Team Classification in Upstream Petroleum Industry

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Abstract: *This paper deals with the classification of teams in Upstream Petroleum Industry, whose business is to Explore and Produce (E&P) crude oil and natural gas. This E&P industry has its distinctive pattern of cross-disciplinary teams for its unique operational dynamics defined by an uncertainty in its exploratory efforts. The industry is input deterministic and output probabilistic. The output cannot be guaranteed for each unit of input; output can only be averaged over a number of inputs over a period of time. For example, oil cannot be guaranteed for each well drilled, but after, say, a hundred wells are drilled, around one-third of the wells will bear oil, depending on the local geology. Based on exploratory study of teams in the Indian public sector enterprise Oil and Natural Gas Corporation Limited (ONGC), this paper considers two important constructs to classify teams in this unique industry: (i) Degree of Interdependence and (ii) Information Diversity. Based on these two constructs, four types of cross-disciplinary teams in upstream petroleum industry have been conceptualized. The purpose of classifying teams is to analyzethe impact of team class on team performance, which is the subject of another Research Paper. This classification is expected to help researchers develop a conceptual framework to analyzeteam performance in upstream petroleum industry.*

Keywords*: Degree of Interdependence, Information Diversity, Cross-disciplinary work-load, Information Trading.*

I. INTRODUCTION

Drivers of team success have been an area of scholarly focus. A number of theories have been used to analyze the variation in team performance. Such theories can be divided into two categories: (i) Compositional theories which draw from the individual characteristics of the team members and (ii) Structural theories which focus on the interaction chemistry among those members. It has been seen (Katz & Kahn, 1978) that interaction (structure-related) chemistry can improve performance of the same team composition significantly. One of the main determinants of team structure has been team class. In the Upstream Petroleum Industry (exploration and production of crude oil and natural gas), team classification is yet to be receive significant scholarly attention. This paper uses two constructs as determinants of team class in the upstream petroleum industry.

II. LITERATURE REVIEW

The Literature Review concerning the two constructs and the concept of a Work Team is discussed below.

A Work Team is a temporary social system in an organization, networking for a pre-defined purpose as per a fixed relational structure [Kozlowski & Bell, 2003]. According to team theorists, organizations need to divide tasks and allocate them among subunits (divisions) of agents for three reasons: limited cognitive capacity of individual agents (March & Simon, 1958), the pressure to adapt to heterogeneous external environments (Lawrence &Lorsch, 1967), and the technological requirements of their tasks (Thompson, 1967).

Information Diversity

This construct 'Information Diversity' (*Stahl et al, 2012*) refers to the distribution (range/standard deviation) of information (including ideas) that each member of the team possesses. Theoretically, the larger the diversity in a team, richer information is available to the team. However, larger diversity also makes it managerially challenging for the team to tap into all the pockets of information residing at each node (member). Information Diversity is said to be more in Teams with greater information variety which need to be pooled from various individuals. It may be noted that the focus in this construct is on information residences and not the level of interaction (information trading). Information can be accessed by an individual team member from another just be asking another, without any significant interaction between the two. Interaction (information trading) among team members with current information (or ideas) and consequent brainstorming will result in creation (development) of new information (ideas) which adds to the information diversity.

As an operationalized measure, the number of individual team members who has information (and ideas) significant to the team assignment can act as a measure of the Information Diversity of the team. To normalize this measure with the team size, the number of individuals can be expressed as a percentage of the team Size. For illustration, if 5 individuals have information significant for team assignment, in a team of 8 members, the Information Diversity is (5/8) x100=62 per cent

Degree of Interdependence

Interdependence has been discussed by various authors since long. The first of them was Karl Marx in Communist Manifesto (Marx, 1848), contrasting the concept with self-sufficiency in economics. Contemporary authors (Natividad & Rawley, 2015) view interdependence to exist when actions in one sub-unit (member of a team) of the organization affect important outcomes in another sub-unit (another member of the same team). The greater the interdependence between units, the greater is the need for communication and cooperation. Management's job is to optimize the whole system and not the sub-units.A high Degree of Interdependence increases complexity as many cross-unit interdependencies require frequent coordination and information exchange. Teams which need more interaction are said to have more Degree of Interdependence.

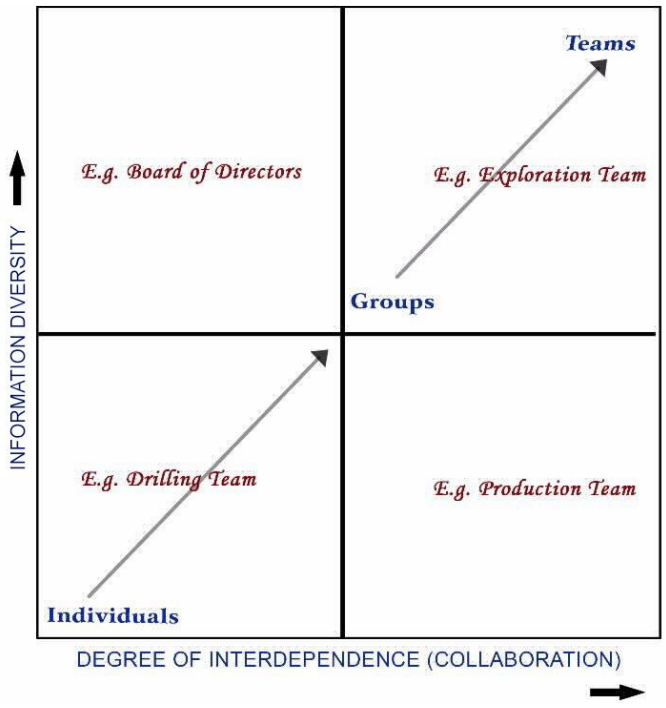
As an operationalized measure, the minimum number of interactions needed among the individual team members of a team during a particular time period, is the Degree of Interdependence of that team. In the same numerical example of the team discussed above in Information Diversity, if the minimum number of interactions required in the 8-member team is 6in a day, the Degree of Interdependence is 6/8x100 per cent = 75 per cent.

III. THEORY AND HYPOTHESES

Based on our exploratory study of a judgmental sample of various teams in the Upstream Petroleum company Oil and Natural Gas Corporation Limited (ONGC, www.ongcindia.com), we propose the following theoretical (conceptual) framework for analyzing the various types of teams in such an organization.

In the context of this Team classification model in corporations with the two constructs viz. Degree of Interdependence (x) and Information Diversity (y), we can identify four (4) broad types of Team class coordinates (x,y) in upstream petroleum industry [shown in the following two way table Figure 1]: (i) High High; e.g. Exploration Team of geo-scientists, (ii) Low Low; e.g. Drilling Team of engineers, (iii) High Low; e.g. Production Team of engineers and (iv) Low High; e.g. The top management Team of Board of Directors. These four types of teams cover the entire Exploration & Production (Upstream) value chain of the petroleum industry. The Figure 1 also shows the continuum Individuals – Groups – Teams, as the constructs Degree of Interdependence and Information Diversity increases from Individuals to Teams, showing the four quadrants.

Table1: Team Classification Across Two Dimensions



Now, let us analyze these four types of teams in Upstream Petroleum Industry (in the four quadrants of Figure 1) vis-à-vis these two constructs and see how these affect their team performance.

Low Low Teams like Drilling Teams

Drilling teams are assigned to drill (bore) wells into underground oil and gas reservoirs. The teams comprise Mechanical Engineers and some Chemists. Wells are drilled with drilling rigs (powered mechanical devices) both for exploring (searching) oil and gas or producing them from proven reservoirs.

Degree of Interdependence is also **Low** in **Drilling Teams** as mechanical engineers do their job reasonably independent of the chemists' jobs.

In **Drilling Teams**, **Information Diversity** is **Low** as only two types of skills are involved: Mechanical Engineering and Chemistry. Information (including ideas) arrive only from these two types of constituencies. The typical range of Information Diversity values in Drilling Teams are less than 30 per cent.

High Low Teams like Production Teams

Production of Oil and Gas is the process of extracting the Oil and Gas, separating the mixture of liquid hydrocarbons, gas, water, and solids, removing the constituents that are non-saleable, and transporting the liquid hydrocarbons to the oil refineries. Production teams comprise of chemical engineers, mechanical engineers, pipeline engineers and chemists.

The **Degree of Interdependence** in **Production Teams** is **High** as the different elements of the team like Pipeline Engineers, Mechanical Engineers, Chemists and Chemical Engineers need to depend on each other. The **Information Diversity** in case of **Production Teams** is **Low**, as not much information is distributed among the members of the production team, it is centrally available which anybody can access.

High HighTeams like Exploration Teams

Exploration of Oil and Gas is the search for hydrocarbon deposits beneath the Earth's surface, by petroleum geologists and geophysicists. The team members' domains of expertise are diverse, ranging from geology, geophysics, geochemistry, petroleum physics, computer science, programming and data science.

The **Degree of Interdependence** in **Exploration Teams** is **High** as the different elements of the team like geologists, geophysicists, geochemists, petroleum physicists, computer scientists, programmers and data scientists need to depend on each other.

The **Information Diversity** in case of **Exploration Teams** is also **High**, as the distribution of information among the members of the exploration team is quite wide, it is not centrally available which anybody can access.

Low High Teams like the Board of Directors

Top Management Teams like the Board of Directors or Executive Committee are tasked with attainment of organizational missions; in listed companies, these top management teams have to ensure Corporate Governance. These teams comprise Directors, one each from Exploration, Drilling Production, Finance, Human Resource headed by a Managing Director.

Degree of Interdependencein Top Management Teams like the Board of Directors is **Low** as each Director is quite independent in his or her domain.

The **Information Diversity** in **Top Management Teams** is **High** as each Director is a specialist in his own field and the fields are disparate in the information demand.

In the above-referred way, any team in the Upstream Petroleum Industry can be classified in this conceptual grid by analyzing the team's two constructs. To find out the grid position (coordinates) of any specific team, we need to find out the composition of the team members which drive their information residency pattern. The grid position of any team has important clues to its performance measures, as we will see in a different paper.

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