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## A STUDY OF ANTS TEAMBUILDING TECHNIQUES AND ITS APPLICATION IN ORGANIZATIONAL WORK TEAMS

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### ABSTRACT

*Ants represent one of evolution's most successful and instructive developments. They are one of the nature's most effective biological team. The most inspiring aspect of ants is their cooperative and collective behavior and their ability to work together with amazing efficiency. Ants based team is looked at because today's modern organizational teams are sometimes successful and sometimes unsuccessful in their performance. Teams are not consistent and effective for several reasons. The reasons for the failure of teams, among others, are inappropriate models used to build teams. The study of ants social organization and key characteristics reveal a useful set of principles and can act like guidelines on how teams need to operate to be truly successful, consistent and adaptable to changing environment. Based on the insights from ants behavior and its social organization, selective ants teamwork techniques have been applied in teams and its impact on the team performance as reflected in team synergy and effectiveness is evaluated. The devolved but integrated strengths of the nature's team with the directive and strategic abilities of human can enable organizational team to transform itself into high performing and responsive team, meet the organizational goals effectively and serve the society efficiently at large.*

### KEYWORDS

Ants, Colony, Team, Team Building, Self-organization, Swarm Intelligence, Synergy, Effectiveness, Altruism.

### INTRODUCTION

Man from time immemorial is learning many things from nature. To quote a few examples what man has learnt from nature are: how to fly like birds; camouflage technique from Chameleon; Climbing walls like Geckos using most advanced dry-adhesive technology found in nature; routing calls efficiently in communication network using Ant-based foraging technique and emulation of engineering marvels of termite mounds (Eric Bonabeau and Meyer, 2001); from robot design to material science and as well as in the areas of nanotechnology engineers and scientists are borrowing mechanism from nature (Ken Thompson, 2008); in the field of medicine pioneers have searched through the rich diversity of plants in jungles to discover the special properties that, once discovered, can be synthesized (Meredith Belbin, 1998); and such other insights have come from observing the natural world around us. Nature offers us an invaluable wisdom learned and tested over the course of millions of years. One such area for learning from nature is to look at nature's most successful living biological teams like ants organization which can provide useful guidelines on how teams need to operate to be truly successful. Ants based biological team is looked at because today's organizational teams don't work consistently and effectively for several reasons.

### REVIEW OF LITERATURE

**Eric Bonabeau and Christopher Meyer (2001)** illustrates an application of Ants foraging technique to find efficient routes to food source using pheromones. This technique has been successfully used in some organizations like Southwest Airlines (improved freight transfer rates); Unilever (to efficiently schedule factory equipments in one of its production facilities); Hewlett-Packard laboratories (developed a computer program based on ant-foraging principles that routes telecom calls effectively); France Telecom, British Telecom, and MCI World Com have taken an early lead in designing such ant-based telecom routing methods; Institute Dalle Molle di Studi sull'Intelligenza Artificiale –IDSIA (has developed an ant-based program that Pina Petroli organization uses to direct its fleet of vehicles in distribution) University of Chicago (has applied the ants "bucket-brigade" technique to order pickers in a large distribution center of a major retail chain).

**Meredith Belbin (1998)** states the behavior of the eusocial insects like ants has been explained by postulating a 'selfish gene'. It is shorthand for saying that the whole genetic complex of an individual creates a body and drives its behavior with the ultimate purpose of protecting and propagating its own genetic complex. The theory holds that the life of an individual is devoted to the perpetuation of his/her genes if necessary at the expense of his/her life.

**Harvey Robbins and Michael Finley (2000)** mainly discuss about team intelligence, team benefits and causes for team failures. Team intelligence is defined as the intelligence about working together. The author explains how to maintain the highest level of team intelligence with required skills, attitudes and emotional flexibility needed to overcome team's inherent differences.

**Jon R. Katzenbach and Douglas K. Smith (2003)** the author discusses eight best practices approach in team-building. These are: to establish urgency and direction, selecting members based on skills (technical and functional, problem-solving and interpersonal); Paying particular attention to first meetings and actions; Setting some clear rules of behavior; set and seize upon a few immediate performance-oriented tasks and goals; challenge the group regularly with fresh facts and information; spending lots of time together; exploiting the power of positive feedback, recognition, and reward which helps to shape behaviors critical to team performance and gives positive reinforcement that encourages continued contributions and commitment.

**Patrick Lencioni (2006)** states the true measure of a team is that it accomplishes the results that it sets out to achieve. To do that on a consistent, ongoing basis, a team must overcome the five dysfunctions – absence of trust, fear of conflict, lack of commitment, avoidance of accountability and inattention to results. The author also provides a framework for building the team using the tools and exercises to overcome dysfunctions.

**Barrie G Dale et al (2009)** points out that teamwork is a key element in getting people involved in improving organizational performance. There are different teams like Quality Circle, Project team, Yield improvement teams and others. Each type of team has its advantages and differ with characteristics in terms of membership, autonomy, scope of activity, problem selection and others.

**Roger Thorson (2005)** provides insights into the realm of effective team building. If an individual is unconscious of their own actions and typical responses to different facets of their life, they are not being as effective in a team setting as they could be; and if individuals are unaware, do not appreciate, or do not understand where the diverse strengths are within the working group, personnel simply do not work optimally as a group. The author explores the connection between individual and group awareness of how an individual deals with situations and how this will connect to improve team building within an organization using MBTI tool. The MBTI has been used to assess an individual and team functioning. a) how an individual prefer to respond to circumstances of gathering information (b) one's attitude towards the outer world (c) personal values, subjectivity, logic and objectivity and (d) whether an individual is predisposed to pay more attention to the outer world of people and activities or inner world of ideas and feelings.

**Steven L McShane (2011)** illustrates the model of team effectiveness. A team is said to be effective when it benefits the organization, its members, and its own survival. Team exists to serve some organizational purpose hence effectiveness is partly measured by the achievement of those objectives. Also, team effectiveness relies on the satisfaction and well-being of the members, and its ability to maintain the commitment to the organizational objectives. The model integrates the main components of team effectiveness – Organizational and Team Environment (rewards, communication, structure, leadership, spatial), Team Design (task characteristics, size, composition), Team Processes (team development, team norms, cohesion, trust) and Team Effectiveness (task accomplishment, satisfy member needs, maintain team survival).

**Ramesh Budani (2011)** state that teams are used for high performance results. All teams must function effectively to contribute positively. Teambuilding consists of two tasks – to create a team carefully, and to make team operate effectively. Enhancing team effectiveness involves four approaches: Teambuilding, Collaboration, Team leadership and Understanding cultural values. Teambuilding demands right members and right type of efforts and establishes a sense of partnership and emotionally intelligent.

**Charles Larry Garner (1998)** the literature contains many views about how teams develop. An early stage, the linear model is the Schultz group development model – this model described the three stages where the interpersonal needs of inclusion, control, and affection area addressed within the group context, by the process of receiving from and giving these three needs areas. Charrier described a five step process or ladder group development. These rungs were politeness, goal setting, bid for power, cooperation, and esprit de corps. The classic stage of group model is Tuckman's four stages of small group development – forming, storming, norming, and performing. Gibson model depicts the following stages in the group development process – mutual acceptance, communication & decision making, motivation & productivity, and control & recognition. Mink's model of group development is patterned on the lines of linear process – First is the development of trust. This enables the development of norm of acceptance of individual differences, giving feedback and problem solving.

**Sigmund A. Lavine (1960)** states the reason for the great for number of ants are their abilities to adjust themselves to almost any environmental conditions like temperature and nesting materials and to eat a wide variety of food. The ants live in communities where each individual does a definite task, working for the common goal. Ants find their way handily by means of their sense of touch and smell which are located in their antennae. When they tap food with their antennae, they actually taste it, for ants not only recognize air-borne smells, but also sense of chemicals, by touch just as human taste buds. Ants recognize both nest mates and intruders. Each species has its own odor.

**Oster and Wilson (1978)** highlights the important distinction of ants is its capacity to conduct all of its operations concurrently instead of sequentially. The system is efficient and reliable as the specialized caste status of each colony member tends to match the contingency to which it responds.

**John H. Sudd and Nigel R. Franks (1987)** discusses about the eusociality or truly social nature of ants society, where individuals of the same colony cooperate in caring for the brood, more or less non-reproductive individuals work for the colony and also exists overlapping of adult generations. The trait of sterility in the case of nonreproductive workers in the ant colonies has been reasoned through the propositions of kin selection and parental manipulation. Kin selection hypothesis states that, by reducing personal survival and reproduction workers nevertheless increases the survival and reproduction of genes they share with other members of the colony by common descent. Individuals suffer but the colony flourishes. The theory of Parental manipulation explains that in ants, the queen is able to neuter (sterilize) and control some of their offspring so as to produce a larger total number of offspring. The parents' personal fitness is raised even though that of some of the offspring is lowered.

**Stephen Olariu and Albert Y. Zomaya (2006)** provides an insight on Swarm Intelligence principles and its applications like ant colony optimization to control of large group of cooperating autonomous agents. Ant colony optimization algorithm based on foraging behavior of real ants has been applied successfully to large number of optimization problems like travelling salesman, scheduling, vehicle routing, networks and others. An Ant algorithm is a multi-agent system, where agents solve required tasks through local interaction, cooperation and combined efforts of agents using emergent property of the ants.

## RELEVANCE OF THE STUDY

The effectiveness and efficiency of the team depends on the synergy. If the coordination and cooperation is high, the synergy level is high, if it is less the synergy is less. The level of synergy affects the productivity and effectiveness of the team. Today, the organizational teams are sometimes successful and sometimes not successful. There is no consistency in their performance due to various dynamic factors like organizational, social, technological, and others on the functioning of the team. The organizational teams are confronted with several problems like lack of cohesiveness, co-ordination, information, communication, cooperative learning, rewards and recognition, motivational and leadership issues leading to conflicts, turnover, inefficiencies and productivity. Also, it is becoming difficult for a team to adapt itself to the changing external environment. These issues have an impact on the overall performance and effectiveness of the team and the organization as well. In order to address the team issues and to build more cohesive, mutually supportive committed team with high standards of performance this study focuses on nature's most successful and efficient ants teams, as their organization represents the pinnacle of social evolution with their colony resembling similar to human organizations. It is the nature that has made them successful and efficient through millions of years of evolutionary process. By studying the ant colonies cooperative, cohesive and collective behavior and their organization structure we are actually learning the wisdom of the nature and applying it in the team building activities in human based organization. This statement has been crystallized into the following objectives.

## OBJECTIVES OF THE STUDY

- To study the Ants team building behavior and its application in building organizational teams.
- To give suggestions to implement the findings in the organizations and improve the effectiveness of teambuilding activities.

## ORGANIZATIONAL TEAMS AND TEAM BUILDING

Organizations throughout the world have increasingly adopted team based work structures. Teams are used for multiple organizational functions to address small and specific organizational task to complex and self-managed work Teams. There are many benefits to using teams in workplace. The Key benefits of work teams include shared goal and responsibilities, innovative and effective problem solving, better decision making, improved communication, better social relations and use of resources, higher productivity and better quality goods and services. Studies reveal that while teams achieve good outcomes, they often fail for one reason or another. Some of the reasons of team failures are misplaced goals, leadership failure, lack of empowerment, trust, communication, rewards and recognition, people problem, wrong policies, unresolved roles, conflicts and others (Harvey A. Robbins and Michael Finley, 2000; Katzenbach and Smith, 2003; Patrick Lencioni, 2006; Barrie G Dale et al, 2009). As a result teams are sometimes successful and sometimes unsuccessful. Hence the performance is not consistent and not effective. The failure rate for work teams is high. The studies indicate that 80 percent of Fortune 500 Companies have half their employees on teams. Many of these teams are of the self-directed nature with estimates of the failure rate at around 50 percent (Keith Denton, 2007). Only a third of change initiatives achieve their objectives and 74% of projects are unsuccessful observes (Ken Thompson, 2008). Academics and management consultants quote team failure rate of 50 percent, and in that half of work teams fail to achieve their goals (Todd Harris, 2008). Roger Thorson (2005) observes that the failure rate of team change efforts is 55 percent. One of the key factors that improve the team performance is by using effective teambuilding methods. Teambuilding is defined as any formal activity intended to improve the development and functioning of a work team (Steven L McShane et al, 2011). Teambuilding is the process



of planning, molding, and guiding a group of individuals into a unified team cited by Terri D Farrar (2009). Teambuilding is a family of organizational development intervention designs and these interventions seek to support work teams improve the way they accomplish the task, work together and enhance interpersonal and problem-solving skills Charles Harry Garner (1998). The main types of teambuilding interventions commonly found are based on goal setting, role definition, interpersonal processes and problem solving. According (R B Rudani, 2011) teambuilding consists of two tasks, to create team carefully and to make team operate effectively. Studies suggest that many teambuilding interventions fail to build an effective team. This calls for exploring new teambuilding techniques to build more effective, consistent and successful teams. One way in which humans have always endeavored to learn, when confronted with barriers, is to see what nature can tell us.

### ANTS TEAMWORK: BIOTEAMING

Ants are one of the nature's most effective team. The most inspiring aspect of Ants is their cooperative and collective behavior and their ability to work together with amazing efficiency. Ants live and work together in communities, and an ant community is called a colony. In their colony, there are three distinct types of members – males, queens and workers (L Huge Newman, 1967). These three groups are called castes (Sigmund A Lavine, 1960). A caste is defined as any set or group of individuals that performs specialized labor in the colony for sustained periods of time (Oster and Wilson, 1978). Holldobler and E.O Wilson (1990) define caste as a group that specializes to some extent on one or more roles. The queen, workers, males of the colony plays different roles. The queen plays an important role in the formation of a colony in the beginning and subsequently engages in the task of creation of workforce for the colony. Despite her title, a queen does not rule (Sigmund A Lavine, 1960). Males live in the colony and play a reproductive role temporarily. The worker ants are non-reproductive female and play very important for the survival of the colony. The worker ants build the nest, forage for food, take care of young, fight predators and carry out other colony activities. Workers even switch jobs to meet the ever-changing needs of the colony.

A colony can solve problems unthinkable for individual ants and colonies respond quickly to their environment. Ants collectively carry out cooperative tasks, such as building nests, finding shortest path to food source, bringing food into the colony, allocating workers to different tasks, defending a territory from neighbors, combining forces to move a large unwieldy object, tending their broods, and perform other functions crucial to colony's well-being. The collective behavior that emerges from a group of social insects has been commonly referred to as Swarm Intelligence (Eric Bonabeau and Meyer, 2001).

The key characteristics of Swarm Intelligence reveal a useful set of organizing principles and can act like guidelines in the application of building work teams in human based organizations. Some of the important principles of swarm intelligence according to Stephan Olariu et al (2006) are: members are autonomous; collective behavior can be performed irrespective of number of individuals; any individual can be added or removed or replaced; robust due scalability and flexibility; massively parallel and its functioning is distributed, that is tasks performed by each individual within its group are the same; and members are self-organized, that is, the intelligence exhibited is not present in the individuals, but rather emerges out of the swarm.

The organizational principles that have evolved to give Ants certain superiority in their organizational behavior can be extracted and adapted in human based organizational work teams. Ant colonies in several respects resemble to human based organizations along with few differences. A comparison between ants colony and human based organization has been given by Sudd and Franks (1987). An organization using economic inputs such as land, labor and capital tend to produce outputs such as goods and services. The translation of these to ants colony means land and labor are equivalent to territory and workers respectively. Capital represents stored resources such as food and the like. The profitable output in case of ants is purely the colony's offspring. An ant colony producing more sexual offspring than its neighbor is effectively increasing its market share, just a profitable company might do.

### ANTS TEAMBUILDING TECHNIQUES AND APPLICATION

The key elements of ants social organization, behavior and their organization principles are broadly classified into (a) Social Factor (b) Task Factor (c) Member Factor and (d) System Factor.

- (a) **Social Factor** – The techniques covered under this factor are Eusocial, Inclusive fitness and Genetic Bonding. Ants are said to be Eusocial or truly social since the individuals of the same colony cooperate in caring for the brood, exhibit division of labor where non-reproductive or sterile individuals work for the fertile individuals within the colony, and there exist an overlap of at least two generations enabling the offspring to assist the adults at least for some period during their lifetime. Genetically, the workers of the colony strongly integrate the colony. They are highly related to each other and the degree of relatedness is 75 percent (Sudd and Franks, 1987). The idea of inclusive fitness is that an organism's fitness depends not only on its own survival and reproduction but on the productiveness of its relatives. By reducing personal survival and reproduction, as in the case of sterile workers, increase the survival and reproduction of genes they share with other members of the colony by common descent. Individuals suffer, but the colony flourishes and so do the genes, including the altruistic genes (Holldobler and Wilson, 1990).
- (b) **Task Factor** – The important areas cover under this factor are caste specialization, Adaptive division of labor, Swarm rules, mutual monitoring and task allocation. Caste Specialization and Adaptive Division of Labor is the foundations of Ants. In an ant colony there are different castes like queen, sterile workers and male performing different tasks. Workers play an important role in the integration of the colony and performing all colony activities except reproduction. Queen's role is to engage in reproduction. There are two propositions in respect of allocation of tasks or division of labor; they are referred to as continuous caste system for flexibility in task allocation and the other discrete caste system for an efficient system with role clarity. The ants follow very simple swarm rules when working in group. The collective and cooperative behavior in ants emerge based on following such simple rules resulting in greater efficiency, flexibility and robustness for carrying out colony tasks. Mutual Monitoring and Task Switching is an important aspect of social design when under certain colony situations workers behavior is either precocious or over aged. Task Allocation in ants organization consists of one or more combination of Task Fixation, Temporal Polytheism, Physical Caste and Genetic Design (Markus Waibel et al, 2006; John H Sudd and Nigel R Franks, 1987). Task Fixation is based on stimulus and positive feedback system, more the stimulus to do the particular activity more the response or work will be done. In the Temporal Polyethism allocation is age-based and different individuals have different roles at different times in their lives. In the Genetic Design system, the response threshold of workers to various tasks is determined based on artificial evolution. Overall, it shows that the type of mapping between genotype and individual behavior greatly influences the dynamics of task specializations and colony productivity, and also between the mapping system and level of colony relatedness and colony perturbations.
- (c) **Member Factor** – The key traits grouped under this factor are Altruism, Behavioral Elasticity and Homogeneous nature. The workers in ant colony exhibit altruism or social donorism which is the single most important feature of social behavior of ant. The altruistic actions of workers integrate the colony tightly and make possible advanced forms of labor specialization. Behavioral Elasticity is another important trait exhibited by ants and one aspect of social design. Ant colonies show great resilience through the measured response of their members through behavioral elasticity. Ants respond to sudden catastrophes based on mutual monitoring and exhibiting flexibility in carrying out additional tasks in the demanding situation.
- (d) **System Factor** – The techniques classified under this factor are Structure, Self-organized, Communication, Recognition, and Collective Leadership. The ant organization is a special kind of hierarchy, which is called a dense hierarchy (Holldobler and Wilson, 1990). The colony is dense in which each individual can communicate with any other. The colony is hierarchy, a hierarchy-like system in which two or more levels of units with activity in the lower units feeding back to higher levels. Ants are self-organized. Their activities are neither centrally controlled nor locally supervised. The system functions and through contextual local interactions via direct or indirect, the latter type is referred to as Stigmergy in which communication takes place between individuals via the environment. Information plays two major roles. They are 'cohesion' and 'coordination' roles (John H Sudd and Nigel R Franks, 1987). Cohesion helps members to know and identify each other, maintain the relationship and share the benefits among its members. This way it increases the individual inclusive fitness. Coordination helps workers to coordinate in colony activities. The techniques for the purpose of application in human based organizational are selected based on the feasibility. The techniques applied are Eusocial, Genetic Bonding, Inclusive Fitness, Swarm Rules, Caste Specialization, Behavioral Elasticity and Mutual Monitoring.

**SUGGESTIONS**

The suggestions are given below:

- The Ants based teambuilding techniques is an innovative and effective method that provides the work team and organization an enabling structure without destroying autonomy and intelligence unlike centralized leadership and hierarchical structure.
- The combining of the devolved but integrated strengths of the ants teambuilding techniques with the directive and strategic abilities of human can make organizational work teams more efficient, adaptive and successful.
- Ants based techniques needs to be applied with an integrated approach like appropriate structure, resources and enabling norms for better results.
- Management and members support are important for successful implementation of Ants based teambuilding techniques.
- Team Building is not a "one-time cure" for sustaining team Synergy and Effectiveness. It is an on-going process.
- Centralized leadership and hierarchical structure can be replaced by a flat team structure and cooperative leadership.
- Transferring decision making away from a centralized leader to a co-operating leadership team through autonomy and empowerment improves transparency, communication, decision making and execution.
- Management to take initiative on providing team based rewards and recognition to the team members equally for working collectively to achieve the team goals. This will be improve and develop inclusive fitness.
- Team to collectively create norms or swarm rules on consensual basis to deal with the team activities like team values, task allocation, task management, conflict resolution, sharing of benefits, team development and others. This will develop robust and resilient team
- Improving the degree of interpersonal relations of team members to make team more sociable and mutually supportive. Guiding and support by the mentors.
- Improving emotional intelligence of members through training and bringing transparency along with helps in creating better mutual understanding, trust and emotional bonding. This is in turn help build a better cohesive team.

**CONCLUSION**

Work teams are increasingly used by many organizations in almost every segment of the economy. Teams are formed for multiple benefits in the workplace. Teams are sometimes successful and sometimes unsuccessful. Hence the performance is not consistent. There is a need for innovative solutions to make teams more successful, consistent and responsive to changes. Nature's most successful living biological teams like Ants can provide useful guidelines on how organizational teams need to operate to be truly successful, consistent and adaptable to change. Application of some selective Ants based teambuilding techniques namely Eusocial, Genetic Bonding, Inclusive Fitness, Swarm Rules, Flat Structure and, Collective Leadership on a sustainable basis enables teams to become more effective and efficient.

**SCOPE FOR FURTHER RESEARCH**

This study only represents a first step within a broader research program about organizational learning and the identification of supportive and enhancing organizational tools. Organizational learning has been studied from a wide variety of perspectives, and it has been generally acknowledged that the phenomenon is of increasing importance for survival in uncertain and turbulent environments. Still, our understanding is limited, and the different research traditions remains splintered. Organizational theory, cognitive psychology, strategy and information systems are approaching learning from different points of view, concentrating on particular issues. Recently, some integrative efforts have been made, but I believe that there is still a long way to go. I have been participating in other in-depth studies similar to this one. The comparison of the findings of each of the studies will hopefully help to verify and refine the propositions of this research, further elaborating on the findings that have emerged from this study. In particular, more work has to be done to deepen our understanding about supports to individual and collective learning processes.

- Behavioral models of social insects or other animal societies that can stimulate new algorithmic approaches.
- Empirical and theoretical research in swarm intelligence.
- Application of swarm intelligence methods, such as ant colony optimization or particle swarm optimization, to real-world problems in management and other areas.
- Theoretical and experimental research in swarm robotics systems.

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