# Role of Game Theory in rational decision making: The case of KTDA managed factories

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## ABSTRACT

The governance of tea factories managed by Kenya Tea development Agency (KTDA) is by factory company directors who are elected by tea farmers (the shareholders). The major expectation from the directors by the farmers is high returns from the tea sales. Since tea industry in Kenya is a price taker, the directors cannot determine the price of the tea in the international market and are not able to meet the farmers' expectations. To improve the returns, the directors can improve the quality of tea and minimize on operational costs through improvement of the factory operations and the infrastructure in the tea catchment area. The farmers fail to understand the objectives of the directors' spending money on such projects and accuse them of the low returns. The directors results to using game theory in their decision making. This paper looks at the influence of game theory in decision making in KTDA managed factories in Kirinyaga County. The study uses primary data from sampled respondents, whereas a self-administered questionnaire is used for collection of data. Data analysis is by use of SPSS. The frequencies, mean, median, standard deviation and skewedness are used to examine the data. The study indicates that game theory has an influence on the decision making in the KTDA managed factories where cooperative game is used. The paper recommends that KTDA managed factories to fully involve the farmers' in decision making, as this will minimize information asymmetry and improve on decision making in the factories.

Key words: Dilemma, Game theory, Governance, Farmers, KDTA-managed factories.

## INTRODUCTION

Governance in KTDA managed factories is by Board of Directors who are elected by the farmers to govern the factories and look after farmers' interests (Keraro *et al.*, 2012; KTDA, 2014; Tea Act, 2012). The directors delegate the day-to-day operations of the factories to the management (KTDA, 2014). The board of directors has the authority of making the decisions and has the responsibility of developing directional policy, endorsing the strategies of the factories overseeing the operations of the factories, and ensuring accountability of the factory companies its shareholders, the farmers (Bhagat and Black, 1999; Keraro *et al.*, 2012; Stathers *et al.*, 2013). The election of the factory directors are held every year where a third of the directors retire, they are however free to offer themselves for re-election (Stathers *et al.*, 2013; Tea Act, 2012). In 2008, a new system of voting was adopted where the voting was by way of shares and the number of votes per farmer depends on the output of the farmer (Keraro *et al.*, 2012; Stathers *et al.*, 2013; Tea Act, 2012). This has reduced the chaotic process of voting and it has seen professionals offering themselves for election (CPDA, 2008; Stathers *et al.*, 2013) as well as made the election competitive (Stathers *et al.*, 2013).

The directors have the mandate of implementing the strategies of the factories on behalf of farmers (Lishenga, 2011). To successfully implement the strategies, directors have to get funds

from tea sales. This means retaining part of the factory earnings from tea sales (Kimathi and Muriithi, 2013; KTDA, 2014) and reducing the pay out to farmers. KTDA is a price taker from the world market and thus the directors are not able to influence prices for better returns to farmers (Chan *et al.*, 2010; Kagira, Kimani and Kagwithi, 2012). In an environment of intense competition among tea factories in terms of paying the highest returns to the shareholders, there is always a high temptation to declare high annual pay-outs at the expense of future development (Kimathi and Muriithi, 2013; Stathers *et al.*, 2013). To a large extent, the farmers are not involved in the processes of making the decisions (Cheruiyot, 2013; Kagira *et al.*, 2012). Lack of involvement of the farmers and the conflict of interest between the factory company Board's long-term objectives and the demand of high annual payments by the farmers create a dilemma in decision making (Keraro *et al.*, 2012; Kimathi and Muriithi, 2013; Stathers *et al.*, 2013). If the directors implement the long-term projects and the factory annual payments are reduced, this may not work well for them (the directors) in the future (Kimathi and Muriithi, 2013). The directors are faced with a dilemma in decision making on whether to pay high annual returns or invest in the companies' long-term objectives that will ensure the long term profitability (Stathers *et al.*, 2013). Again, some of the strategies reduce on demand for the labour, (Kagira *et al.*, 2012), yet some of the voters expect jobs in return for voting for the directors.

Directors are rational and they would make decisions that will benefit them, though they may not be rational in the long-run. The directors thus make decision that will satisfy the farmers and at the same time improve their chances of re-election (Keraro *et al.*, 2012; Stathers *et al.*, 2013). This brings a scenario of cooperative game theory in the decision making by the directors. Cooperative game theory is situations where the objectives of participants are partially cooperative and partially conflicting (Erhun, 2003; Kelly, 2003). The participants tend to cooperate in order to achieve the highest benefits possible (Kelly, 2003). The decisions made are of self-interest, they consider short-term benefits at the expense of the long-term objectives of the factory (Song and Panayides, 2000; Stathers *et al.*, 2013). It is this background that informs this study on the influence of game theory on the decision making in KTDA managed tea factories.

## Problem statement

Governance in the KTDA managed factories is by factory directors who are elected by the farmers (KTDA, 2014; Tea Act, 2012). The Board of Directors has the responsibility of overseeing the success of the factories (Bhagat and Black, 1999; Kagira *et al.*, 2012; Keraro *et al.*, 2012). To ensure success, they have to implement some strategies which include capital projects. This requires directors retain part of the factory earnings from tea sales, and this means reducing the payout to farmers (Kimathi and Muriithi, 2013; KTDA, 2014). There is always a high temptation to declare high annual payouts at the expense of future development due to the completion in the industry on the highest paying factory (Kimathi and Muriithi, 2013; Stathers *et al.*, 2013). This brings out the conflict of interest between the factory company boards' long-term objectives and the demand for high annual payments by the farmers (Keraro *et al.*, 2012; Kimathi and Muriithi, 2013; Stathers *et al.*, 2013). The directors are faced with a dilemma in decision making on whether to pay high returns or invest in the long-term projects (Stathers *et al.*, 2013). The directors make decisions that are rational to their own interest at the expense of the long-term objectives of the factory (Kagira *et al.*, 2012; Keraro *et al.*, 2012). This brings a scenario of cooperative game theory in the decision making by the directors (Erhun, 2003; Kelly, 2003). The purpose of this study was to evaluate the role of game theory on the decisions made by the directors.

## Objective of the study

The objective of the study was to find out the influence of game theory in the rational decision making in KTDA managed factories.

## LITERATURE REVIEW

Game theory is a science of interactive decision-making among decision makers who have no full control of the outcome of the decision (Kelly, 2003). The theory came into existence as a field in its own in 1944 after the publication of the monumental volume, *Theory of Games and Economic Behaviour* by von Neumann and the economist Oskar Morgenstern (Hammond and Seidl, 2003). Game theory was broadened theoretically and applied to problems of war and politics in the 1950s and 1960s (Erhun, 2003; Kelly, 2003) Since the 1970s, game theory has driven a revolution in economic theory. By the end of 1990s, a high-profile application of game theory has been the design of auctions. Game theorists have been involved in the design of auctions for allocating rights to the use of bands of the electromagnetic spectrum to the mobile telecommunications industry (Kelly, 2003). Game theory is concerned with decision making in organizations where the outcome depends on the decisions of two or more autonomous players, and where no single decision maker has full control over the outcomes (Kelly, 2003; Song and Panayides, 2002). This theory aims to reach optimal solutions to situations of conflict and cooperation under the assumption that players are rational and act in their best self-interests. (Kelly, 2003; von Neumann and Morgenstern, 1953). Each player in the game must consider what the others will do before setting up a strategy and during the implementation period as a decision made by one player has an impact on the other players (Child and Faulkner, 1998).

Game theory is classified into two categories, non-cooperative game approaches (Tirole, 1988) and cooperative approaches (Curiel, 1997). Cooperative game deals with a situation where a group of decision-makers decide to undertake a project together for the mutual benefit of the group members (Kelly, 2003). In cooperative game theory, members tend to form a coalition, which refers to the formation of sub-sets of players' options under coordinated strategies (Song and Panayides, 2002). A cooperative game specifies what payoffs each potential group, or potential coalition, can get by the cooperation of its members (Colman, 2003). In every possible coalition, there is a given set of feasible benefits to the members (Colman, 2003; Song and Panayides, 2002). The benefits are as a result of cooperation by the members of the coalition; it is in the players' interest to cooperate so as to achieve the highest possible benefits (Lemaire, 1991). Coalitional games involve a set of players, denoted by $N = \{1, \dots N\}$ who come together to form cooperative groups so as to strengthen their positions in a game. A coalition of $S \subseteq N$ represents cooperation the players in S act as a unit (Kelly, 2003). Players cooperate and they create a value of the collation denoted as v; it quantifies the worth of a coalition also referred to as utility. The coalition value can be assigned a number and be divided in any manner among the coalition members or cannot be assigned a single real number, or there are restrictions on distribution of the utility (Das and Teng, 1999, 2000). Coalitions have to choose a course of action from several alternatives (Song and Panayides, 2002). Kelly (2003), Doyle (1998) and Wang and Ruh (2007) observe that game is an abstraction of situations involving interacting decision makers where their interests are conflicting. A game gives the possible patterns of behaviour or strategies, any relevant probability influences (Kelly, 2003; Wang and Ruhe, 2007). Thus most of the studies in game theory do not focus on computing a value, but indicating a possible pattern of behaviour (Kelly, 2003).

The KTDA directors are expected to undertake long term projects which may affect the cash-flow in the short run but it is beneficial to the organization in the long run (Keraro *et al.*, 2012; Stathers *et al.*, 2013). The projects which include modernization may also reduce the labour requirement, yet the directors would like to provide jobs to their campaigners (Keraro *et al.*, 2012). Cases of over-employment, employment of the persons who voted for the directors and unqualified staff are many (Keraro *et al.*, 2012; Stathers *et al.*, 2013). Procurement of the various items for the factory is given to people who helped during the elections of the directors (CCDA, 2008). The directors will not want to be in conflict with the people who elected them; they thus

avoid undertaking any project that may conflict with the expectations of the voters (Keraro *et al.*, 2012). It has been observed that, most of the development activities are concentrated on the electoral zones facing election at any particular year (Stathers *et al.*, 2013) as a way of influencing the decision of farmers during elections.

Players in a game are concerned with the value they will get from the coalition and thus they try to maximize the returns (Song and Panayides, 2002). Election of directors in KTDA managed factories is through competitive voting (Keraro *et al.*, 2012). Farmers form coalitions for the support of the candidate they think will deliver high value to them. The benefits expected by the farmers are high annual return from tea sales, better services, as well as individual benefits such as provision of jobs (Kagira *et al.*, 2012; Kimathi and Muriuki, 2013). Directors on the other hand are rational, and they make decision that will maximize the value from the actions they take (Keraro *et al.*, 2012; Stathers *et al.*, 2013). The directors thus take actions that will increase their chances for re-election (Kimathi and Muriuki, 2013; Stathers *et al.*, 2013). They cooperate with the farmers and make decisions which will increase the members into the coalition and improve the chances of re-election (Keraro *et al.*, 2012).

## CONCEPTUAL FRAMEWORK

The relationship between the independent and dependent variables is illustrated in Figure 1:
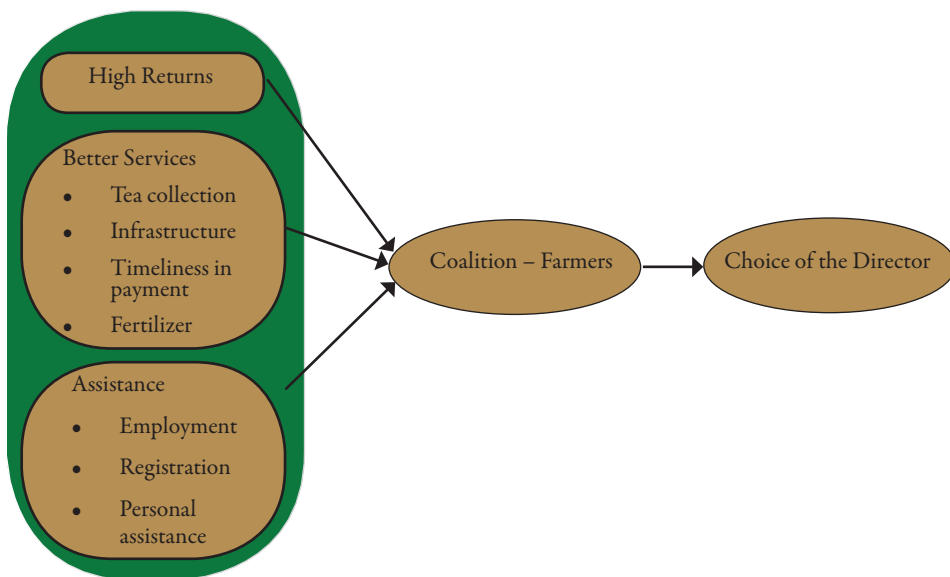


**Figure 1: Conceptual framework.**

The directors are always faced with opposition from the farmers who would like to vie for the positions of directors. The directors have no influences on the prices of tea (Chan *et al.*, 2010; Kagira *et al.*, 2012), which is the major expectation by the farmers. The directors thus undertake other activities that will buy-in more members into their coalition (Keraro *et al.*, 2012; Stathers *et al.*, 2013). Directors minimize on long-term activities that may involve major cash outflow so as to pay high returns, provide employment to supporters irrespective of availability of positions (Keraro *et al.*, 2012; Stathers *et al.*, 2013), giving procurement contracts to supporters (CCDA, 2008), undertaking development projects at the time of election, and channeling project funds where they expect much influence (Stathers *et al.*, 2013). The farmers thus form a collation to elect a person who will maximize the utility they receive, however they do not consider the long-term success of the factories (Keraro *et al.*, 2012).

Due to conflicting interests of the directors and the farmers, the directors make decisions that are rational to their own interest at the expense of the long-term objectives of the factories. It is in is this background that informs the current study on the influence of game theory on the decision making in KTDA managed tea factories.

## METHODOLOGY

### Research design

This study utilized descriptive research designs. Descriptive researches portray an accurate profile of persons, events, or situations (Robson, 2002). The research was aimed at collecting information from respondents on influences in decision making. The target population constituted farmers of KTDA managed factories. A sample of 164 farmers and 47 employees were selected from KTDA managed tea factories from Kirinyaga County.

### Data analysis

Primary data was collected and analyzed using descriptive statistics comprising of frequencies, mean, the standard deviation and skewness. The qualitative data was converted to quantitative for the analysis. The study evaluated what influences the decision making in the factory as per the employees' perception. The study also evaluated the farmers' expectation of their directors.

## RESULTS AND DISCUSSION

### Employees' perception on decision making by directors

The study sought to establish the perception of the employees on what influences directors' decision making. The employees know the priorities of the factories, and are involved in decision making in the factories. They were thus able to judge what influences the decision making at the factory level. The respondents gave the following responses on the decision making perception.

**Table 1: Employees' perception on influencers of decision making.**

| Descriptive Statistics | | | | | | | |
|---|---|---|---|---|---|---|---|
| | N | Minimum | Maximum | Mean | Std. Deviation | Skewness | |
| | Statistic | Statistic | Statistic | Statistic | Statistic | Statistic | Std. Error |
| Strategic objectives | 47 | 2.00 | 5.00 | 3.2128 | 1.08219 | .522 | .347 |
| High returns | 47 | 1.00 | 5.00 | 3.7660 | 1.20168 | −.860 | .347 |
| Better services | 47 | 1.00 | 5.00 | 3.8085 | 1.09620 | −.947 | .347 |
| Retaining directorship | 47 | 1.00 | 5.00 | 3.7872 | 1.14086 | −1.030 | .347 |
| Demand by farmers | 47 | 1.00 | 5.00 | 3.7660 | 1.14612 | −.965 | .347 |
| Valid N (listwise) | 47 | | | | | | |

The rating of company's strategies was positively skewed at 0.522 as compared to farmers' expectations of between −0.860 and −.1030. A positive skewness indicates that majority gave a low rating of the attribute while a negative rating indicates that majority of the respondent gave a high rating of this attribute. The directors' decisions are heavily influenced by the farmers needs as compared to the company strategies.

## Farmers' expectations from the directors

The study sought to find out what the farmers expect from the directors they elect. The following were the responses from the respondents. The respondents were allowed to choose more one expectation, thus the cumulative percentage was more, 100%.

**Table 2: Farmers' expectations from the directors.**

|  |  | Frequency | Percentage | Valid Percentage |
|---|---|---|---|---|
| | High returns | 148 | 90.2 | 90.2 |
| | Better services | 71 | 43 | 43 |
| Valid | Employment | 46 | 28 | 28 |
| | Assistance | 45 | 27 | 27 |
| | Not sure | 6 | 5 | 5 |

The data indicates that majority of the farmers expected high returns and better services from the directors.

## Farmers' preference on long-term projects

The study sought to find out what the farmers would prefer between investments in long-term projects and receive high returns in the future or receiving high return at present. Their responses are provided in the table below:

**Table 3: Farmers' preference between retention of money and payment at present.**

| | | Frequency | Percentage | Valid Percentage | Cumulative Percentage |
|---|---|---|---|---|---|
| | **High Returns** | | | | |
| | High returns | 110 | 67.1 | 67.1 | 67.1 |
| Valid | Long-term investment | 37 | 22.6 | 22.6 | 89.6 |
| | Not sure | 17 | 10.4 | 10.4 | 100.0 |
| | Total | 164 | 100.0 | 100.0 | |

Majority of the farmers preferred to receive high returns at present.

## Preference of a candidate

The study sought to find out if the farmers are promised more benefits, whether they will change the person they elected in the previous election. The following were the responses.

**Table 4: Influence of favours on farmers' decision.**

| | | Frequency | Percentage | Valid Percentage | Cumulative Percentage |
|---|---|---|---|---|---|
| | **Preference of a candidate** | | | | |
| Valid | Will change | 122 | 74.4 | 74.4 | 74.4 |
| | Will not change | 33 | 20.1 | 20.1 | 94.5 |
| | Not sure | 9 | 5.5 | 5.5 | 100.0 |
| | Total | 164 | 100.0 | 100.0 | |

Most of the farmers (74.4%) indicated that if promised more benefits, they may change their preferred candidate.

## DISCUSSION

From the study, the farmers' expectations are conflicting with the long-term objectives of the factories as the farmers would prefer high returns from the sales and the same time better services. Better services in the long-run require re-investment of funds which can only come from the sales of tea. The directors on the other hand would like to retain their seat in the subsequent elections. Due to conflicting interest, the directors enter in a coalition with the farmers for mutual benefit. Thus, this study tries to indicate behaviour pattern by the players as observed by Kelly (2003), Doyle (1998) and Wang and Ruhe (2007) where the farmers gave a high rating for their expectations, the same was also highly rated as what influences directors decision making by the employees. The study shows cooperative game theory influences the decision making in the KTDA managed factories.

## CONCLUSION

The directors have the responsibility ensuring effective management of the factories for the benefit of the farmers. The decisions made should be rational both in the short-run and long-run. There is need for more involvement of the farmers in setting the factory company strategies for the farmers to understand the reasons for undertaking certain strategies. With involvement of farmers, there will be a reduction in information asymmetry. This will minimize the conflict of the farmers' interest and the long-term interests of the factories. With this, the directors will be in a position of making rational decisions.

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