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Organization Culture Theory: From Organizational Culture of Schein to Appreciative Inquiry of Cooperrider & Whitney

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ABSTRACT

Organization is a relatively young science in comparison with the other scientific disciplines. (Ivanko, 2013) Accounts of the growth of organizational theory usually start with Taylor and Weber, but, as Scott (1987) mentions, organizations were present in the old civilizations which goes back to Sumerians (5000, BC) and which experiences its maturation phase with Taylor, Fayol and Weber, continuing to come up to present with modern management methods and principles. The modern organization may be the most crucial innovation of the past 100 years and it is a theory which will never complete its evolution as the human being continues to exist. Understanding how organizations work has been the focus of scientists and scholars until the early part of the 20th century. Just as organizations have evolved, so to have the theories explaining them. These theories can be divided into 9 different "schools" of thought (Shafritz, Ott, Jang, 2005): Classical Organization Theory, Neoclassical Organization Theory, Human Resource Theory, or the Organizational Behavior Perspective, Modern Structural Organization Theory, Organizational Economics Theory, Power and Politics Organization Theory, Organizational Culture Theory, Reform Though Changes in Organizational Culture and Theories of Organizations and Environments. This introductory paper will concentrate on the organization culture theory and is divided as follows: The introduction talks about the developments of the organization and organization theory from its early stages with detailed definitions. In section 2, theoretical roots in other words literature review on the subject will be presented. At further section, by looking at the perspectives of the 9 pioneering people (Schein, Martin, Ouchi, and Cooperrider & Whitney) main principles of the classical organization theory are presented one by one. Section 4 mentions strengths and weaknesses of the classical organizational theory and section 5 discusses and concludes the paper.

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I. Introduction

Science of management is a process arise of which goes back to Sumerians (5000, BC) and which experiences its maturation phase with Taylor, Fayol and Weber, going to exist up to present with modern management methods and principles such as, Total Quality Management, Process Management and it is a theory that will never complete its development. On the contrary, to developments and changes in world economy and industry during years before First World War, especially fast economic growth breaking out in the USA, production techniques used being far away from science interested some scientists. With Industry Revolution happening at the end of 18th c., human abilities, skills and energy were replaced with machines, small scaled employers who couldn't adapt to these changes began to work as workers in enterprising implementing change; and production moved from small locations to big locations (factories). Thus came out with problems regarding management and organization structure (Celik and Dogan, 2011).

Organization is a relatively young science in comparison with the other scientific disciplines. An organization is a system of two or more persons, engaged in cooperative action, trying to reach some purpose. Organizations are bounded

systems of structured social interaction featuring authority relations, communication systems, and the use of incentives. Example of organizations includes businesses, hospitals, colleges, retail stores et cetera. (Ivanko, 2013) Accounts of the growth of organizational theory usually start with Taylor and Weber, but, as Scott (1987) mentions, organizations were present in the old civilizations which goes back to Sumerians (5000, BC).

Complex forms of organization were necessitated and did change as families grew into tribes and tribes evolved into nations. The earliest written record, the clay tablets of the Sumerians, recorded division of labor and supervision practices. In Sumerian society, as in various others since then, the wisest and best leaders were thought to be the priests and other religious leaders.

Likewise, the ancient Babylonian cities developed very strict codes, such as the code of Hammurabi. King Nebuchadnezzar used color codes to control production of the hanging gardens and there were weekly and annual reports, norms for productivity, and rewards for piecework. The Egyptians organized their human and their slaves to build cities and pyramids. Construction of one pyramid, around 5000 B.C., required the labor of 100,000 people working for

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approximately 20 years. Planning, organizing, and controlling were required elements.

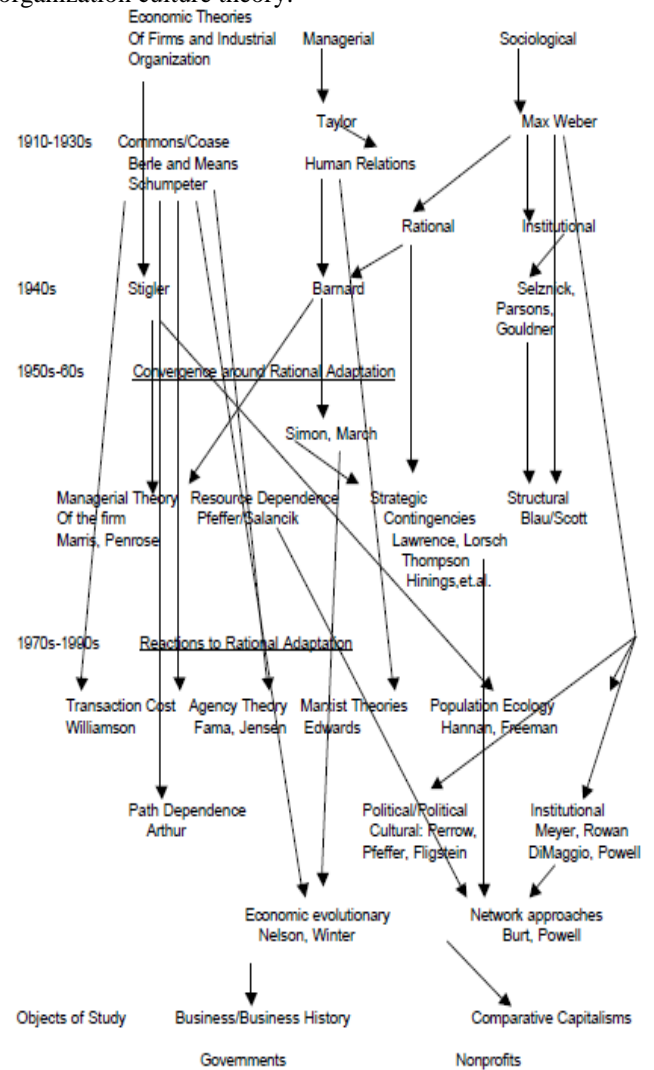
China was perfected military organization based on line-and-staff principles and utilized these same principles in the early Chinese dynasties. Confucius wrote parables that offered practical suggestions for public administration. The city-states of ancient Greece were commonwealths, with councils, courts, administrative officials, and boards of generals. Socrates talked about management as a skill different from technical knowledge and experience. Plato wrote about specialization and suggested notions of a healthy republic. Many think the Roman Empire did well also because of the Romans' great ability to organize the military and conquer new lands. Similarly, those sent to govern the far-flung parts of the empire were successful administrators and were able to maintain relationships with the other provinces and the empire as a whole. There are various other ancient examples of organization development, such as Hannibal leading a massive army across the Alps, Alexander the Great building a vast inter-connected empire, and the first emperor of China building the Great Wall. Many of the practices employed today in leading, managing, and administering modern organizations have their origins in antiquity.

	1900		1911	Taylor - Scientific Management
Weber - Bureaucracy Model	1922		1925	Fayol - Administrative Theory
Mayo - Hawthorne Studies	1933		1954	Maslow - Hierarchy of Needs
McGregor - Theory X-Theory Y	1957		1957	Tannenbaum-Schmidt - Continuum of Leader Behavior
Simon & March - Organizations	1958		1961	Burns & Stalker - Management of Innovation
Blake-Mouton - Managerial Grid	1964		1965	Woodward - Industrial organisation
McClelland - Achievement Theory	1965		1966	Herzberg - Motivation-Hygiene
Likert - Systems 1-4	1967		1967	Fiedler - Contingency Model
Olsson - Management By Objectives	1968		1969	Hersey-Blanchard - Situational Leadership
Alderfer - Existence, Relationship and Growth	1972		1974	House-Mitchell - Path-Goal
Vroom - Expectancy Theory	1976		1980	Hackman & Oldham - Jodesign
Mintzberg - Organizational Design	1981		1985	Schein - Organizational Culture
Senge - The Learning Organization	1990		1991	Toyota - Lean
Martin - Culture in Organizations	1992		1995	Weick - Sensemaking in Organizations
Whetten-Cameron - Empowerment	1995		1997	Kotter - Leading Change
Fairholm - Values-Based Leadership	1998		1998	Scott - Rational, Natural and Open Systems
Knowledge Society - Kolind	2001			

The Industrial Revolution caused occurrence a need for new thinking and the refinement of old thinking. However, modern management theory, as discussed in this paper and applied specifically to organizations, is primarily a phenomenon of the 20th century with new theoretical constructs and practices emerging now in the early 21st century. Taylor, Fayol and Weber, continuing to come up to present with modern management methods and principles. The modern organization may be the most crucial innovation of the past 100 years and it is a theory which will never complete its evolution as the human being continues to exist. Organization theory comes from practice and the evolution of it depends on

the evolution of organization practice. The development of productivity causes the development of organization theory. As environments have become more complex, organizations go to be flat-structure, class stratified, network relationship, flexible and fuzzy boundary. The paradigm of organization theory has developed to the complexity one as seen below (Chunxia et. al, 2013).

Understanding how organizations work has been the focus of scientists and scholars until the early part of the 20th century. Just as organizations have evolved, so to have the theories explaining them. These theories can be divided into 9 different "schools" of thought (Shafritz, Ott, Jang, 2005): Classical Organization Theory, Neoclassical Organization Theory, Human Resource Theory, or the Organizational Behavior Perspective, Modern Structural Organization Theory, Organizational Economics Theory, Power and Politics Organization Theory, Organizational Culture Theory, Reform Though Changes in Organizational Culture and Theories of Organizations and Environments. This paper will concentrate on organization culture theory.



II. Literature Review

The literature on organizational culture is as relevant to public science management as it is to the management of private sector business organizations. Given a rapidly changing environment and continuing insights into organizational effectiveness, science organizations, as most other organizations, are seriously rethinking what they do and how they can best define and maintain their goals and objectives. Once goals are explained, it is required to address

the type of culture that is necessary to advance these goals and objectives and to be sure that the successful implementation of the necessary changes. In addition, the organizational effectiveness literature has been tremendously underlining the significance of culture in motivating and maximizing the value of its intellectual assets, particularly its human capital. This is especially crucial in knowledge intensive organizations, such as publicly funded scientific laboratories. This review of the organizational culture literature does it seeable that (1) culture is required for both successful organizational change and maximizing the value of human capital (2) culture management should become a critical management competency, and (3) while the right culture may be a required condition for organizational success, it is by no means a sufficient condition. An important challenge for managers is to determine what the most effective culture is for their organization and, when necessary, how to change the organizational culture effectively.

Organizational culture became a business phenomenon in the early 1980s, triggered by four seminal books:

- Ouchi's (1981) *Theory Z: How American Business Can Meet the Japanese Challenge*
- Pascale and Athos's (1982) *The Art of Japanese Management: Applications for American Executives*
- Deal and Kennedy's (1982) *Corporate Cultures: The Rites and Rituals of Corporate Life*
- Peters and Waterman's (1982) *In Search of Excellence: Lessons from America's Best Run Companies*.

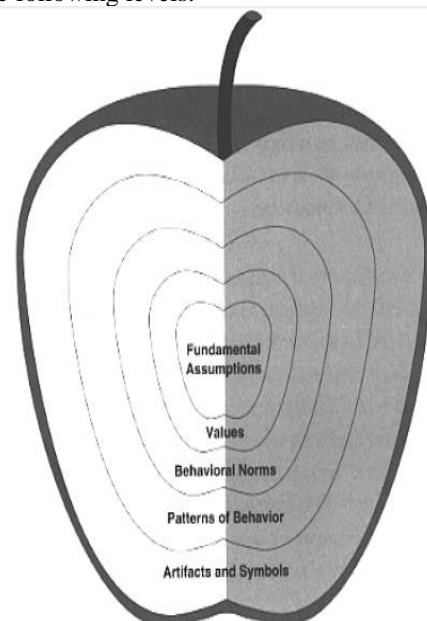
The concept of organizational culture also appealed to organizational scientists and practitioners who had grown disillusioned with the prevailing formalistic, quantitative organizational research. The concentration on organizational culture changed attention away from the functional and technical aspects (the so-called *hard side*) of management that could be more readily quantified and empirically analyzed to the interpersonal and symbolic aspects (the *soft side*) of management that required in-depth, qualitative studies of organizational life. This concentration on the qualitative, symbolic aspects of organizations and management stimulated a large literature on *leadership*. In addition, specialized literatures occurred around particular variants of organizational culture considered increasingly important for success in the modern business world, such as change oriented culture, learning culture, innovating culture, team- and project-oriented cultures. More recently, attention has shifted to identifying and creating an organizational culture that facilitates agility; promotes alliances, partnerships and networks; encourages knowledge management; fosters corporate responsibility and/or moral integrity; and embraces diversity. The concept of organizational culture has created a massive literature with enormous popularity. By the 1990s, a literature search would generate over 2500 hits (Alvesson and Berg 1992). It is an extremely significant literature because the concept of organizational culture has been central to much of the subsequent work on organizational effectiveness.

Although the concept of organizational culture was came in front in the early 1980s, its roots can be gone back to the early human relations view of organizations that originated in the 1940s. Human relations theorists viewed the informal, nonmaterial, interpersonal, and moral bases of cooperation and commitment as perhaps more important than the formal, material, and instrumental controls stressed by the rational system theorists. The human relations perspective drew its inspiration from even earlier anthropological and sociological

work on culture related with groups and societies (see Geertz 1973; Mead 1934; Durkheim 1964; Weber 1947, 1958).

Attention to organizational culture lost ground as organizational science, and social science on general, became increasingly quantitative. To the extent that research on organizational culture survived, its focus changed to its more measurable aspects, particularly employee attitudes and perceptions and/or observable organizational conditions thought to correspond to employee perceptions (i.e., the level of individual involvement, the degree of delegation, the extent of social distance as implied by status differences, and the amount of coordination across units). This research, known to as *organizational climate* studies, was prominent during the 1960s and 1970s (Denison 1990). The renewed interest in organizational culture that emerged in the late 1970s and concluded in the four books mentioned above suggested that a deeper, more complex anthropological approach was necessary to understand crucial but largely invisible aspects of organizational life. This renewed interest in organizational culture represented a return to the early organizational literature but it went far beyond this literature in contributing important new insights and ways of thinking about the role, significance, and characteristics of organizational culture. Also, research on the effect of culture on organizational performance and investigations into how organizational cultures are created, maintained, and changed received greater attention. The main difference was that organizational culture was now seen less as a natural, organically emergent phenomenon and more as a *manipulable and manageable* competitive asset.

Definitions of organizational culture initially focused on distinguishing levels of organizational culture and strong versus weak cultures. Many definitions of culture give primacy to the cognitive components, such as assumptions, beliefs, and values. Others tried to expand the concept to touch behaviors and artifacts, leading to a common distinction between the visible and the hidden levels of organizational culture – a distinction basically corresponding to the *climate/culture* distinction noted above (Kotter and Heskett 1992). In contrast to the distinction between the visible and hidden levels, some theorists distinguished multiple levels. Schein (1985), one of the foremost experts in the area, explains the following levels.



In Schein's understanding, fundamental assumptions constitute the core and most crucial aspect of organizational culture. In an order, he points out the following formal definition of organizational 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 true way to perceive, think, and feel within relation to those problems (Schein 1992:12). While the deeper levels may have been somewhat invisible in the past, this may no longer be the case. As a result of greater attention being directed at managing culture, organizations are recognizing the importance of articulating and stressing their fundamental assumptions. This is somehow similar to what later exists with knowledge management – greater attention becomes directed at making the tacit knowledge within an organization more explicit and accessible “Knowledge Management”). This suggests a general trend toward more explicitly managing what previously was thought largely unmanageable.

Although all organizations have cultures, some seem to be having stronger, more deeply rooted cultures than others. Firstly, a strong culture was conceptualized as a coherent set of beliefs, values, assumptions, and practices embraced by most members of the organization. The emphasis was on (1) the degree of consistency of beliefs, values, assumptions, and practice across organizational members; and (2) the pervasiveness (number) of consistent beliefs, values, assumptions, and practices. Any other early proponents of organizational culture tended to assume that a strong, pervasive culture was beneficial to all organizations because it fostered motivation, commitment, identity, solidarity, and sameness, which, in turn, facilitated internal integration and coordination. Some, however, underlined that a strong culture might be more crucial for some types of organizations than others. For instance, volunteer organizations may need to stress culture more than business organizations. Still others say that potential dysfunctions of a strong culture, to the point of suggesting that a strong culture may not always be wanted. For example, a strong culture and the internalized controls associated with it could result in individuals placing unconstrained demands on themselves, as well as acting as a barrier to adaptation and change. A strong culture could also be a means of manipulation and co-optation (Perrow 1979). It could also contribute to a displacement of goals or sub-goal formation, meaning that behavioral norms and ways of doing things become so significant that they begin to overshadow the original aim of the organization (Merton 1957; March and Simon 1958).

Culture was firstly seen as a means of enhancing internal integration and coordination, but the open system view of organizations recognized that culture is also important in mediating adaptation to the environment. The traditional view of a strong culture could be oppositely to the ability of organizations to adapt and shift. Seeing culture as crucial for reasoning organizational innovation, the acceptance of new ideas and perspectives, and needed organizational change may require a different, or more nuanced, view of organizational culture. Schein (1992) notes that, indeed, a strong organizational culture has generally been viewed as a conservative power. However, in contrast to the view that a strong organizational culture may be dysfunctional for contemporary business organizations that need to be change-oriented, he argues that just because a strong organizational

culture is fairly stable does not mean that the organization will be resistant to change. It is possible for the content of a strong culture to be change-oriented, even if strong organizational cultures in the past typically were not. He offers that the culture of modern organizations should be *strong* but *limited*, differentiating main assumptions that are *pivotal* (vital to organizational survival and success) from everything else that is merely *relevant* (desirable but not mandatory). Today's organizations, characterized by rapidly changing environments and internal workforce diversity, need a strong organizational culture but one that is less pervasive in terms of prescribing particular norms and behavioral patterns than may have existed in the past. This view was supported by Collins and Porras (1994) in their famous study (*Built to Last*) of companies that had strong and lasting performance.

Schein (1992) suggests that organizational culture is even more important today than it was in the past. Increased competition, globalization, mergers, acquisitions, alliances, and various workforce developments have created a greater need for: Coordination and integration across organizational units in order to improve efficiency, quality, and speed of designing, manufacturing, and delivering products and services product innovation. Moreover, a greater need to adapt to these external and internal changes, organizational culture has become more crucial because, for an increasing number of corporations, intellectual as opposed to material assets now create the fundamental source of value. Maximizing the value of employees as intellectual assets requires a culture that promotes their intellectual participation and reasoning both individual and organizational learning, new knowledge creation and application, and the willingness to share knowledge with others. Culture today should play a key role in facilitating:

- Knowledge management
- Creativity
- Participative management
- Leadership.

III. Major Theorists and Contributions

Edgar H. Schein – *The Concept of Organizational Culture: Why Bother*

Organizational culture is an crucial concept. It is a perspective from which to get into knowledge the behavior of individuals and groups within organizations. Like so various other concepts, organizational culture is not defined the same way by any two popular theorists or researchers. Some of the definitions of culture explain it as:

- Symbols, language, ideologies, rituals and myths.
- Organizational scripts derived from the personal scripts of the organization's founder(s) or dominant leader(s).
- A product; historical; based on symbols; and an abstraction from behavior and the products of behavior.

Why do we require the concept of culture anyway? What does it add that concepts like norms, behavior patterns and climate do not necessarily convey? Why not just settle for the study of symbols and observed behavior patterns in their own right? Why do we need a conceptually “deeper” level? To answer these questions we must stop and ask ourselves about the origin of the culture concept. Why was it taken out of the context of representing some of the more refined aspects of social phenomena into anthropology as a core concept for having time on societies?

According to Schein's theory

Culture implies stability

Without doing the necessary historical analysis, Schein

Would speculate that the concept was required initial of all to describe the fact that, in most societies, strong phenomena persisted over time and displayed remarkable stability, even in the face of pressures toward change. This stability would be especially noticeable in some of the preliterate societies that had survived in a basically unchanged way for centuries. Culture, then, has something to do with long-range stability.

Culture emphasizes conceptual sharing

Secondly, he would speculate that what struck early ethnographers was the remarkable degree of similarity not only of manifest behavior but also the perceptions, cognitions, and feelings of the members of a given society, offering that there was something under the surface that new members learned, which led to a high degree of similarity of outlook. Culture, then, has something to do with sharing or consensus via the members of a group. The most obvious aspect of such sharing is the common language and conceptual categories that are discovered whenever one studies a social group that has had any kind of history and shared experience; the study of socialization processes, especially their content, then became one of the primary ways of deciphering what the common underlying shared things were.

Culture implies patterning

Thirdly, he would speculate that what struck at least some anthropologists was the degree to which patterns were evident in societies. The observed regularities reflected higher order phenomena that caused patterns and paradigms, sometimes leading to premature formulations of cultural types. The fact that early typologies proved to be more stereotypic and ignored significant variations among and within societies only reinforced the idea that patterns had to be studied carefully and were somehow at the crux of deciphering cultural phenomena.

Culture implies dynamics

How is one to describe the perpetuation of observed regularities and the ability of a group to perpetuate patterns over long periods of time and across many generations of membership? The analysis of culture forces us to the analysis of how culture is created and perpetuated, thus leading to studies of the socialization process and a renewed emphasis on origins. Anthropologists had difficulty with cultural origins because one could not obtain historical data on the kinds of societies that were studied. Current attempts to apply culture to organizations do not suffer from this limitation because one can reconstruct historically the origin of organizations. In fact, historians have designed some of the best cultural analyses in organization studies, because they have been able to capture the dynamic, holistic patterning that is characteristic of cultures

Culture implies all aspects of group life

If one looks at early ethnographies, one is struck by the fact that cultural phenomena penetrate all of the aspects of daily life. There is virtually nothing that we do that is not colored by our shared ways of looking at things. In analyzing culture, then, it gets crucial not to develop simplistic models that rely only on a few key dimensions, but to find models that reflect the vastness that culture represents.

Schein offers that what we need is a model of culture that does justice to (a) what the concept connotes and (b) what has been its source of utility in other fields. Such a model comes out of an eclectic approach that draws on anthropology, sociology, and social psychology, and that reflects research methods broader than the traditional ones. Specifically, we need to add to other methods what he has named the

“cultural perspective”, by which he means what one learns when one is in a helper/consultant role (as contrasted with a researcher role). Sometimes one learns most about what culture is, how it operates, and what its implications are when one is helping an organization to solve real problems. At such times the insiders are more open, more willing to reveal what they really think and feel, and, thereby, make it more obvious what things are shared and how things are patterned. At such times, one also starts to understand what it means to go to “deeper” levels.

Joanne Martin – Organizational Culture: Pieces of the Puzzle (Shafritz, Ott, Jang, 2005).

- “Attempts to answer the questions ‘what is culture’ and ‘what is not culture?’ using the intellectual traditions of functionalism, critical theory, and postmodernism” (p. 344).
- “What distinguishes a cultural study from an inventory is a willingness to look beneath the surface, to gain an in-depth understanding of how people interpret the meanings of manifestations and how interpretations form patterns of clarity, inconsistency, and ambiguity that can be used to characterize understandings of working lives” (p. 344).’
- “She concludes ‘Because cultural researchers do not agree what we should study when we claim to be studying culture, and because our definitions of culture do not always agree with how we operationalize the concept, it is no wonder that we also disagree about what we have learned, so far, about culture’” (p. 344).
- “Common types of rituals” (p. 370).
- “Cultural manifestations are consistent or not, cultural members appear to agree or not, and interpretations are singular and clear or multiple and ambiguous” (p. 380).

William G. Ouchi – The Z Organization (Shafritz, Ott, Jang, 2005).

The origin of the William Ouchi was Japan and affected by American management system. That's, why The Organization is an amalgam of Japan and American management system.

13 step must be implemented for successful Z Organization

Step 1: To understand Z organization structure

Step 2: To determine organization philosophy

Step 3: To determine adopted and expected management philosophy

Step 4: To set organization to new management idea occur

Step 5 : To improve employees skills and abilities

Step 6: To control implemented management philosophy and management

Step 7: To develop cooperation with trade unions

13 step must be implemented for successful Z Organization (cont'd)

Step 8: To set and apply stable decisions for employment structure

Step 9: To think going concern and to provide development and progress of the organization

Step 10: To provide employees career opportunities

Step 11: To change in organization must be started the top. (Top – down)

Step 12: To participate employees comments and suggestions for decision making process

Step 13: To integrate all level of employees.

The Fifth Discipline: A shift of Mind

The Fifth Discipline is an essential structure of Learning Organization. These discipline are:

- Systems Thinking

- Personal Mastery
- Mental Models
- Building Shared Vision
- Team Learning

System Thinking

Due to the organizational environment is to complex, decisions for entity's system should be taken wholly. Decisions which are taken in accordance to part of the organization cannot be added benefit.

Personnel Mastery

People have personnel mastery, to show all attention and care on their job.

The learning desire of an organization cannot be more than a profession.

Building Shared Vision

The organization objective should be accepted by all of the employees. This means, everyone wants to reach common target provides with belief.

Team Learning

Team oriented working results pass the individual outcomes mostly. The democratic and fair environment is the way of team successful.

David L. Cooperrider and Diana Whitney – *Appreciative Inquiry* (Shafritz, Ott, Jang, 2005)

- Appreciative Inquiry (AI) “proposes, quite bluntly, that organizations are not, at their core, problems to be solved. Organizations are centers of vital connections and life-giving potentials: relationships, partnerships, alliances, and ever-expanding webs of knowledge and action that are capable of harnessing the power of combinations of strengths” (p. 345).
- Based on a “socio-rationalist” view “that engages organizational embers in a process for appreciating and valuing what might be rather than analyzing existing problems or their causes” (p. 345).
- “The principles of Appreciative Inquiry suggest the idea that collective strengths do more than perform – they transform (p. 395).
- The Positive Core of Organizational Life – p. 398.

IV. Strengths and Weaknesses (Shafritz, Ott, Jang, 2005)

Strengths

It is an open system that seeks to better understand external environments.

- Offers many tools to understand organizational culture.
- Diverse collection of subjects.
- Helped address the U.S. economic slowdown from the 1970s-1990s. Explains symbolism within organizations.
- Offers viewpoints of “how” to initiate changes in organizational culture.
- Blends human relations aspects with other schools of thought.
- Incorporated, and resulted in, a huge body of organizational change tools (TQM, REGO, etc.).

Weaknesses

- Focuses mainly on external environments.
- Explains organizational culture is difficult to identify and measure (such as the
- predetermined patterns).
- Less rational.
- Since culture and symbolism are hard to identify, changes based on such need rational approaches.

V. DISCUSSION AND CONCLUSION

In understanding the role of organizational culture in achieving the desired changes in public science management, the various public science organizations will need to

understand not only their internal culture but the cultural attributes best suited to promoting desired behaviors on the part of the science system as a whole. A crucial role for science management is to help define and bring about the cultural orientations that will provide the context and promote the behaviors, values, and relationships that cause effective science, including scientific collaborations. This literature suggests it would be worthwhile to (1) identify how science funding and directing organizations could promote appropriate cultural orientations and a favorable cultural environment for funded science organizations (laboratories, universities, and private R&D centers) and (2) determine the cultural orientations and cultural environment needed within the funding and directing organizations to make this exist.

Relevant questions for managers and science include:

1. Have the goals and strategies for effecting effective and efficient scientific development shifted over time?
2. What culture attributes are required to ease achieve the goals and strategies on the part of publicly funded science organizations (public and private laboratories, universities, R&D centers, etc.) as well as the goals and strategies required to achieve effective and efficient scientific development for the system as a whole? Is there potential conflict among these two sets of goals and strategies? How could this conflict be addressed?
3. How can public science funding and directing organizations contribute to bringing about desired cultural attributes in these publicly funded science organizations? What are the obstacles to doing this?
4. Will the culture (and perhaps goals, strategies, structures, and practices) of public science funding and directing organizations need to change with the aim of for them to be successful in effecting desired change within the publicly funded science organizations? If so, what changes may be required?
5. How can desired cultural (as well as strategy, structure, and practice) changes be identified by and promoted within the many science funding and directing organizations? Will this require a collaborative effort among these organizations? If so, how can this collaboration be encouraged? What are the obstacles to successful cultural shift?

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