Employed for more than 5 Years (M5 Group)

Event	Cultural change as indicated by adjectives A	Cultural change as indicated by high scoring B	Positive / Negative Counts C
1	Yes	Yes	Negative
2	Inconclusive	Yes	Inconclusive
3	Inconclusive	Yes	Negative
4	Yes	Yes	Negative
5	Yes	Yes	Negative
6	Yes	Yes	Negative
7	Yes	Yes	Negative
8	Yes	Yes	Negative

The results for the M5 Group as provided in Table 6 are the same as for the All Group. The noticeable differences between the L5 and M5 Groups are the results for Events 6 and 7. Those employed for 5 years or less indicated that the cultural changes for these two events were more inconclusive than for those employed for more than 5 years.

In summary an indication of the impact on the organisational culture by the events as measured on Groups L5 and M5 is provided in Figure 1: Impact on Culture, where the mostly negative impact except for event 2 and partially for event 7 group L5 is notable.

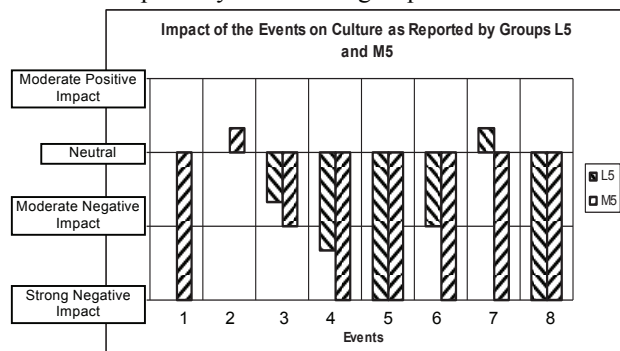


Figure 1: Impact on Culture

5. CONCLUSIONS AND RECOMMENDATIONS

The hypothesis tested stated: “Major events do impact the culture of an engineering organisation”. The results show that most of the events have changed the culture of the engineering organisation and in all instances where a change was measured, the culture had weakened. As can be expected, Event 8 had a strong impact on the change in the engineering organisation’s culture; it was when the announcement was made that restructuring (and lay-offs by implication) is imminent.

The results from events 1, 4, 5, 6, 7 and 8 support the hypothesis that major events can change an engineering organisation's culture. It is inconclusive whether events 2 and 3 have changed the engineering organisation's culture or not.

All the events, except for Event 2, have weakened the engineering organisation's culture. Although the measurements on Event 2 indicate that the event was inconclusive regarding its ability to change the culture, the indications are that the event tended to weaken the culture. Those employed for longer than 5 years experienced the cultural changes due to events 6 and 7 more distinctly and more negatively than those employed for a lesser number of years.

5.1 Area for further investigation

Engineering organisations are spending focussed and expensive effort to reduce the risk of not achieving their project goals and to ensure an effective workforce. The question can be asked whether the culture can be managed to endure the unforeseen and improve the predictability in outcome.

Further investigation will improve the understanding of how a major event may impact the culture of an engineering organisation. Furthermore if it is assumed that those working longer within an organisation are in a position to express themselves more strongly during or prior to an event and thereby influencing the cultural change, then understanding how these employees may impact the dissemination of the new culture into the organisation is important. The ideal situation will be to prepare the organisation in advance of an upcoming visible and even not so visible event with the intent to stay on course or to adjust course to be able to survive the event.

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