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The Forgotten Dimension: Work Culture in Plant Turnaround Maintenance of a Malaysian Petrochemical Company

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Abstract

Purpose: The purpose of this study is to examine the management style of immediate superiors and work-related values of subordinates in a plant turnaround maintenance setting.
Design/methodology/approach: As the study was conducted in a real industrial plant setting, questionnaires were used as the main method for data collection due to practicability. The questionnaires were administered to staff of the Propane Dehydrogenation Plant who are involved in the turnaround and the workers of the turnaround contractors. Nine items (using a five-point, bipolar rating scale) related to individualism-collectivism, power distance and masculinity-femininity were used to measure predominant management styles of the immediate superior. Additionally, twenty-three items (using a five-point, bipolar rating scale) are used to operationalize the dimensions of sociability and solidarity. The study was coordinated through the Turnaround Central Services Department of the petrochemical company. Out of the 250 questionnaires distributed, 137 were returned, yielding an overall response rate of 55%.
Findings: Turnaround maintenance with enormous activities, inevitably leads to division of labor, horizontal and vertical differentiation among the organizational members. As such, common direction, coordination, and control of organizational resources through the appropriate organizational culture are vital. Understanding the behavioral pattern of the workforce will facilitate planning initiatives for organizational improvement. Initiatives to be taken by management involving the staff should take into consideration these cultural elements and value system. By and large initiatives that are in congruence with the value systems of the workforce are more readily accepted rather than those departing from their cultural patterns. After all, labour has reached a stage whereby it is no longer a simple commodity that can merely be bought and sold in the market.
Research limitations/implications: A larger sample size that covers more companies is required to ensure representative groups of people for the results to be generalized in the petrochemical industry. Furthermore, there was a lack of prior research studies of work culture in plant turnaround maintenance environment.
Originality/value: The analysis showed that immediate superiors live out low power distance characteristic whereas the subordinates subscribed to high power distance work value. It was argued that the organizational structure, structuring processes, rules and guidelines that were established to certain extant shaped the relationships between immediate superiors and subordinates and hence the power distance.

Keywords: management style, work-related values, individualism, collectivism, masculinity, femininity, power distance, solidarity, sociability, plant turnaround maintenance

Paper Type: Research paper

1. Introduction

Plant turnaround maintenance is an event that demands huge manpower due to the large amount of maintenance activities to be carried out in a predetermined short time frame. Hundreds of thousands of maintenance man-hours are required depending on the volume of the work and the window of opportunity available. Obviously, large-scale workforces are hired through temporary subcontracting, staffing agencies and at times from the original equipment manufacturers. It is not uncommon to have foreign workforce and specialists during the execution of the turnaround maintenance. The central issue in this respect is the diversity of the manpower as the consequent of various knowledge skills, abilities, attitudes, motivations, and behaviors, to name a few. As

such differences in cultural values and practices in particular subordinates' work-related values and superior's management styles are to be anticipated.

The event consists of multiplicity of inter-related activities, performed at the same time, in the same place and at times on different levels of the plant. Area congestions increase the chances of potential accidents, conflicts, errors, and confusion that are greater compared to normal maintenance environment. Furthermore, there are inevitably conflicting demands in the process of executing the turnaround maintenance activities such as differing objectives placed between quality and duration, cost and duration, and duration and safety. The highly regulated operational environment, the need for integration and coordination of multiple interfaces across the turnaround maintenance activities suggest the importance of having a compatible work culture among the organizational members.

The organization of turnaround is temporary in nature and by and large the members of the organization are changing. Hence, high possibility that people do not know each other particularly well. This situation harbors the possibility of disintegration. How to get everyone on-board? How to win the hearts and minds and interest of the people? What holds the turnaround maintenance team together? What makes the turnaround activities moved as planned successfully? In answering these questions, the turnaround maintenance leaders need to understand the behavior of the turnaround workforce and their social relationships that develop the cohesive and coherent team. Following that, the appropriate work culture could be developed and reinforced. Well managed work culture can lead to sustainable source of competitive advantage (Hoeckline, 1996). Therefore, it is pertinent that the work culture that facilitates the management of sustainable turnaround organizational performance be comprehended. Hence, it is the objective of this study to investigate the work culture of plant turnaround maintenance in Propane Dehydrogenation Plant (PDH), Malaysia and examine the degree of differences between the subordinates' work-related values and the superior's behavioral characteristics of management practices.

2. Literature Review

Work Culture

The pursuit of achieving organizational goals typically is a collective effort of the organizational members. Most of the work in the organization is performed by individuals working together with others in the organization. Inevitably, compatible work culture among the members is crucial to foster teamwork. However, frequently culture is taken for granted or neglected. Culture has been identified by many scholars namely Hofstede (1980), Handy (1993), Goffee and Jones (1998), Cameron and Quinn (1999), and Schein (2004) to name a few. Fundamentally there are wide agreement that culture comprises ideas, patterns, attitude, experiences, beliefs, and values of the members of the organization. As stated by Schein (2004), culture is "deep-lying, basic assumptions and beliefs that operate unconsciously and are shared by members of the organization and more or less taken for granted". It is the "deeper level of basic assumptions and expectations that participants bring to the group as part of their cultural heritage or psychological baggage" (Fincher, 1986). As illustrated in Figure 1, the work culture and values of the organizational members are shaped by the ideologies, rules, procedures, their normative socialization, and their work environment.

Through extensive research, several dimensional measures of culture were developed. For instance, Hofstede (1980) focused on management styles namely power distance, uncertainty avoidance, individualism versus collectivism, masculinity versus femininity, and long-term versus short-term orientation. Goffee and Jones (1998) established two dimensional measures of sociability and solidarity. Charles Handy (1993) popularized four typologies of culture namely power culture, role culture, task culture, and people culture. Cameron and Quinn (1999) categorized culture into four dimensions that is clan, hierarchical, entrepreneurial and result-oriented. Hofstede (1980) suggested that there are substantial differences in work-related values such as power distance, individualism, and long-term orientation between western and eastern countries. The westerners generally are more individualistic, has small power distance, low uncertainty avoidance, and short-term oriented. On the contrary, eastern cultures value collective undertakings, has large power distance, high uncertainty avoidance, and long-term oriented. This is supported by Asma (1996) and Raduan et al. (2008) based on their studies in Malaysian organizational context. Among the cultural dimensions highlighted above, power distance is the most influential in examining behaviors in organization (Dickson et al., 2003). Various researchers stated that the structures and processes that are established in the organization shape the intensity of the power distance culture as they deal directly with the distribution of power and authority (Lachman et al., 1994).

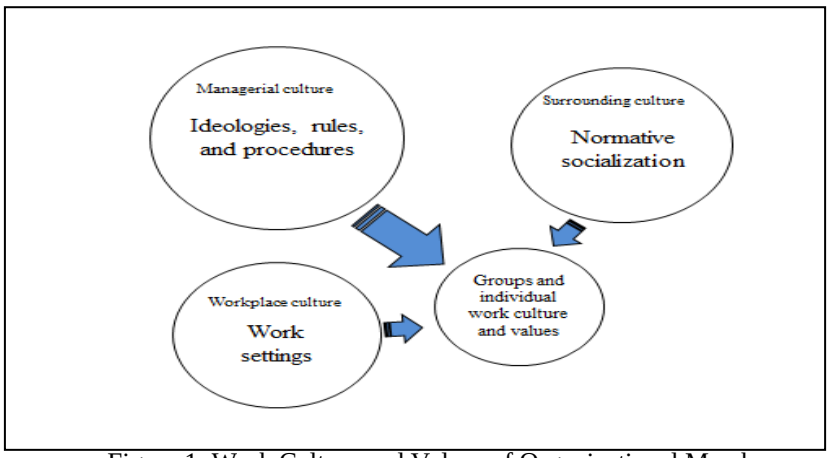

Figure 1: Work Culture and Values of Organizational Members

The work culture holds companies together, creates the sense of community and common way of thinking. It reflects the nature of relationships of the people within the organization (Goffee and Jones, 1998). It is the embedded social behavior of the organization that distinguishes one organization from the others. It is the reflection the unique character of the organizational members. It provides an important framework for analyzing the members' conception of the organization and identifying appropriate mechanisms in controlling and coordinating the activities in the organization.

The central issue is managing the large manpower and diversity as reflected by their diverse background, knowledge, skills, abilities, attitudes, motivations, and behaviors. Differences in cultural values and practices among these workforces are inevitable. As pointed out by DeBakey (2007),

"*Culture that characterizes any group is made of the knowledge, beliefs, customs, and practices shared within the group. These are taken for granted, but they guide attitudes and behaviors, which in turn determine actual outcomes. When a business seeks to improve its performance, it must examine its culture and assess the impact of its practices on the desired results".*

It is incumbent upon the turnaround maintenance manager to build a cooperative network among these divergent allies. In view of this, focusing on technology and technical systems alone in achieving successful turnaround deemed insufficient. Equal attention has to be given to social dimensions too namely the work culture and values of the people involved in the turnaround event even though the turnaround organization is temporary. Cultural issues are significant in understanding human behavior as culture plays important role in shaping organizations through the values and attitudes of the employees. Inevitably, culture influences various aspects of managing and organizing the turnaround event. It is pertinent for the turnaround management to identify and mitigate incompatibility of the company's work culture with those of their contractors and sub-contractors even though at times some differences are unavoidable. The relationships that work best are those that foster strong, compatible culture. The values, beliefs and behaviors are not against the grains or norms. Organizational members that have compatible work culture will have the tendency to communicate with each other more often due to in-group attachments and shared perceptions. Due to insignificant cultural barriers, positive social associations and in-group social contacts are fostered that generates behaviors such as solidarity, conformity to the norms of the organization and sociability.

3. Research Design and Methodology

In this study, multiple dimensions of culture were employed to ensure impartiality in measurement. The dimensions include power distance, individualism-collectivism, masculinity-femininity, sociability and solidarity. The power distance, individualism-collectivism, and masculinity-femininity are used to describe the predominant management style in managing and organizing the turnaround maintenance. These dimensions have been frequently used and provide valid measures of the behavioral characteristics of management practices of superiors (Hofstede and Bond, 1988). As such, the dimensions are appropriate in describing empirically the management styles being practiced in turnaround maintenance organization of PDH. Indicators of sociability and solidarity measure the nature of relationship of the diverse organizational members within the turnaround organization.

3.1. Research Instrument and Data Collection

As the study was conducted in a real industrial plant setting, questionnaires were used as the main method for data collection due to practicability. The questionnaires were administered to staff of the Propane Dehydrogenation Plant who are involved in the turnaround and the workers of the turnaround contractors. Nine items (using a five-point, bipolar rating scale) related to individualism-collectivism, power distance and masculinity-femininity were used to measure predominant management styles of the immediate superior. Additionally, twenty-three items (using a five-point, bipolar rating scale) are used to operationalize the dimensions of sociability and solidarity. The study was coordinated through the Turnaround Central Services Department of the petrochemical company. Out of the 250 questionnaires distributed, 137 were returned, yielding an overall response rate of 55%.

3.2. Characteristics of the Sample

Majority of the respondents (89%) were male and about 11% were female, reflecting the traditional male dominance in plant turnaround maintenance. PDH staff made up 27% of the respondents and the statistics showed that only 40% of them have been with PETRONAS for more than six years. The remaining 73% of the respondents were employees of 24 turnaround maintenance contractors. Out of the 100 respondents, only 31% have more than six years experience in plant turnaround maintenance. About 82% of the respondents were below 40 years old, indicating a sample of young turnaround maintenance personnel. These figures demonstrate that large majority of the PDH turnaround workforce did not have sufficient skills and exposure in turnaround maintenance environment.

However, the respondents could be regarded as well educated. Close to 62% have certificate/diploma/degree, and 3% have masters' degree. The remaining respondents have either secondary or higher school education. By and large, the respondents (96%) were Malay, while four percents were Chinese, Indian, and other ethnicity.

4. Background of Propane Dehydrogenation Plant, MTBE Malaysia Sdn Bhd

As a major step towards establishing a regional petrochemical production hub, Malaysia has invested heavily in the development of integrated petrochemical industries with the aim of promoting the development of the country's industrial base, especially the plastics and chemical based component manufacturing industry. One of the petrochemical industries is located in the east of the Peninsular Malaysia. Established in 1989, it produces methyl tertiary butyl ether, and polypropylene. As part of its expansion plan, a propane dehydrogenation (PDH) plant was commissioned in May 2001. It has an installed production capacity of 300,000 tons per annum. The propane dehydrogenation functions as catalyst and acts an alternative route to propylene.

The capital intensive plant and technology employed by PDH plant are subjected to regular statutory inspections by the Department of Safety and Health (DOSH) for the renewal of the plant Certificate of Fitness (CF). Since the plant is operating continuously, plant shutdowns have to be planned at regular intervals to facilitate the inspection and implementation of turnaround maintenance programs. In total, close to 1700 equipment are included in the work lists of the plant turnaround. Among others reactors, vessels, columns, heaters, filters, heat exchangers accumulators, compressors, boilers, pumps, motors, and various sizes of valves to name a few. Due to the large number of works that have to be completed within a predetermined short window of opportunity, PDH employed 24 contractors to execute the maintenance work. During peak period of the turnaround nearly 1900 maintenance workers were in the plant. Certainly, plant turnaround maintenance forms a major activity in PDH and has been given close attention by the management of the plant operations division.

5. Results and Analysis

5.1. Management Styles

Table 1 shows the overall results that represent the immediate superior's behavioral characteristics of management practices during the plant turnaround maintenance of PDH. The reliability statistics (Cronbach's alpha) are 0.65, 0.78, and 0.80 for femininity/masculinity, individualism/ collectivism, and power distance respectively. The alpha coefficients indicate that the scales are reliable in measuring the cultural dimensions. The mean scores indicate moderately high degree of femininity-orientation (3.59), high level of collectivism (3.93), and moderately low power distance (3.85).

Table 1: Management Styles – overall results

Cultural Dimensions		Femininity/ Masculinity (a)	Individualism/ collectivism (b)	Power distance (c)
N	Valid	137	137	137
	Missing	0	0	0
Mean		3.59	3.93	3.85
Std. Deviation		0.65	0.59	0.72
Minimum		1.00	2.00	1.00
Maximum		5.00	5.00	5.00
Cronbach's Alpha		0.65	0.78	0.80

Note (a): Scale 1-5, ranging from (1) strongly disagree to (5) strongly agree
The higher the score, the higher the degree of *femininity*.
Note (b): Scale 1-5, ranging from (1) strongly disagree to (5) strongly agree
The higher the score, the higher the degree of *collectivism*.
Note (c): Scale 1-5, ranging from (1) strongly disagree to (5) strongly agree
The higher the score, the lower the *power distance*.

5.2. Work Related Values

As comparison, Table 2 highlights the subordinates' work related values. The reliability statistics (Cronbach's alpha) are 0.65, 0.67, and 0.69 for femininity/masculinity, individualism/ collectivism, and power distance respectively. The alpha coefficients indicate that the scales are reliable in representing the work-related values. The mean score (4.12) indicates that the subordinates favor a work environment with high degree of femininity-orientation. They also give high preference to collective-orientation work values as indicated by a mean value of 4.20. On the contrary, a mean value of 3.15 reveals that the subordinates prefer a moderately high power distance between them and their immediate superior. The statistics suggest that the subordinates prefer receiving instruction rather than being consulted by their superior, that in most occasions they should agree with their superior's decisions, and they try to avoid any form of disagreement with immediate superior.

Table 2: Work Related Values – overall results

		FEMININITY/ MASCULINITY (A)	INDIVIDUALISM/ COLLECTIVISM (B)	POWER DISTANCE (C)
N	Valid	137	137	137
	Missing	0	0	0
Mean		4.12	4.20	3.15
Standard Deviation		0.59	0.55	0.79
Minimum		2.00	2.00	1.00
Maximum		5.00	5.00	5.00
Cronbach's Alpha		0.65	0.67	0.69

Note (a): Scale 1-5, ranging from (1) strongly disagree to (5) strongly agree
The higher the score, the higher the degree of *femininity*.
Note (b): Scale 1-5, ranging from (1) strongly disagree to (5) strongly agree
The higher the score, the higher the degree of *collectivism*.
Note (c): Scale 1-5, ranging from (1) strongly disagree to (5) strongly agree
The higher the score, the lower the *power distance*.

5.3. Sociability and Solidarity

Table 3 shows the overall results that represent sociability and solidarity among the organizational members of the plant turnaround maintenance. The sociability scale consists of 12 items. The reliability coefficient alpha is 0.82 which indicates a high level of consistency among the items that represent the scale. The solidarity scale comprises of 12 items. The reliability coefficient alpha is 0.87 that signifies a high level of consistency among the items that symbolize the scale.

The mean score for *sociability* scale is 3.68. Responses to the individual items suggested high level of sociability culture among the members of the turnaround maintenance organization (mean ranges from 3.10 to 3.98). The statistics indicate an environment of friendliness among the members of the turnaround organization. Generally, the comfort of sincere and reciprocal friendship among the organizational members facilitates the spirit of togetherness. Consequently, high morale, teamwork and sharing of information prevailed.

The mean score for *solidarity* scale is 3.76. The statistics showed that responses to the individual items implied a considerably high spirit of solidarity between the members of the turnaround maintenance organization (mean

ranges from 3.65 to 4.15). The responses suggested that they have mutual interests and clearly understood shared goals that benefit all. Thus, solidarity promotes performance-driven values and behavior among the organizational members which is crucial for turnaround.

Table 3: Descriptive Statistics – Sociability/Solidarity

		Sociability [(a)]	Solidarity [(b)]
N	Valid	137	137
	Missing	0	0
Mean		3.68	3.89
Std. Deviation		0.49	0.48
Minimum		2.00	2.00
Maximum		5.00	5.00
Cronbach's Alpha		0.82	0.87

Note (a): Scale 1-5, ranging from (1) strongly disagree to (5) strongly agree
The higher the score, the higher the degree of *sociability*.
Note (b): Scale 1-5, ranging from (1) strongly disagree to (5) strongly agree
The higher the score, the higher the degree of *solidarity*.

6. Discussion

The results show that the respondents are largely oriented towards high femininity and collectivism culture. This is expected as large majority of the respondents are Malaysians who have high preference for working with group and promote the importance of the needs of group over individual. They stressed the importance of cohesion within the turnaround members and they give higher priority to meeting the turnaround goals over their individual objectives. They strived to have good working relationships, avoiding any forms of criticisms, and prefer to negotiate and compromise in resolving conflicts among them. Large majority stressed on making group decisions, equality, and often polite, cultured and well-mannered when interacting with others.

Further analysis revealed moderately high solidarity culture prevailed among the respondents. They are mindful and understand the objectives of the turnaround. They are clear about their tasks and the relationships with the other work activities. These are facilitated by having guidelines and instructions about the work that they are executing. On overall, the workers have high collective will to meet the objectives of the organization. High sociability culture prevailed among the respondents as well. The turnaround members get along very well and disputes are rare. Some of them often socialize after their working hours and with that they build close long-term relationships with each other. The statistics showed that the co-workers stay in contact with those who have left the company just to know how they are doing. Large majority agreed that to certain extent they protect each other.

The above mentioned culture traits reflected the horizontal collectivism that prevailed among the respondents. These traits are well suited for the turnaround environment. Turnaround maintenance involved voluminous work activities. During turnaround, the work was so engaging and the members spend more than 10 hours at work daily. Furthermore, space is quite a constraint in plant turnaround environment. As such, much space is shared either formally or informally. Issues and challenges are inevitable in this highly-pressurized environment and need to be handled swiftly. Hence, the horizontal collectivism culture that prevailed among the turnaround team members helps to alleviate or at least mitigate the possibility of conflict.

On the contrary, the statistics revealed a certain degree of difference in the power distance, vis-a-vis between the management style of the immediate superior and the preferred values of the subordinates. It is empirically demonstrated that low power distance culture prevailed among the immediate superior. The results indicated that superiors prefer limited dependence of subordinates on them and that they favor participative behavior by requesting and accepting ideas, suggestions and feedback from subordinates. On the contrary, the subordinates have preference for moderately high power distance culture where there is usually a strong dependence of subordinates on their superiors. They prefer to receive instruction rather than being consulted by their superior. By and large, they resent disagreement with immediate superior's decisions. Obviously, autocratic and paternalistic management approaches were preferred by the subordinates. This finding support the study of Offermann and Hellmann, (1997) where they found that autocratic and paternalistic management approach were more prevalent across high power distance culture.

It can be argued that the rules, guidelines and processes that are established in the turnaround environment shaped the power distance cultural trait among the subordinates. Due to the nature of the work settings namely the petrochemical production, technology employed, and the processes involved, the company accorded high importance on respecting and complying to safety rules, guidelines and processes during the execution of the

turnaround maintenance activities. Monitoring and control of safety aspects were highly emphasized. Subordinates were closely monitored to ensure that they are in line with the working guidelines of the turnaround. For instance, everyone has to undergo a one-day session of safety training before they are given the approval to enter the turnaround work premises. On top of this, they have to obtain daily work permit prior to execution of any jobs. These requirements are imposed by the Department of Safety and Health (DOSH), Malaysia. Consequently, it has induced the company towards adopting strict monitoring system.

Managing and organizing the complex turnaround maintenance activities are mitigated by designing and establishing suitable organizational structure and structuring processes. The organizational structure is configured based on hierarchic functional-type structure as illustrated in Figure 2. It was observed that organization structuring processes were highly centralized and formalized. This is the norm with large turnaround maintenance as discovered by previous researches that have been conducted (Zulkipli *et al.*, 2008; Zulkipli and Mohammed, 2010).

As time is the essence in turnaround maintenance, quick decisions are crucial during the execution of the maintenance activities. Failure to do so risk delaying work, reducing productivity, schedule slippage, and ultimately leads to costs overrun. The hierarchic structure and top down approach style of management promote faster decisions by minimizing time-consuming negotiations to achieve consensus (Zulkipli and Mohammed, 2011a; Zulkipli and Mohammed, 2011b; Baum and Wally, 2003; Lin and Germain, 2003). The above background framed the subordinates' behavior and thus encouraged them to adopt a top down approach culture that prevailed.

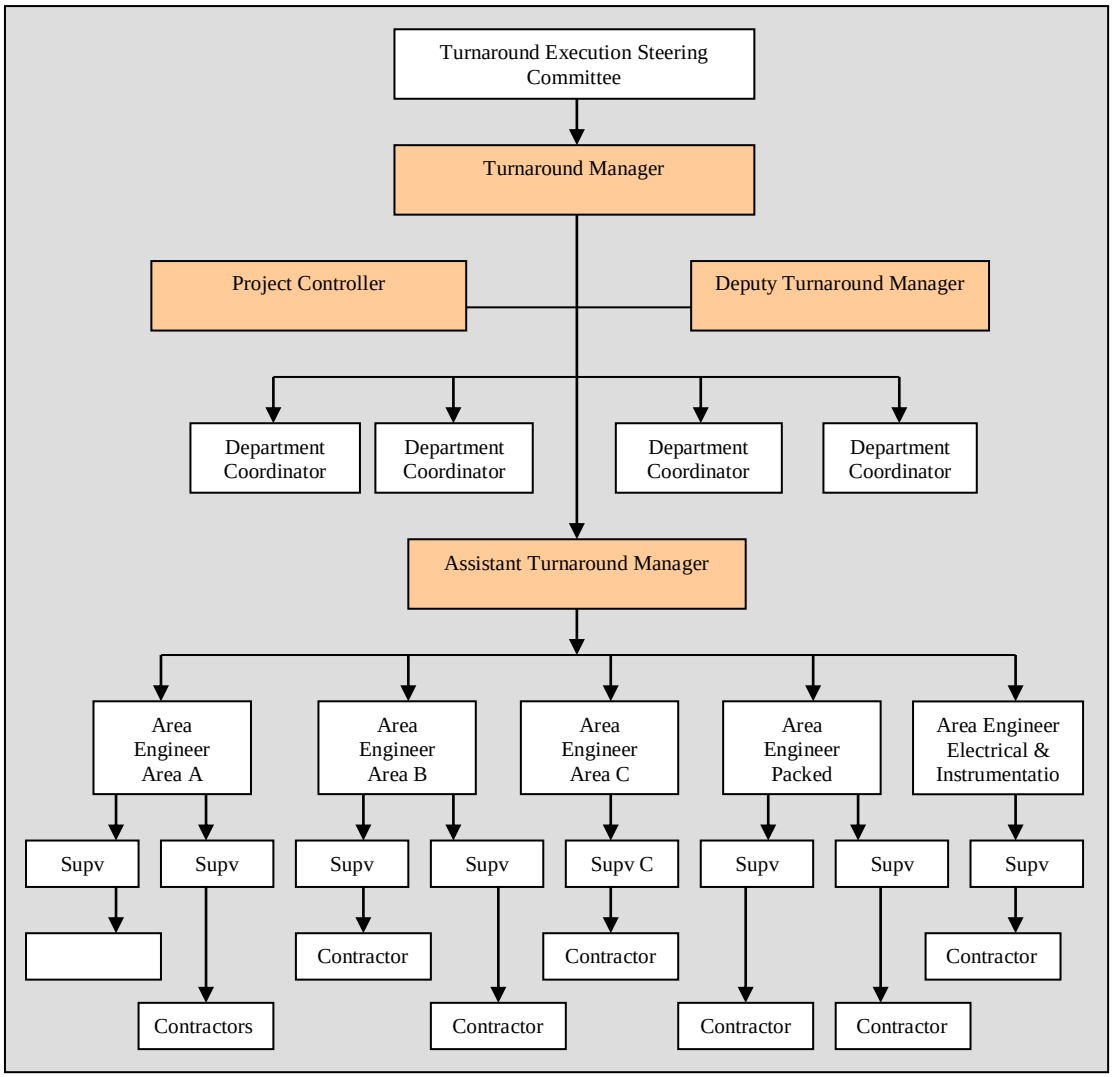

Figure 2. Organizational Structure for Turnaround Execution

7. Conclusions

This paper has provided crucial contributions in understanding the work culture of plant turnaround maintenance that has been given least attention by turnaround professionals and academicians alike. Turnaround maintenance with enormous activities, inevitably leads to division of labor, horizontal and vertical differentiation among the organizational members. As such, common direction, coordination, and control of organizational resources through the appropriate organizational culture are vital. Understanding the behavioral pattern of the workforce for planning initiatives on organizational improvement has and will continue to pose a challenge to the management of turnaround maintenance. Initiatives to be taken by management involving the staff should take into consideration these cultural elements and value system. By and large initiatives that are in congruence with the value systems of the workforce are more readily accepted rather than those departing from their cultural patterns. After all, labour has reached a stage whereby it is no longer a simple commodity that can merely be bought and sold in the market.

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