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Full Length Research Paper

Managing sustainability with strategic planning tools: A longitudinal analysis of multiple case studies

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Over the last few years, laws concerning the waste sector have changed considerably. The European and national laws apply strict rules to companies in order to protect the environment and quality of life. The issue of sustainability is receiving increasing attention, and many organizations have implemented environmental and social management systems in order to manage and control sustainability-related issues. This paper examines whether sustainability-oriented goals have been identified and managed through appropriate strategic planning tools in several Italian state-owned waste companies. This question is examined using a business model highlighting the cause-and-effect relations among key success variables, according to social and environmental patterns. The empirical analysis uses multiple case studies conducted through interviews with managers holding key positions within organizations and an investigation of internal documents. The results show a high diffusion of social and environmental goals although their management through advanced managerial systems is still limited. This work has important theoretical and practical implications because it extends the existing literature on sustainability and strategic planning tools in public utility companies and provides a guide for further reflections on this topic.

Key words: Waste sector, public utility, sustainability, strategic planning tool, strategy map

INTRODUCTION

The waste sector is being impacted by the increasing prescriptive efforts to safeguard the environment and human wellbeing. Increasing waste production is creating environmental and social problems, for which waste companies are partially responsible. Companies can keep these problems under control through the creation of partnerships with local communities and by engaging fully in the pursuit of social and environmental goals. The Italian waste sector is complex, especially in terms of regulatory and legislative processes. Unfortunately, the

transformation process has not been smooth, and Italian waste policy has been characterized by a high degree of fragmentation among laws and regulations. The proliferation of laws resulted from the need to cope with various European Union Directives. European and Italian laws (Directive 2000/60/EC and Italian Legislative Decree 152/2006) apply strict rules to companies in order to protect the environment and countries' quality of life. National and regional laws define their objectives in terms of the collection, separation, and recycling of wastes.

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Italy's waste production is increasing (by +0.3% since 2015). Data on waste production per head indicate that the highest values have been reached in central Italy, followed by the northern and southern regions (ISPRA Report, 2015). In 2014, the highest recycling rates were recorded in the northern regions of Italy (56.7%), followed by the center (40.8%), and the south (31.3%). Three alternative ways to delegate waste services delivery are available: in-house contracts, public tenders aimed at identifying a private service provider, or public-private partnerships (PPPs). The pursuit of social purposes and the promotion of the economic and social development of local communities are distinctive aspects of companies working in public utility sectors, such as the waste sector. These companies should thus define their strategies and goals on the basis of the needs of their stakeholders and the specific needs of their area of operations without neglecting the political and legal constraints affecting current and future planning. Analyses of the external environment in which companies operate and the relevant intra-organizational factors seem propaedeutic to a definition of their strategies and expected results. In this context, it is useful to discuss sustainability and its three main components: economic (e.g., profitability, cost saving), social (e.g., stakeholders, public welfare) and environmental (e.g., protection of the environment and area of operations). Company behavior and performance can strongly impact the environment and human wellbeing. This study focuses on several Italian state-owned waste sector companies that offer one or more of the following services: the collection of undifferentiated and recyclable wastes, transportation services to disposal centers, the management of disposal centers, and urban hygiene services (e.g., road and park cleaning).

The literature (Hood, 1995; Boston et al., 1996; Northcott and Taulapapa, 2012) shows that, in the last decades, public sector organizations around the world have faced increasing pressure to demonstrate effective performance management. Thus, performance management practices previously confined to the private sector have begun to be used by companies that offer public services as a means of improving their performance and accountability (Hood, 1995; Jackson and Lapsley, 2003; Perera et al., 2003; Lapsley and Wright, 2004). However, few studies have focused on advanced management control systems in the public sector (Northcott and Taulapapa, 2012). This study fills this gap by analyzing how sustainability issues are managed through appropriate strategic planning tools in several Italian public utilities operating via in-house contracts (state-owned) in the waste sector.

Results show that, according with the main literature on this topic, in the sample of public utilities analysed the sustainability strategic planning systems are not widespread. Consequently, this work proposes a business model focused on sustainability-related issues, in order to provide companies with the logical tools to support

internal and external decision-making and communication processes. The proposed sustainable business model has been successfully implemented by some companies: some of those declared benefits such as a better communication with key stakeholders or a significant support in internal decision-making process.

The rest of the paper is organized as follows. The section below presents a literature review. The study's empirical research method is then described. Next, the findings are outlined and discussed. Finally, the paper ends with concluding remarks.

LITERATURE REVIEW

Sustainability management

Sustainability management is not a new topic; however, it continues to have international significance for both the private sector and the public utility sector (Boyce, 2000; Frost and Seamer, 2002; Line et al., 2002; Vagnoni, 2001). European and national laws, which apply strict rules to public utility companies such as waste sector firms, have helped increase the attention being paid to sustainability, particularly concerning the promotion of efficiency, effectiveness, and accountability (Maruccio and Steccolini, 2005). It becomes increasingly clear that, to survive and thrive, organizations must make decisions that serve the interests of the environment and society (Adams and Frost, 2008). In recent years, several companies have recognized the potential of sustainability-oriented behaviors and have begun to use internal and external reports to manage, control, and communicate sustainability-related issues (Bieker et al., 2002), but what does "sustainability" mean?

The term "sustainability" is closely tied to "sustainable development," although it is difficult to define clearly. An early definition, included in the Brundtland Report of 1987, described "sustainable development" as "*the ability to meet the needs of the present without compromising the possibility of future generations to meet their own needs.*" Usually, "sustainable development" highlights the interdependence of the economic, social, and environmental spheres (Elkington, 1997). Such an approach to sustainability management aims at the simultaneous achievement of ecological, social, and economic goals (Figgie et al., 2001; Schaltegger and Burrit, 2000; O'Connor, 2006). O'Connor (2006) introduces a fourth sphere, the system of regulation that arbitrates among the claims made by the actors in the social, economic, and environmental spheres. The analysis of sustainability also focuses on the interactions and interdependencies among these spheres and on the characterization of the performance and quality in each one. Nidumolo et al. (2009) has also defined sustainability as a key driver for innovation, pointing out that the search for sustainability is transforming the competitive arena,

leading to a rethinking of the characteristics of products, technologies, processes, and business models.

It is thus becoming increasingly important for both public utility sector and private sector firms to formulate strategies that identify the sustainability goals that need to be managed and communicated at different levels of the organization.

Translation of sustainability strategy into operational terms

Kaplan and Norton (2000) identify several strategic themes. One of them, *“be a good corporate citizen,”* can be considered sustainability-oriented because it is focused on managing relationships with external stakeholders, especially in areas subject to regulation (e.g., utilities, healthcare, telecommunications), safety concerns, and environmental risk management. Bieker et al. (2002) identify different sustainability-oriented competitive strategies:

- i) The “safe” strategy aims to manage, prevent, or control the harmful effects caused by behavior inconsistent with sustainability;
- ii) The “credible” strategy is a common strategy in sectors where reputation and credibility provide competitive advantage. Through this strategy, companies seek to prevent conflicts with stakeholders and create a positive image;
- iii) The “efficient” strategy combines efficiency and sustainability in process management;
- iv) The “innovative” strategy aims to differentiate products and services from those offered by competitors. In this case, the company’s approach to sustainability can be considered a source of competitive advantage;
- v) The “transformative” strategy consists in being an active part of the institutional changes in the market, such as pushing towards social and/or environmental reporting.

After defining a strategy, it is necessary to translate it into operational terms. Indeed, the ability to execute a strategy is as important as the strategy itself (Kaplan and Norton, 2000). The theme of sustainability can be included along with strategic intentions and the related critical success factors in the creation of an organizational sustainability-oriented culture (Epstein and Buhovac, 2014; Epstein and Roy, 2001; Schaltegger et al., 2012). The research has also emphasized the importance of identifying the sustainability indicators within business performance models (Epstein and Buhovac, 2014; Schaltegger and Wagner, 2006; Figge et al., 2002; Dias-Sardinha and Reijnders, 2001). The strategy map and balanced scorecard, theorized by Kaplan and Norton (1992, 1996, 2000, 2004), play a key role in translating strategy into action because they force managers to identify the key success factors and their

cause-and-effect relations to a greater extent than other strategic planning tools do. Key success factors are specified within four perspectives (learning and growth, internal processes, customers, and financial) and are then measured with a balanced set of financial and non-financial indicators.

These tools have been criticized for failing to consider several variables, such as the effects on the environment and the community in which the organization is operating (Smith, 2005). However, Kaplan and Norton (1996) argue that this framework cannot be considered a “straitjacket” but, on the contrary, can be adapted to environmental and social issues. The flexibility of the strategy map and balanced scorecard allows managers to choose an approach that works best with the company’s strategic goals, corporate culture, and sustainability (Butler et al., 2011). Some authors (Bieker et al., 2001, 2002; Dias-Sardinha et al., 2002, 2007; Figge et al., 2002; Fülöp et al., 2016; Hódi Hernádi, 2012) suggest a Sustainability Balanced Scorecard, based on the theorization of Kaplan and Norton, but with a focus on sustainability-oriented competitive strategy. It provides a broader scope by showing the causal links among the key economic, social, and ecological factors. Sustainability can be added to the original four perspectives of the strategy map as a different perspective, or the social and environmental aspects can be combined (Figge et al., 2002). Figge and Hahn (2001) proposed the inclusion of an additional perspective, the non-market perspective, especially for companies significantly influenced by social and environmental factors. Bieker et al. (2002) also suggest an additional perspective—social or environmental—to address the strategic orientation of sustainable development. Brusa (2007) states that the economic and financial perspectives reflect the constraints on public utilities rather than their main goals. Epstein and Wisner (2001) suggests a list of social and environmental indicators that should be included within the four “classical perspectives.”

Whichever framework is chosen, this tool has limitations, as social impacts are not easy to measure or quantify (Huang et al., 2014). Several studies (Dias-Sardinha and Reijnders, 2005; Moller and Schaltegger, 2005; Sidiropoulos et al., 2004) on the Sustainability Balanced Scorecard have focused on sustainability indicators such as those linked to eco-efficiency, which are easily quantified. However, as suggested by Moller and Schaltegger (2005), a comprehensive framework should connect all the pillars of sustainability. If a company is able to properly manage sustainability issues, the information generated from the Balanced Scorecard and other strategic planning tools should not be used solely for internal purposes. Companies can become more transparent and inform external stakeholders about their sustainability performance (Butler et al., 2011). One way to do this is through external reports such as Integrated Reporting and Sustainability Reporting, based

on guidance from the International Integrated Reporting Council (IIRC) and Global Reporting Initiative (GRI), respectively. These documents externally disclose the most critical impacts on the environment, society, and economy and can influence the process of organizational legitimacy assessment (Gray et al., 2009; Greiling and Grüb, 2014). Despite their relevance, these reports represent only a final output, which should be preceded by the identification of the drivers and processes leading to the development of an organization's sustainability culture and practices (Huang et al., 2014). The strategic planning tools provide the foundation regardless of which structure is chosen. They can support the implementation of a sustainability-oriented strategy and help drive the organizational structure as it works toward sustainability goals.

Although the relevance of strategic planning and management control systems is widely recognized, many managers of public utilities seem to ignore them or choose not to apply them (Martinez et al., 2015). The management literature has found that Italian public utilities such as those analyzed in this study are slowly but surely increasing the use of these systems (Gandini, 2004). This trend is probably driven by the need to manage more increasingly complex decisional processes and pay greater attention to cost-effectiveness (Martinez et al., 2015).

METHODS

Aim and research questions

This study analyzes if a sample of state-owned Italian companies operating in the waste sector has identified and managed sustainability goals using advanced management tools that allow them to translate strategic objectives into action. The proper management of economic, social, and environmental issues can enable the provision of high-quality services that are environmentally friendly and respectful of the local community's needs.

First, the study investigated if the companies identified strategic goals that were sustainability-oriented and then if they used strategic planning tools to translate the sustainability goals into operational terms. The research focused on the following strategic planning tools:

- i) Business performance models (Balanced Scorecard, strategy map, tableau de bord, Skandia Navigator);
- ii) Strategic plans;
- iii) Economic and financial planning documents;
- iv) Performance indicators (both financial and non-financial);
- v) Business Process Improvement (BPI), Business Process Reengineering (BPR), or tools to support the review of strategic programs;
- vi) Other management tools (e.g., Integrated Reporting, Target Costing, Differential Reasoning).

Based on analyses of internal documents and interviews, the study drew up a proposal for a business model that translates the companies' strategy into a coherent set of drivers according to social and environmental patterns. The business model follows the

logic of the strategy map (Kaplan and Norton, 2004) because, to a greater extent than other strategic planning tools, it provides a language by which companies can describe their strategy, highlighting the cause-and-effect relations among the key success variables. The proposed business model is intended as a guide, not an inflexible framework, and must be adjusted according to the organizational structure and distinctive key variables involved.

This research began at the end of 2010 and concluded its first stage in 2012. At the end of this period, the results and a draft of the business model were presented to the interviewed companies. Their feedback allowed us to refine the logic and the drivers of the strategy map. During the second phase, concluded in 2015, we kept in touch with the companies in order to verify changes in the sustainability orientation or in the use of the strategic planning tools. This enabled the formulation of a more accurate version of the strategy map. No consulting relationships with the companies were established during the research process. The main research questions were as follows:

RQ1: Do strategic goals include the sustainability issue? Have they changed over time (from 2012 to 2015)?

R.Q.2: What are the main strategic planning tools adopted by companies to manage strategic goals, how has the use of these tools changed over the years (from 2012 to 2015)?

Approach

The research was conducted through the case study method, a qualitative approach where theory and empirical research are intertwined. Although this method is somewhat subjective and is often criticized for a lack of statistical reliability and validity, it is especially useful when it is necessary to understand a complex issue (Yin, 1994). It can also develop expertise and reinforce what is already known through previous research. While the conclusions reached from a single case study may be uncertain, the use of multiple cases enhances their robustness (Robson, 1993; Yin, 1994). Scapens (1990) notes the importance of case studies for understanding reality. This study used a qualitative method and performed a multiple case study analysis because examining sustainability strategies and their implementation is a complex task, and it is not possible to analyze internal dynamics through a quantitative method.

This study's data collection drew from multiple sources of evidence, which allowed us to increase the validity of our constructs (Yin, 1994). The sources included semi-structured interviews with key respondents (top and middle-level managers of strategic, financial, and technical units), industrial reports, strategic planning reports, annual reports, technical and non-technical documents, and project reports. The interviews lasted between one and three hours and included questions intended to verify the quality of the answers. The questions were on both general and specific topics such as the peculiarity of the business, the strategy orientation and role of sustainability, the features of the strategic planning process and related tools, the indicators being monitored, the main stakeholders, the role of the environment in the company's management, and the external communication process. The interviews were useful for understanding the peculiarities of the strategic planning tools used and identifying the critical success factors of the businesses, together with their cause-and-effect relations. A draft of the results was sent to all interviewees for their comments and to ensure that the technical details were interpreted correctly, which, according to Yin (1984), ensures construct validity.

The interview has advantages as a survey tool, such as its ability to provide flexibility, capture nonverbal behavior, allow environmental control, change the order of questions, enable completeness, and obtain responses from interested interviewees,

Table 1. Sustainability strategic goals.

Sustainability strategic goals	2012	2015
Prevalence of social and environmental goals (%)	80	90
Prevalence of economic and financial goals (%)	20	10
Total (%)	100	100

Source: Author's own work.

Table 2. Sustainability-oriented strategy.

Sustainability strategy	2015
Safe Strategy (%)	70
Credible Strategy (%)	10
Efficient Strategy (%)	20
Innovative Strategy (%)	0
Transformative Strategy (%)	0
Total (%)	100

Source: Author's own work.

but it has also disadvantages such as its costs and time consumption, the interviewer's influence on respondents, and its lower degree of question standardization. Consequently, interviews were semi-structured in order to keep them within the main question areas while allowing the interviewees to offer their own opinions. According to Yin (1984), open-ended interviews can expand the depth of data gathering and increase the number of information sources. We did not use the questionnaire as a survey tool because it would not have allowed us to verify if respondents knew much about the company's strategy and implementing dynamics; practical insights into the possibilities and problems concerning those issues were needed in qualitative terms.

The sample

The sample comprises 10 state-owned enterprises whose shareholders are local municipalities located in the Piedmont and Lombardy regions of Italy's northwest. Piedmont and Lombardy are among the most committed regions in Italy regarding waste prevention, environmental impacts, and separated collection (ANCI and CONAI Report, 2015). Enterprises were selected from the Italian Register of Environmental Managers, based on business area and firm size. Several dimensions were used as discriminating factors: only companies offering services to more than 100,000 people¹ and that were located in larger cities were considered. The selected cases are representative because they operate in regions that take particular care of their environment and local community and provide services to a significant number of users. In addition, the companies analyzed were chosen on the basis of several shared features: their public nature, the typology of their waste collection services (both recyclable and non-recyclable), their transport to disposal centers and its management, and their urban hygiene services. The sample firms also offer secondary urban hygiene services in the municipalities where they operate.

¹ The selection was based on information in the Register of Environmental Operators.

RESULTS

This section focuses on intra-organizational factors, particularly the sustainability goals and management tools that make the strategic orientation effective.

Sustainability goals

First, RQ1 was investigated through the interviews and internal documents; the goal was to determine if environmental and social aspects were prominent within the strategic goals. The results, shown in Table 1, include both the historical results, obtained during the first stage of the research (completed in 2012), and the updated results (obtained in 2015).

A sustainability orientation is widespread within the companies in both 2012 and 2015. Indeed, companies in which social and environmental goals are crucial topics represent 80% of the sample in 2012 and 90% in 2015. A minority of companies shows a preponderance of economic and financial strategic issues. Only one company in 2012 and two companies in 2015 have formalized a strategy; in the remaining cases, a strategy has been deliberated and is well-known at the top-management level but is not formalized in a document. Using the classification of Bieker et al. (2002), we then analyzed the strategic orientation in 2015.

Table 2 shows the prevalence of a strategy oriented to managing and reducing risks, with a focus on environmental risks, followed by an "efficient" strategy aiming to improve "eco-efficiency" and "socio-efficiency" (Wackernagel and Rees, 1996; Dyllick and Hockerts, 2002) and a "credible" strategy of preventing conflicts

Table 3. Diffusion of strategic planning tools.

Strategic planning tools	2012	2015
Business performance models (%)	10	30
Strategic plans (%)	30	40
Economic and financial planning documents (%)	80	90
Performance indicators (financial and non-financial) (%)	30	50
BPI/BPR tools (%)	30	30
Others (%)	40	30

Source: Author's own work.

with authorities and other stakeholders. Next, the study investigated if the strategic goals were translated into operational terms.

Diffusion of strategic planning tools

The second research question examines the diffusion of strategic planning tools within the state-owned enterprises. The tools analyzed are business performance models, strategic plans, economic and financial planning documents, performance indicators (both financial and non-financial), Business Process Improvement (BPI)/ Business Process Reengineering (BPR) tools, and others (e.g., integrated reporting, target costing, differential reasoning). Table 3 shows the results for 2015.

The results show little diffusion of advanced management control systems; however, a positive trend emerges between 2012 and 2015. In 2012, only one company uses a business performance model comparable to the tableau de bord (Lanzel and Cibert, 1962); in 2015, one company continues to use the tableau de bord and two companies use the strategy map following the framework suggested in the next section. The CFO of a company that uses the strategy map declared as follows: *"I think that this business model is a powerful tool that offers an integrated and complete vision of our company but unfortunately in the coming years we'll probably abandon this tool as it is too expensive. The financial constraints imposed by the municipality which is also our main shareholder force us to make heavy cuts especially in administrative and staff areas. This is because we don't want to penalize the service and consequently the final users."*

Use of the strategic plan has increased from 30 to 40%, and economic and financial planning documents are widespread within the companies. It was decided to differentiate the strategic plan from the economic and financial planning documents because, after analyzing these types of documents in depth, we found that some of the documents labeled "strategic plan" were actually just financial plans. The systematic use of financial and non-financial indicators has increased over time, while the use of BPR/BPI systems has remained stable.

Conversely, use of the other managerial tools that can be employed to support strategy implementation has decreased. No company has ever used integrated reporting or target costing; only differential reasoning has been used.

Strategy map

The interviews and internal document analysis revealed little diffusion of management tools for aligning organizational units to strategy. One useful framework for describing and communicating a strategic plan is the strategy map (Kaplan and Norton, 2001, 2004), which can bridge the gap between strategies and action plans. The business model is built following the logic of the strategy map because it highlights the cause-and-effect relations among the key success variables of a strategy better than other strategic planning tools. Based on information and suggestions obtained through the interviews and documents analysis, four perspectives were identified and adapted to the peculiarities of the sector:

- i) Value creation for consumers (end users): the key success factors necessary to maximize the public utility;
- ii) Internal processes: the critical internal process in which the company excels;
- iii) Learning and growth: the employees' skills, the companies' communication campaigns, and the investments in research and innovation;
- iv) Economic and financial balance: the economic and financial goals necessary to optimize costs, reduce the financial intervention of public administration and banks, and apply the fairest price to final users.

Figure 1 shows the strategy map, highlighting the strategic environmental and social objectives. Companies should adapt the proposed model according to their specific needs and activities. The proposed strategy map identifies the key success factors that could be considered common among the companies analyzed. The arrows of effects proceed from the lower perspectives to the higher ones, while the arrows of

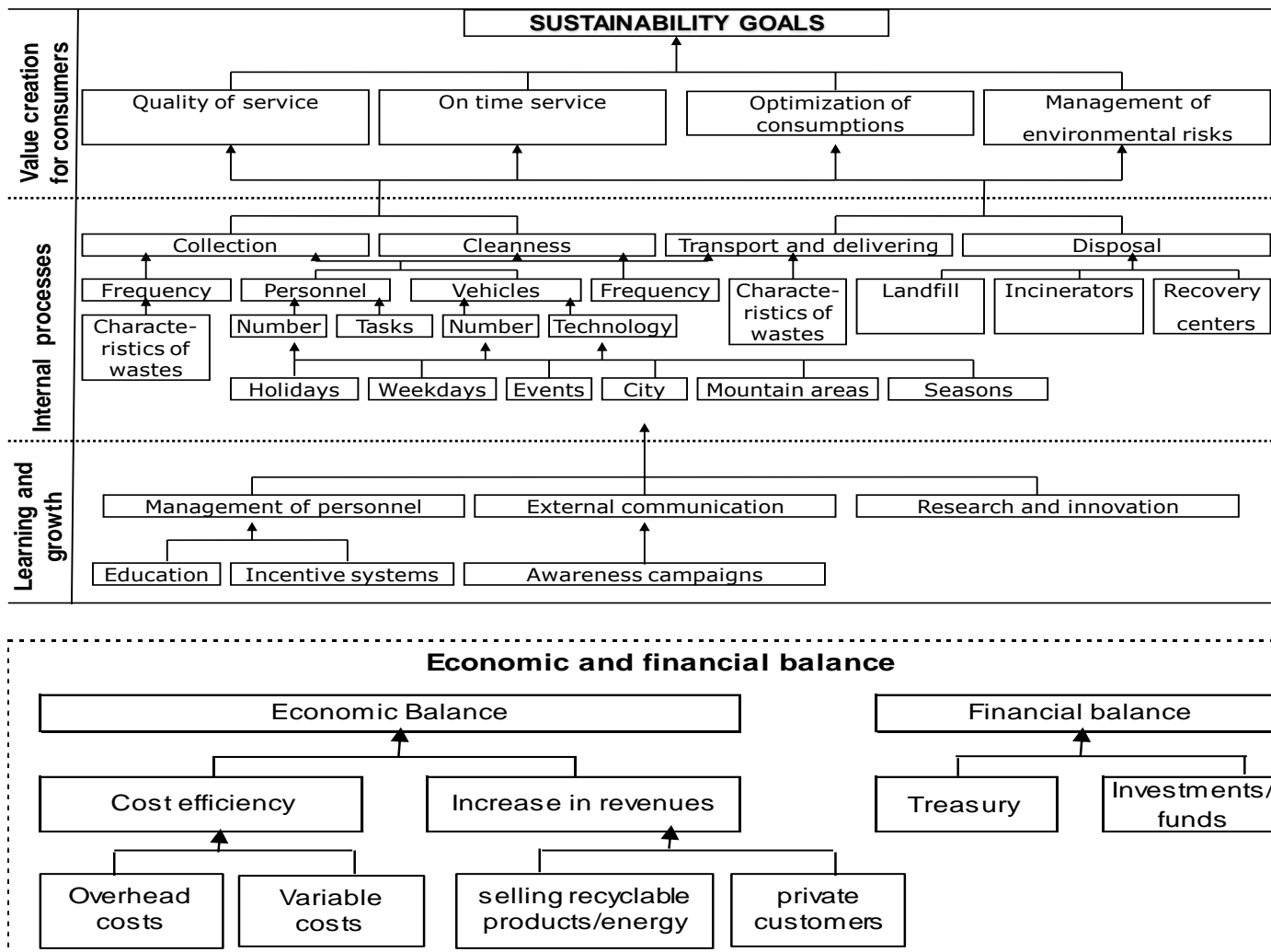


Figure 1. Strategy map for waste sector companies. Source: author’s own work.

strategic interference (which are not explicitly drawn in the map) proceed from the higher perspective to the lower ones. The perspectives are logically, rather than mathematically, related. The economic and financial perspective is presented separately because it influences the other perspectives while also being influenced by them. The economic and financial aspects are relevant to publicly owned enterprises, but they represent a constraint, not a final goal, because their management is focused on creating public utility rather than profits. Companies have to deal with the scarcity of resources and manage them efficiently and effectively in order to achieve excellence.

Starting with the highest perspective, the basic objectives of management are orientated toward the creation of value for final users (citizens). Such value creation can be attained through on-time service with high-level quality. It can also derive from an optimization of resource consumption in an attempt to reduce the

environmental impacts generated by company activities or an appropriate management of environmental risks in order to protect the firm’s area of operations and the health of residents. These key success factors enable companies to reach their environmental goals and enhance the wellbeing (quality of life) of local communities.

The second perspective concerns the internal processes in which the organization excels. The map highlights the critical processes which, if managed efficiently and effectively, will enable the organization to ultimately reach the goals of the first perspective. Based on the companies’ similarities, the critical processes concern collection (on public property or in private buildings), transport and delivery, the management of disposal centers, and urban cleaning.

The third perspective identifies the infrastructure that companies must build to create long-term growth and foster learning. This perspective takes into consideration the intangible assets of employee management, external

communication, and research and innovation. One key variable is represented by the campaigns undertaken to communicate the new initiatives directed at the area of operations and intended to engage citizens in the companies' goals and policies. These are powerful tools that help build trust and partnerships with the local community. The last intangible asset is research for technological innovation, which requires cooperation with suppliers and research centers in order to find the best technological solutions with the least environmental impact.

DISCUSSION

This study conducts a longitudinal analysis on how the sustainability issue can be a guiding principle used to define long-term goals and day-to-day activities, focusing on Italian state-owned companies in the waste sector. Many studies (Adams and Frost, 2008; Epstein and Buhovac, 2014; Epstein and Roy, 2001; Figgie et al., 2001; Schaltegger and Burrit, 2000; O' Connor, 2006; Schaltegger et al., 2012) have investigated the presence of social and environmental concerns in strategic goals. Our results show a high sustainability orientation in the sample, though too often these objectives are not formalized or communicated to the lower levels of the organization. The most prevalent strategy focuses on the prevention of harmful effects linked to behavior inconsistent with sustainability (Bieker et al., 2002).

Attention then turned to the strategy implementation tools that allow the execution of the sustainability goals. As has been observed in the literature (Martinez et al., 2015), these tools are not particularly widespread in the sample. The most advanced systems, business performance models, are used by only 30% of the sample (and one company will probably abandon the strategy map because it is too expensive). On the other hand, financial plans are widespread. However, if such plans are not linked to the strategic goals and other managerial systems, they can lose their strategic significance because they will fail to consider the variables that can affect the results. However, over the years, a positive trend emerged, as was observed by Gandini (2004). The limited diffusion of advanced managerial systems encouraged us to build a business model based on the logic of the strategy map that directly reflects the companies' strategy and considers the crucial problem of the alignment of different organizational units.

As suggested by many authors (Butler et al., 2011; Brusa, 2007; Epstein and Wisner, 2001; Figgie and Hahn, 2004), the four perspectives of the strategy map, suitably adapted to the peculiarities of the sector, include sustainability-related issues. According to Brusa (2007), the economic and financial perspective does not represent the main goal of a company. Indeed, the basic objectives of management should be oriented toward the

creation of value for final users (citizens), which can be attained via on-time service with high quality standards. In accordance with the main literature (Epstein and Buhovac, 2014; Schaltegger and Wagner, 2006; Figgie et al., 2002; Dias-Sardinha and Reijnders, 2001), the three pillars of sustainability are apparent at this stage in the will to i) optimize resource consumption and financial factors (economic); ii) rethink techniques and processes in order to improve service features and protect the area of operations and residents' wellbeing (social); and iii) reduce the environmental impact (environmental). This map could be a valid framework for companies operating in the waste sector as a way to trace the indicators necessary to monitor performance, but it must be adapted to the company's needs, mission, culture, and goals.

This study has several theoretical and practical implications, as it extends the literature on sustainability and strategic planning tools in public utilities companies, filling a gap that has been highlighted in the literature (Northcott and Taulapapa, 2012). The main limitation of this work derives from the research method chosen. The analysis of a limited number of companies does not allow statistical generalization. However, a qualitative investigation was necessary to understand fully how sustainability goals are integrated within the organizations. Future research could extend the number of case studies in order to validate our results, and also include private service providers in the waste sector to examine if a change in sustainability orientation occurs in the diffusion of strategic planning tools and in the features of the strategy map.

CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

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Full Length Research Paper

Model selection on tourism forecasting: A comparison between Bayesian model averaging and Lasso

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This study tries to tackle the tourism forecasting problem using online search queries. This recent-developed methodology is subject to several criticisms, one of which is how to choose satisfying search queries to be built in the forecasting model. This study compares two popular candidates, which are the Bayesian Model Averaging (BMA) approach and the Least Absolute Shrinkage and Selector Operator (Lasso) approach. Evidence shows that the two approaches produce similar forecasting performance but different query selection results.

Key words: Tourism forecasting, query selection, Bayesian model averaging, Lasso, Baidu query data.

INTRODUCTION

In recent years, much attention on forecasting based on user generated content (UGC) has been paid. One representative is the data from search engine services. The users of search engines search certain key words, or queries, to acquire some information on purpose, which leaves the service providers a new route to analysis users' motivation and information demand.

In addition to these analyses, forecasting on certain issues can be conducted. A typical example is the Google Flu Trends (GFT), initialized in 2008, which has made several successful forecasts of flu outbreaks in US. The first paper on this issue is Ginsberg et al. (2009).

However, GFT is not as successful as it was initialized, and it has gone through many criticisms. Those criticisms come from the worries about the uncertainties of the query data generation process (DGP) and the model

instability (Butler, 2013) for example. Nevertheless, the forecasting on other aspects based on query data still contributes knowledge to both practitioners and academia, for example in tourism forecasting (Bangwayo-Skeete and Skeete, 2015; Yang et al., 2015; Li et al., 2017). The difference of the performance in different areas using search query data emerges partially from the variable selection approaches and forecasting models.

In most research, variable selection procedures based on correlation coefficient, purely subjective index compositing or other criteria might be problematic. Several researches try to improve the forecasting model by introducing variable selection models, such as spike and slab (Scott and Varian, 2014) and other pioneer approaches. As pointed by Brynjolfsson et al. (2015),

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successful forecasting based on query data has several problems to be settled, one of which is to solve the variable selection problem.

This study employed two frequently-used models with variable selection property to build the forecasting model on tourists forecasting. They are the Bayesian Model Averaging (BMA) approach and the Least Absolute Shrinkage and Selector Operator (Lasso) approach. Lasso is first proposed by Tibshirani (2011), and has many successful variants in predicting genome, economic amounts etc. BMA is sufficiently described in Hoeting et al. (1999), and it also has several follow-up updates.

In general, the two approaches can both select variables and conduct forecasting; however the mechanisms are totally different. The BMA approach, presumably, believes uncertainties exist in each model. Instead of choosing the best model, it advocates to combine those top models selected through Bayesian Factor or other criteria. Lasso applies soft-thresholding by introducing a penalty on model parameters when minimizing its squared error objective. Due to the different originalities of the two approaches, the theoretical comparison becomes extremely hard and, even, trivial.

However, from a practitioner's point of view, choosing between the two approaches is extremely useful. Except for the forecasting performance, the best model sizes and which variables are selected through BMA and Lasso also contribute to the forecasting practitioners.

Forecasting models

This section is to recap the main specification of the Bayesian Model Averaging (BMA), Least Absolute Shrinkage and Selector Operator (Lasso). Without loss of generality, we assume the underlying true model is of linear form, as shown in Equation 1:

$$y = \alpha + X\beta + \epsilon, \epsilon \sim N(0, \sigma^2 I), \quad (1)$$

where α is the constant, X contains K covariates with N observations, and β is the $K \times 1$ vector. Besides, in this model, we assume homoscedastic standard errors. Based on this specification, we now discuss the main results of BMA and Lasso.

Bayesian model averaging

To allow model uncertainties, we rearrange model (1) as

$$y = \alpha_\gamma + X_\gamma \beta_\gamma + \epsilon, \epsilon \sim N(0, \sigma^2 I), \quad (2)$$

with γ as the model index, where $\gamma = 1, 2, \dots, 2^K$. Each model of (2) in the Bayesian framework requires assumptions on priors of coefficient parameters β and variance σ^2 . Following the tradition assumption,

(Feldkircher, 2012; Moral-Benito, 2015), we assume β follows a normal distribution with parameter Zellner's g in Feldkircher (2012):

$$\beta_\gamma | g \sim N\left(0, \sigma^2 \left(\frac{1}{g} X'X\right)^{-1}\right), \quad (3)$$

where different specifications of Zellner's g would yield different model performance and model size. The choice of g could be fixed, for example, N (Unit Information Prior), empirical Bayes g whose idea is to use the information in the data to help improve the models, and Hyper- g prior who gives the ratio $\frac{g}{1+g}$ a Beta prior and usually we set $g = N$ therefore $E \frac{g}{1+g} = \frac{N}{1+N}$. Importantly, $\frac{g}{1+g}$ acts as a shrinkage factor because from Equation (3) we have

$$E(\beta_\gamma | y, X, g, M_\gamma) = \frac{g}{1+g} \widehat{\beta}_\gamma^{OLS}, \quad (4)$$

hence smaller g yields harder shrinkage on parameter estimates, which can be regarded as a way of variable selection.

The variance σ^2 has a non-informative prior

$$p(\sigma) \propto \sigma^{-1}. \quad (5)$$

In addition, each model M_γ is assigned with a prior probability $p(M_\gamma)$. Normally, the priors of the models can be of any form, as long as it follows the subjective knowledge of the person who conducts forecasting. The most convenient priors are the Uniform, the Binomial and the Beta-Binomial (Doppelhofer and Miller, 2004; Ley and Steel, 2009). After specifying all the priors, we can then calculate the posterior model inclusion probabilities through

$$p(M_\gamma | y, X) = \frac{p(y | M_\gamma, X) p(M_\gamma)}{p(y | X)}, \quad (6)$$

where $p(y | X)$ is the integrated likelihood, and it can be calculated through

$$p(y | X) = \sum_{s=1}^{2^K} p(y | M_s, X) p(M_s) \quad (7)$$

After estimating the in-sample posterior densities of models and parameters, we can then conduct out-of-sample forecasting y_f according to

$$p(y_f | y) = \sum_{i=1}^{2^K} p(M_i | y) \int p(y_f | \theta_i, y, M_i) p(\theta_i | y, M_i) d\theta_i, \quad (8)$$

where $\theta_i = ((\alpha_i, \beta_i)')$, while $p(y_t|\theta_i, y, M_i)$ is the out-of-sample likelihood and $p(\theta_i|y, M_i)$ is the posterior of parameters in model i . When the number of regressors becomes larger, the enumerate methods seem to be implausible, instead MCMC sample is the best choice to approximate the posterior densities of models. At any state, for instance t , staying at model i will jump to model j at state $t + 1$ according to the transition density p_{ij} . However, in general, the transition density is neither known nor reversible. Therefore, the most frequently-used algorithm is the Metropolis-Hastings algorithm in this case and we adopt a random walk kernel during the sampling, the transition from model i to model j is based on

$$p_{ij} = \min \left\{ 1, \frac{p(M_j|y, X)}{p(M_i|y, X)} \right\}, \quad (9)$$

then we can approximate all the relevant posteriors we need.

Lasso

The Lasso estimator on model (1) is to minimize the following criterion function:

$$(y - X\beta)'(y - X\beta) + \lambda \sum_{j=1}^K |\beta^j|, \quad (10)$$

and Lasso has a nice property against Ridge regression estimator

$$(y - X\beta)'(y - X\beta) + \lambda \sum_{j=1}^K (\beta^j)^2, \quad (11)$$

is that Lasso exhibit hard thresholding property which can rule out some irrelevant variables stricter than Ridge estimator.

Commonly, to guarantee the model stability of Lasso such that we can also mitigate model uncertainty to some degree, we apply cross-validation. Basically, we divide the sample into d subsamples. By taking $d - 1$ out of d subsample we estimate Lasso and take the rest one to compute the prediction errors. Then taking the average of the results, we can have a more stable forecasting model. In the empirical part, we choose to split the sample into 10 subsamples.

Notably, one might argue that the analysis here might be problematic since the time series structure could be destroyed during the cross-validation. However, the cross-validation here is not simply resampling over the original sample, instead block sampling methods are employed to keep the time series structure. Moreover, to have a more fair comparison, this paper does not expand

the model into ARIMA or other popular time series models, since the introduction of lags might offset the true effects from the queries. The extension could be made in the future, and model (1) can be extended to any desired form, while this paper only contributes a benchmark.

Data collection

We collect the daily tourist records from a five-star resort, Jiuzhaigou, in Sichuan province in China. The reason why we choose this resort is that this resort is a perfect representative of those resorts attracting considerable amount of tourists everyday, and it has stably long-run inputs than any other new started resorts. In addition, compared to other resorts, the data it has is well-recorded, thus the data quality can be guaranteed.

The corresponding search query data is collected from a search engine website, provided by a dominant search engine service supplier, Baidu, in China. This company takes huge market shares so that the sample selection bias, on an aggregated level, is mitigated than any other data sources. We collect the data using an enumerate manner, namely we first pick several representative queries by our subjective knowledge and then take the recommended queries from the recommendation system of the search engine. Once either few new queries are recommended or the new words are totally irrelevant from our subjective knowledge, we stop iterating.

Finally, we have 148 relevant queries as candidates as indicators for forecasting. The queries collected reflect numerous demands on the tours to Jiuzhaigou, as summarized in the following categories: the name of the resort and its relevant information, the detailed information on the scenes inside the resort, the travelling information regarding the plans, suggestions, routes and other resorts nearby etc. Since the queries are in Chinese, in which the forming of words are quite different from English, we code each of them into an English category plus a number as an identifier. For example, the fifth query about travel information is coded as "TravellInformation5". It can be seen that some queries are intuitively important since most of the travellers will search them while some queries recommended by the website are not a must for travellers to search. Subjective selection of queries become invalid given huge amount of candidate queries.

Therefore, it is needed to employ variable selection models to select the proper queries. Currently, we collect both the actual tourists records and the search query data from the 1st of June, 2012 to the 31th of August, 2014, with 822 observations on a daily basis.

Empirical comparisons

This section shows the comparisons of forecasting performance and variable selection between BMA and

Lasso. For the BMA models, the forecasting performance evaluation is based on the posterior means of the predicted tourist amounts in the out-of-sample evaluation. For the Lasso, we apply 10-folded cross-validation method, and use the best model to do out-of-sample evaluation. For the stability of the results, the evaluation of each model takes the average of 5 times evaluations. Compared to Lasso, some details of BMA are given, because the basic settings of BMA are much flexible than Lasso which only has one tuning parameter λ . Even though the Lasso is of simpler form, we also estimate Ridge estimator as a contrast.

To conduct this, we will consider the effects of different model priors, different MCMC sampling methods and different Zellner's g s. Since the Zellner's g acts as a shrinkage element which is viewed as the most important feature of BMA models, in the following empirical parts we first compare the models with different model priors and MCMC methods, then choose the best model featuring different Zellner's g to compare with Lasso.

Therefore after this short introduction, we then discuss the forecasting performance and the variable selection, and some estimate results of both BMA and Lasso are given prior to the comparison.

Model estimates

Before conducting the comparison, we first give some model estimates to have some straightforward ideas about the models involved, including the posterior inclusion probabilities of BMA models with different model priors, the quality of different MCMC methods and the shrinkage results of Lasso compared with Ridge estimator.

BMA estimates

We first estimate the BMA models. Since the performance model priors might be sensitive to the model's prior, that is $p(M_\gamma)$, we employ three different model priors to be compared for robustness, that is, uniform prior, binomial prior, and the beta-binomial prior. In addition, to avoid the case where certain MCMC sample is not effective in this particular research, we employ both the birth-death sampler and the reversible-jump sampler (Madigan et al., 1995).

In simple words, the birth-death sampler, in each round, randomly pick a variable to drop or to add, depending on whether the chosen variable is in the current model or not. The reversible-jump sampler assigns birth-death method a probability of 50% and for the other 50%, it swaps one of the variables already in the model with another one which is not in the current model. Importantly, the posterior mean of each parameter estimate is the weighted average across the top 200 models. To be

noticed, if a variable is not included in a certain model, the coefficient, that is, zero, is also accounted into this average.

In Figure 1, "uniform" means the model prior is of the uniform type, "fixed" means that the prior is of the binomial type with expectation of 20, and "random" means that the prior is of beta-binomial type. We can see that the model with uniform prior shrinkages smoothly and model with binomial prior shows unstable performance when assigning inclusive probabilities to variables. Nevertheless, all the priors make no huge distinction with each other (Figure 2).

The MCMC methods might suffer from some low-quality approximations, and one way to examine them is to compare them with the analytical results, which are those smooth and red lines in Figure 2. We find that the reversible jump MCMC has better quality than birth-death one. In general, the models with Beta-binomial are accompanied with the worst MCMC approximation, and the models with uniform, that is, a non-informative prior, are poorly approximated through MCMC because the uniform prior requires all the models being assigned with equal weights.

Lasso estimates

The algorithm used to implement Lasso is the coordinate descent method. We first select the penalty parameter, λ without cross-validation. The number of λ sequence employed is 100. This is the same to ridge regression. Figure 3 explicitly shows the hard-thresholding property of Lasso. In this empirical question, we have 148 independent variables in total. The horizontal axis is the penalty term realization of Equation (10) on the left panel in Figure 3, and the penalty term realization of Equation (11) on the right panel. As we can find, the shrinkage in Lasso is stricter than in Ridge. As the penalty becomes larger, given λ , less variables will be screened out in Lasso; while in ridge regression, the shrinkage is milder. Obviously, the chosen model given λ might be unstable somehow, therefore when we conduct forecasting we use cross-validation to select proper models, and the criterion of model selection of the cross-validation consists of three types: Deviance, MAE (Mean Absolute Error), and MSE (Mean Squared Error). The results will be discussed in detail in the forecasting performance section.

Forecasting performance

Now we make use of the estimates, and employ the test sample to calculate the RMSE (Rooted Mean of Squared Errors) to make comparison. We use 800 out of 822 observations to estimate and select the model, and let the other 22 to be an out-of-sample for evaluation.

The outcome can be read from Table 1, and the overall

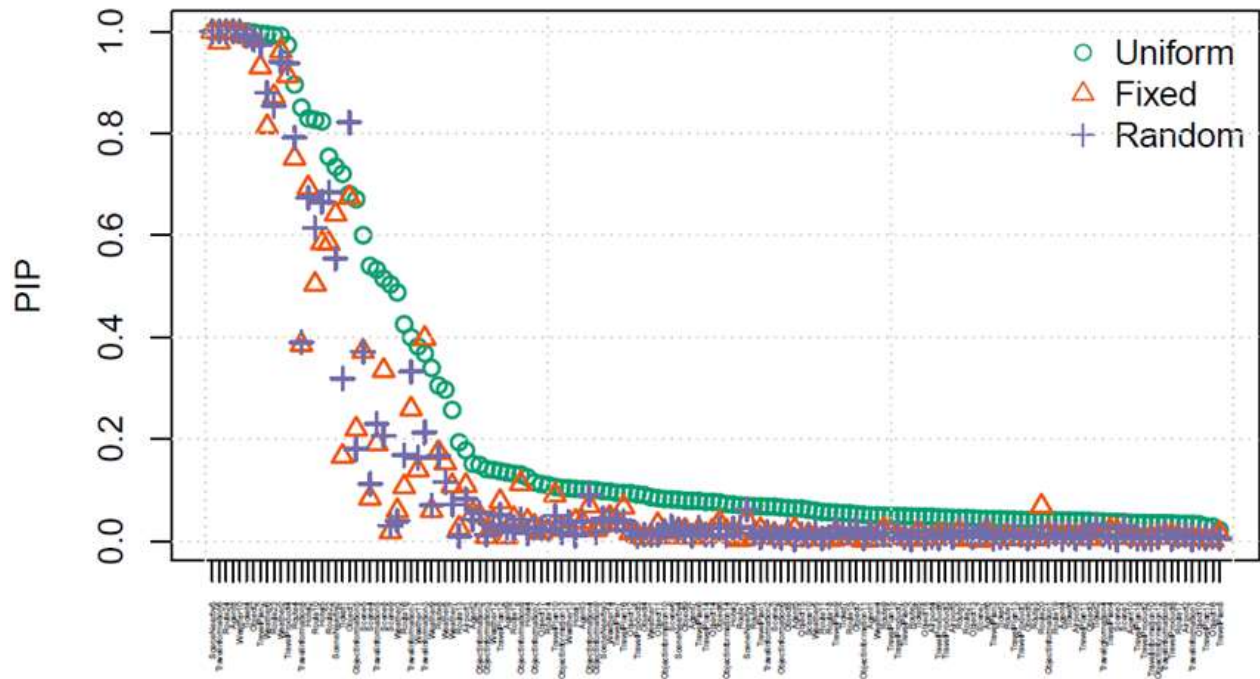


Figure 1. Posterior inclusive probabilities with different model priors.

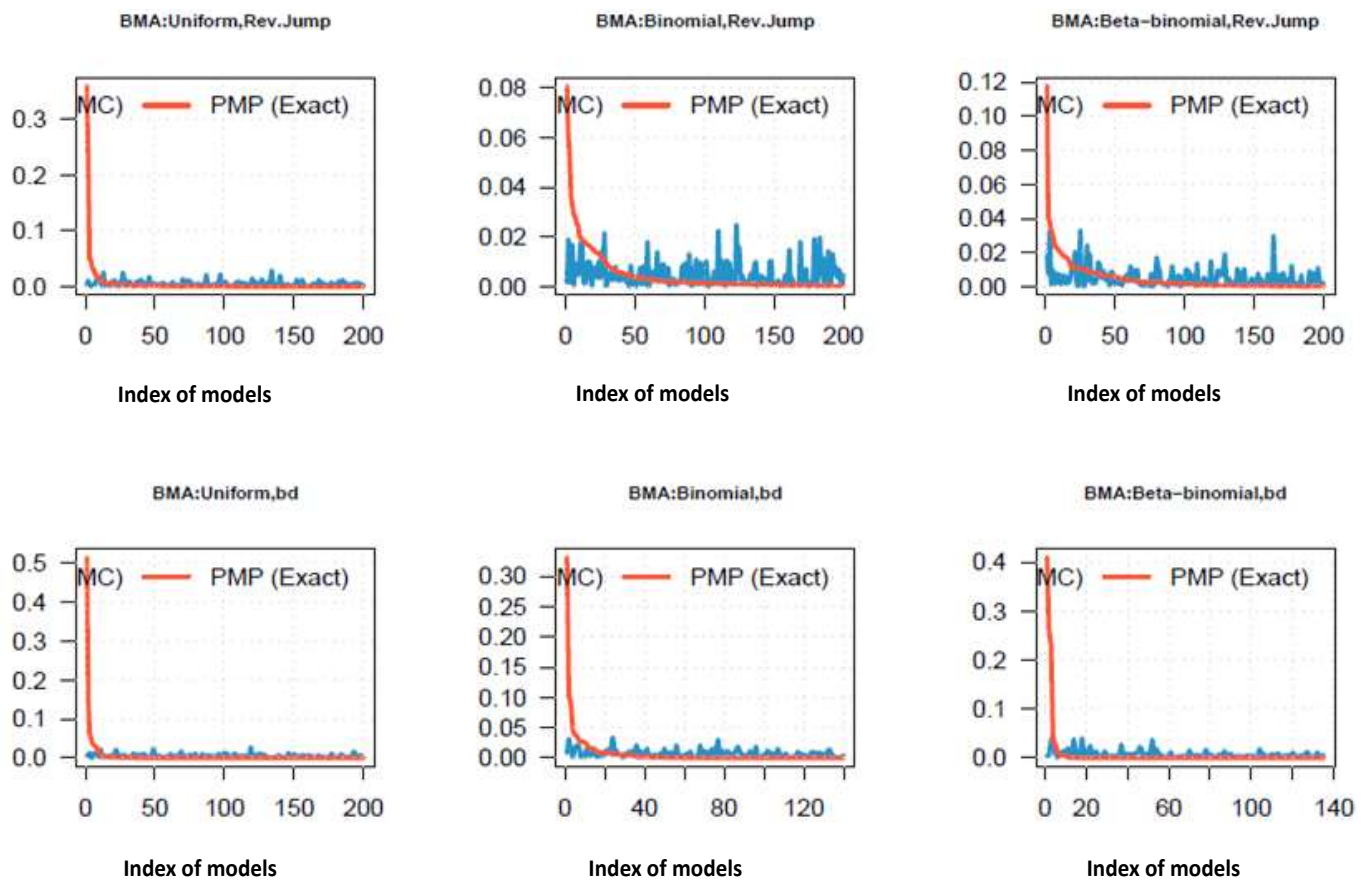


Figure 2. Posterior model probabilities of MCMC and analytical results.

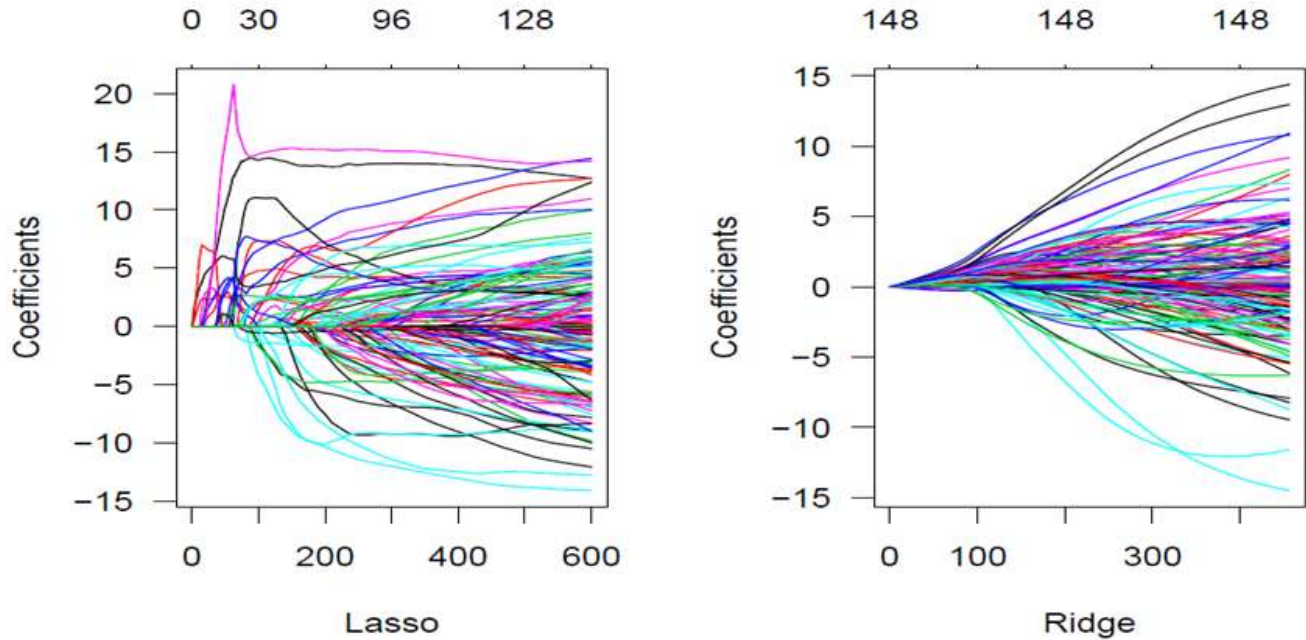


Figure 3. Model selection of lasso and ridge regression.

Table 1. Forecasting performance.

Model	Detail	RM SE
BMA	Uniform, Birth-death	3892.62
	Binomial, Birth-death	3903.516
	Beta-binomial, Birth-death	3912.273
	Uniform, Reversible Jump	3644.754
	Binomial, Reversible Jump	3861.538
	Beta-binomial, Reversible Jump	4075.911
Lasso	Lasso	5214.74
	Ridge	7978.638
	Lasso-CV-deviance	3934.523
	Lasso-CV-mae	4014.339
	Lasso-CV-mse	3794.487
BMA	Uniform, UIP	3517.69
(Zellner's g)	Uniform, EBL	3571.29
	Uniform, Hyper-g	4044.663

distribution of residuals can be seen in Figure 4. It can be read that the best performance is from the BMA with uniform prior and the reversible jump MCMC method. In general, we find that the forecasts using uniform priors are the best, using binomial ranks second and beta-binomial performs worst among the BMA forecasts. This might be an evidence that the non-informative priors actually are

good at forecasting. For the lasso, the forecast with MSE cross-validation performs best, and this might be due to that the criterion we use for out-of-sample evaluation is RMSE, which is the closest criterion to MSE. From the numerical results, we do not find whether BMA outperform Lasso, or the other way around in general. If we further look at Figure 4, we also find that the residual sequences

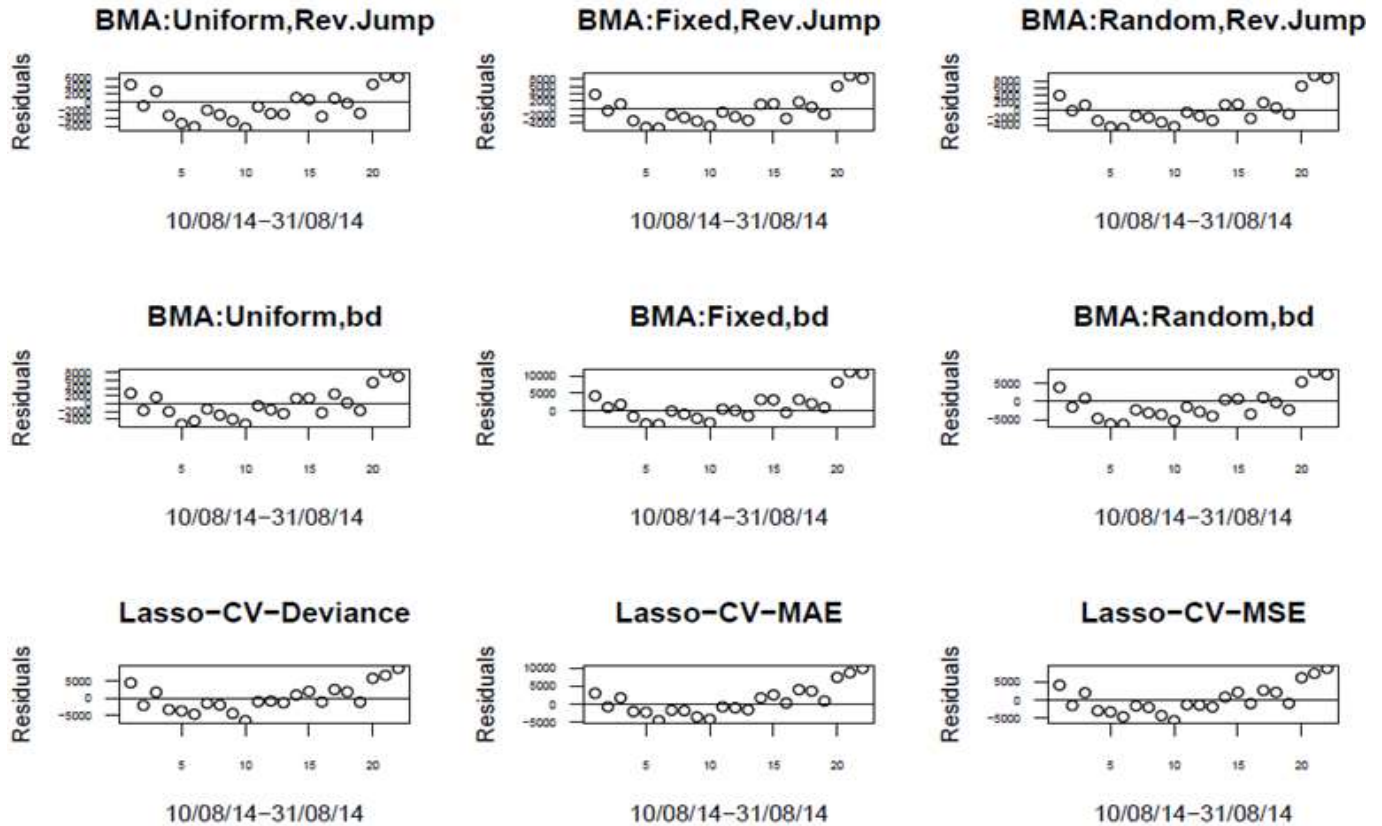


Figure 4. Residual plots for BMA and lasso.

have similar patterns, that is, some fluctuations or seasonal patterns on a weekly basis. This implies that the models can be improved considering more complex time series variants such as ARIMA, ARCH, etc. However, in this paper, the linear model is sufficient for comparison of query selections so we will not complicate the settings.

Till now, we only take various model priors and MCMC methods into account. As a crucial element, the Zellner's g seems to play more important roles in forecasting and model selection. We choose three types of g s in our research: fixed with $g = N$, the Empirical Bayes, Local type (Hansen and Yu (2001)), and the hyper- g type (Liang et al., 2008).

Based on the "best" model, that is, model with prior uniform and with reversible jump sampler, we conduct the evaluation 5 times, and take the average. The RMSE are 3517.69, 3571.29 and 4044.66, respectively. It can be read that, still, the simple rule wins, since the model with uniform model prior and fixed g has the best performance. It outperforms Lasso, but we cannot say BMA is definitely better than Lasso, since the performance difference is not huge. Nevertheless, the performance reached by both BMA and Lasso is satisfying, compared to the previous results, even though there is space to improve (Figure 4).

Model size and variable selection

First of all, the variable selection here is somewhat confusing in BMA context, since the philosophy of model averaging is proposed against model selection. However, we can treat the posterior inclusion probability (PIP) as the measure of likelihood that certain variables should be included or not. The PIPs demonstrate the posterior probabilities that a variable is included in the models. This is calculated through the summation of the posterior probability of those best models including this variable.

It would be trivial to compare the variable selection if the model sizes are not taken into consideration. In other words, the larger model has more variables, and it has high probability to contain all the variables selected by the small model. Therefore, we first compare the model sizes across different models.

For the BMA models, the model priors affect the model sizes, however, since the likelihoods dominate the posterior as sample size becomes larger, the model sizes are mainly affected by the information underlying the data. In Figure 5, we compare the models with different model priors and Zellner's g s. For the Uniform prior, the expected model size is around 70, while the posterior size is around 30. For the Binomial prior, since we set the

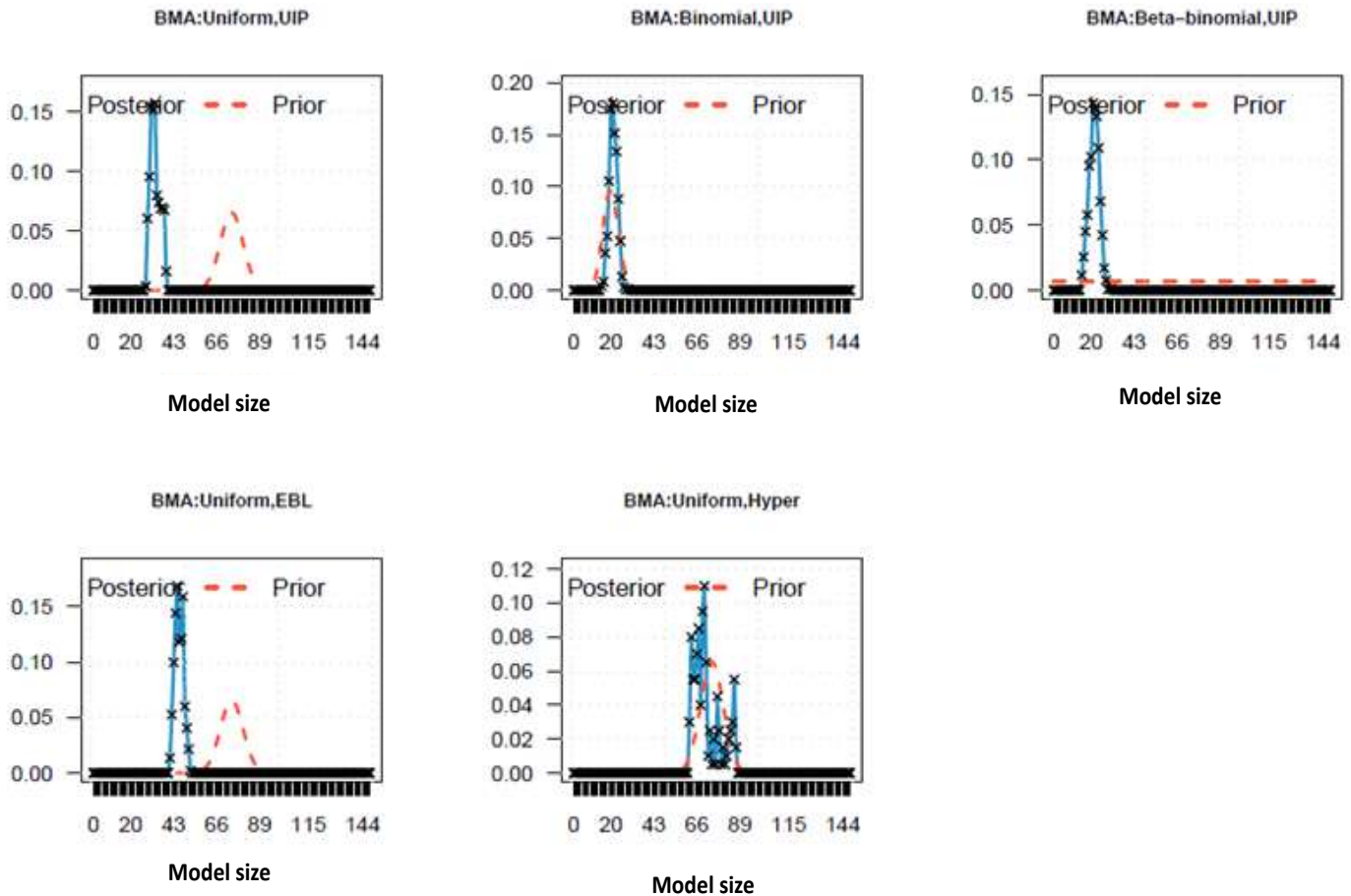


Figure 5. Model size of BMA.

expected model size as 20, the posterior is also around 20. For the Beta-binomial, the prior is totally flat over the horizontal axis, while the posterior is still around 20. Zellner's g does affect the posterior model sizes, and we find that more complex g yields more complex posterior size distributions. In addition, all the models with uniform priors has larger model sizes because the prior "drags" the posterior toward it (Figure 5). The model sizes of Lasso with cross-validation, as in Figure 6, are around 30 or slightly above. Cross-validation with deviance selects the best model with the size around 30, similar to the mae type. However, the MSE type are slightly larger.

All the comparisons earlier mentioned show that the model sizes differ little between Lasso and BMA. This implies that the intrinsic model size supported by the data is around 30 to have a better forecasting performance. Therefore, it is interesting to see whether Lasso and BMA select similar variables or not. If they select several common variables, the practitioners can then pay more attention to those common queries.

The variable selection results are given in Table 2, and the variables on the list are selected by the Lasso with deviance. If other methods have extra selected variables,

then we currently do not report them in the table, since those variables are not important in magnitude, and this does not affect our results because we can see that the estimates of those on-the-list variables are similar. For the BMA estimates, we not only show the parameter estimates, but also give the posterior inclusive probabilities, which is an indicator whether certain variables are not important from BMA point of view. Of course, all the candidate variables has been assigned a PIP, but most of them are very low (Figure 6).

Conclusions

Forecasting tourist arrivals is beneficial. Using online information to conduct forecasts is of great value. In the past, we have no choices; while nowadays, we have too many choices. Selecting proper queries to be built in the forecasting models plays crucial roles among practitioners and academia. Previous research reveals the limitations of conducting simple index composition, or variable selection based on correlation coefficient or other criteria.

Lasso and BMA are both ways to select statistically

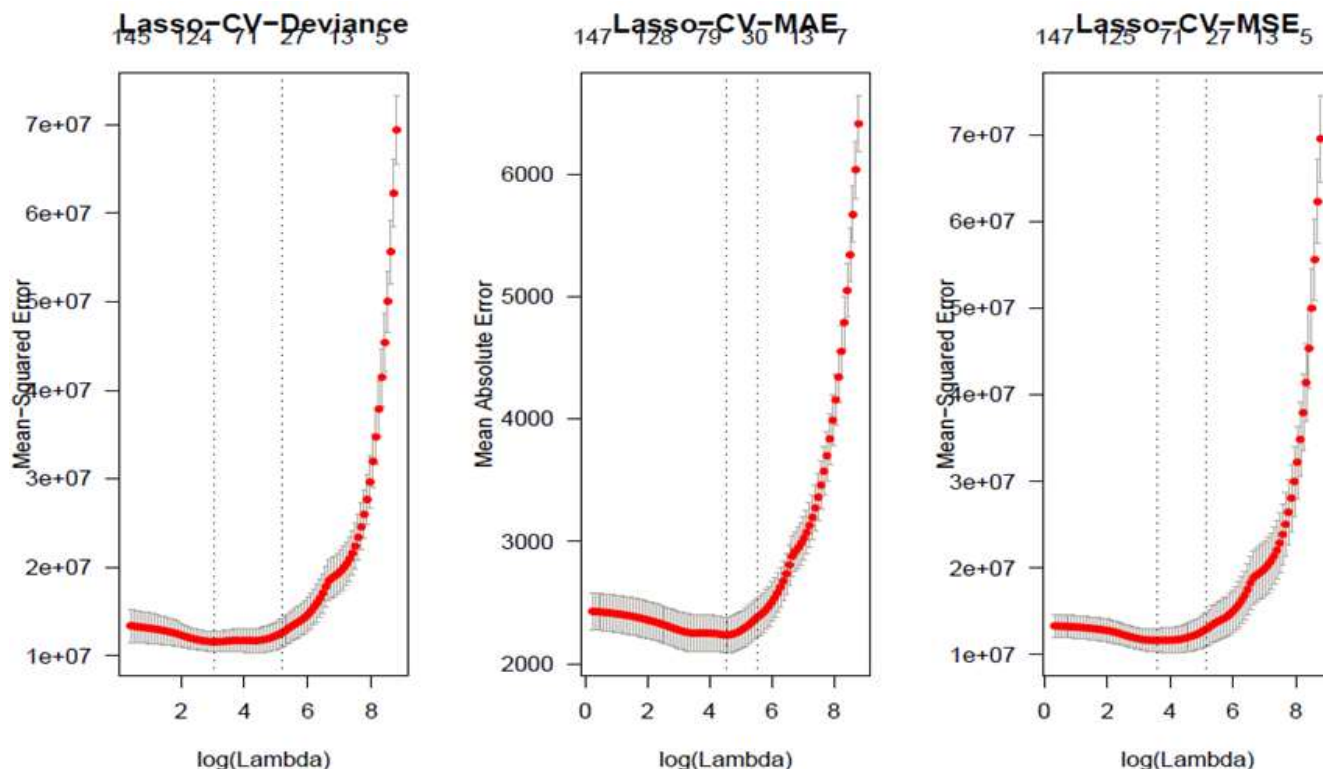


Figure 6. Model size of Lasso.

Table 2. Variable selection results.

Variable	Deviance	Lasso			BMA	
		MAE	MSE	UIP	EBL	Hyper
Object1	0.07	0.07	0.06	0.16 (0.80)	0.05 (0.30)	0.16 (0.74)
Object2	4.60	4.78	4.76	5.06 (1.00)	4.69 (1.00)	3.84 (1.00)
Object8	1.55	1.91	2.13	0.26 (0.09)	0.58 (0.16)	2.09 (0.68)
ObjectInformation 5	-2.73	-3.99	-8.35	-6.13 (0.49)	-9.13 (0.71)	-16.89 (1.00)
ObjectInformation 8	7.20	7.34	7.13	0.32 (0.06)	1.12 (0.24)	4.50 (1.00)
Scene2	3.53	3.77	5.70	2.73 (0.34)	1.56 (0.19)	9.26 (1.00)
Scene4	0.43	1.52	4.93	6.42 (0.49)	11.77 (0.84)	15.72 (1.00)
Scene5	14.4	14.2	14.17	5.75 (0.41)	13.01 (0.95)	11.16 (1.00)
Scene8	6.24	6.53	7.72	3.81 (0.32)	3.86 (0.37)	10.26 (1.00)
SceneNearby2	0.004	0.04	0.21	0.27 (0.51)	0.57 (0.98)	0.18 (0.39)
TravelPlan3	0.04	-0.18	1.4	0.07 (0.03)	0.04 (0.03)	1.31 (0.36)
TravelPlan10	11.03	11.06	10.12	0.53 (0.10)	0.09 (0.03)	0.59 (0.21)
Route10	-0.45	-1.34	-4.23	-12.71 (1.00)	-12.44 (1.00)	-11.59 (1.00)
Route12	-0.73	-1.69	-4.09	-0.76 (0.15)	-1.11 (0.16)	-5.56 (1.00)
Route23	0.49	1.37	5.42	14.06 (0.98)	14.96 (1.00)	13.55 (1.00)
Agent1	1.78	2.04	2.62	0.71 (0.14)	0.47 (0.14)	3.47 (0.75)
Agent8	-1.38	-1.41	-1.54	-1.81 (1.00)	-1.92 (1.00)	-2.17 (1.00)
Agent10	-0.51	-0.53	-0.53	-0.03 (0.12)	0.00 (0.08)	-0.10 (0.82)
Weather2	2.60	2.55	2.50	3.58 (1.00)	3.94 (1.00)	4.21 (1.00)
Weather4	0.10	0.17	0.14	-0.03 (0.06)	0.00 (0.00)	0.00 (0.00)
Weather6	3.37	3.45	3.87	8.03 (1.00)	9.13 (1.00)	10.17 (1.00)
Weather9	0.63	1	-	-0.96 (0.15)	-3.30 (0.50)	-3.37 (0.58)

Table 2. Contd.

Ticket2	1.48	1.16	0.40	0.07 (0.06)	1.01 (0.24)	0.94 (0.70)
Ticket4	14.62	14.8	15.23	15.13 (1.00)	14.51 (1.00)	13.47 (1.00)
Hotel1	1.96	2.17	2.35	1.26 (0.17)	0.39 (0.10)	6.14 (0.72)
Hotel2	7.51	7.37	6.82	6.48 (0.65)	10.65 (0.97)	6.62 (0.51)
Travel product4	1.80	2.19	3.38	7.75 (1.00)	5.66 (0.79)	0.00 (0.00)
Other variable	No	No	Yes	Yes	Yes	Yes
RMSE	3934.523	4014.339	3794.487	3517.687	3571.288	4044.663

important variables. We employ these methods to conduct forecasts, and the models exhibit satisfying performance. In addition, the difference of performance between two approaches is not huge, while BMA with uniform model priors and unit information prior on Zellner's g performs best.

Lasso demonstrates strict shrinkage and selects fewer queries entering the models, while BMA selects queries based on posterior inclusive probabilities. There are several important queries which are both selected by Lasso and BMA, while some other variables chosen by BMA are screened out by Lasso, vice versa.

It is still open for expanding the models featured with more complex components, however computational issue is another vital point to be studied in depth, especially with more queries implemented by MCMC methods.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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Full Length Research Paper

Internal auditing and financial performance of public institutions in Kenya: A case study of Kenya Meat Commission

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Internal auditing provides audit services to the management at all levels, including board of directors and audit committee, thus improving the organizations corporate governance. The objectives that guided the research were effect of corporate governance on financial performance and effect of audit committee on financial performance. The researcher used case study research design; this was due to the fact that data was collected from one organization only, that is, Kenya Meat Commission (KMC). The sample size was all fifty seven management staff at KMC. Open and close ended questionnaires were used to collect primary data from the respondents. The data collected was quantitative. Descriptive statistics, time series and regression analysis were used to analyze the data. The data was presented in the form of tables. The data collected ascertained that internal auditing plays a major role in the financial performance. The findings of this study, however, are at odds with the aforementioned position. The researcher found that the relationship between the internal audit function existence and financial performance at the KMC was insignificant. That is, existence of internal auditing does not influence the profitability and return on investment. The researcher recommends that the internal audit function should be more independent and manned by competent staff. There should also be an independent oversight body to oversee the operations of the state corporation.

Key words: Financial performance, internal auditing, corporate governance audit committee.

INTRODUCTION

Internal auditing is often seen as an overall monitoring activity with responsibility to management for assessing the effectiveness of control procedures which are the responsibility of other functional managers (Kent, 2003). Internal auditing is taking on increased importance in many of today's global organizations by assisting management in evaluating controls and operations and

thereby providing an important element of global control. Internal auditing is an independent, objective assurance and consulting activity designed to add value and improve an organization's operations (Kent, 2003). Being independent and objective, internal auditing helps an organization accomplish its objectives by bringing a systematic, disciplined approach to evaluate and improve

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the effectiveness of risk management, control, and governance processes.

According to Millichamp (2000), Mainoma (2007) and Sani (2009), internal auditing includes among others reviewing the adequacy and effectiveness of internal control system, its compliance with government regulations, accounting rules and standards, securing the asset of the organization in order to prevent misappropriation. This ensures that the organizational goals and objectives are achieved. Internal auditing acts as an in-house consultant on control matters. Hermanson and Rittenberg (2003) deduced that an effective internal audit function existence leads to superior organizational performance. Similar sentiments were expressed by Prasad and Rao (1989). They observed that the internal auditor saves the organization from malpractices and irregularities by acting as a watch dog. This helps ensure high level of productivity and profit.

Peursem (2004), a study undertaken in New Zealand, internal auditors were required to evaluate the importance of their functions in connection with audit engagements. The findings of the study were true professions exist although it does not dominate auditors with high level of experience and are in public practice have significant influence over the management. Additionally, if the auditors have accountancy training, their influence level is high due to the fact that they are members of accountancy professional bodies. These findings are supported by Coopers and Craig (1983), Cooper et al. (1966) and Gramling (1997), who had portrayed reservations over the effectiveness of the role of internal auditors. Peursem conducted a follow up study in New Zealand to determine whether the auditor influences his role. This involved checking on internal auditors' objectivity while working with the management so as to be able to report on their performance.

The findings of the study were that for those internal auditors who best balanced their role, they had external professional status and their organizations had both formal and informal communication network. Sunday (2007) conducted a study on internal audit function and corporate governance. The study established that there is a positive relationship between quality of internal audit function and quality of corporate governance. Makoju (2000) noted that bureaucracy and sluggishness of government employees has resulted to the inadequate performance of state corporations. The issue of high incidences of fraud and government staff employment being inclined to political affiliation rather than ability to perform was also found to have contributed to the inadequate financial performance.

In his study, Dogo (2003) established that the existence of accounting systems of public institutions in Kenya does not guarantee proper and up to-date financial records. This made auditing of such institutions very cumbersome if not impossible. The study also established that accounting control practices such as internal auditing of a

company plays a key role in the success of an enterprise as it prevents possible deviations from the predetermined objectives and policies. Therefore, the study recommends that public institutions should install exhaustive system of accounting controls in order to better financial performance. The study focused on existence of accounting systems and performance of public institutions. However, it failed to establish the influence of internal auditing on financial performance. Therefore, this research seeks to investigate the ways in which internal auditing influences financial performance in public institutions in Kenya.

RESEARCH DESIGN AND METHODOLOGY

The research design adopted case study design. This is because data was collected and analyzed from 57 management staff at Kenya Meat Commission. A case study is an in depth investigation of an individual, group, institution or phenomenon (Mugenda, 2003). The target population comprised 57 management staff from all the 15 departments at the Kenya Meat Commission. A census study will be conducted. Primary data was collected from the respondents using open and closed ended questionnaires. The reason for using a questionnaire is because it is cheap and quick as compared to face to face interview. The questionnaires were developed from the three mentioned variables that is corporate governance and audit committee which are the independent variables and financial performance which is the dependent variable. It had four sections, section one constituted the bio data of the respondents, section two had questions on internal auditing function in the institution, section three had questions on the influence of internal auditing on financial performance and the last was on financial performance. The indicators of each variable were used to develop questions using the likert scale. Data was summarized in tables and the mean values calculated for each variable as shown in Tables 2, 3 and 4.

The questionnaires were administered using drop and pick later method. This is because some of the respondents are seniors officers and the researcher had difficult time accessing them due to their busy schedules. Data was collected in the month of July 2012. The data collected was quantitative. Descriptive statistics and time series were used to analyze the quantitative data. Time series is an arrangement of statistical data in accordance with the time of its occurrence. According to Yule and Kendall (2000), "When we observe numerical features of an individual or a population at different points of time, the sets of observations constitute a time series". The following regression model was generated to show the relationship between the independent variable and the dependent variable.

$$Y = a + \beta_1 X_1 + \beta_2 X_2 + e$$

where Y = Financial Performance, a = Constant, X₁ = Corporate Governance, X₂ = Audit Committee, β_j = Coefficient of X_j, and e = Error Term

Table 1 gives an explanation of the independent and dependent variables used in the study.

RESULTS AND DISCUSSION

From the 57 questionnaires distributed, 50 filled in questionnaires were collected. Tables 2, 3 and 4 indicate

Table 1. Description of variables used in regression analysis.

Variable	Type of variable	Explanation of variables
Corporate governance	Predictor-X1	Whether there is indication of corporate governance factors
Audit committee	Predictor-X2	Financial statements Integrity and independence of audit function
Financial performance	Dependent-Y	Annual profit targets

the mean and the standard deviation for the variables. Table 2 shows the influence of internal audit independence on financial performance. Table 3 shows the influence of corporate governance on financial performance, while Table 4 shows the influence of audit committee on financial performance. The mean score of the study ranges from 1.49 to 4.59, while the standard deviation ranges from 0.045 to 1.61. For a five point likert scale, this is an indication that the study concepts were being practiced in a reasonable level. Additionally, the standard deviation is small. This implies that the study sample is a reasonable reflection of the population (Saunders, 2006). The study used both correlation and regression analysis to test the relationship between dependent and independent variables. Tables 5 and 6 show the correlation, while Tables 7, 8 and 9 summarize the regression statistics for the regression model. These include regression coefficients, F-statistic and the regression coefficients. The parameters indicate that the regression model was significant. This means that the independent variables not only have positive influence on financial performance but it is also significant.

As shown in Table 2, the mandate of the internal audit department is properly stated by company management was rated the highest with a mean score of 4.60 followed by management's open door policy with a mean score of 4.54. The internal audit reports being handled by top management rather than the finance manager, the internal audit department authority is properly stated, and the appointment or removal, promotion and remuneration of all internal audit staff is by merit were rated slightly above average. Further, internal audit reports and recommendations are acted upon by company's management, and the internal audit department staff is adequate qualified and experienced was rated slightly below average. No restrictions to any part of the company or to any document, and autonomy in work execution were rated lowest. The finding of the study that the internal audit function's mandate is properly stated by company management was highly rated as asserted in earlier studies by Sani (2009), who noted that internal audit is responsible for the audit of all financial transactions by conducting an ongoing carrying examination of all accounting books and records maintained in the organization with a view to checking or detecting fraud and correcting errors. According to Mathison (2005), the scope and objective depend upon the responsibilities assigned to the internal auditor by the

management, the size and structure of the enterprise and the skills and experience of the internal auditor.

The finding of the study that the internal audit department of the company has inadequate staff that is qualified and experienced contradicts earlier studies of Sabari (2003) and Dandago (2000) who concluded that internal audit department should be properly organized, adequately staffed and equipped to be able to effectively perform its functions. However, Sunday (2003), argued that the internal audit function's mandate depends upon the size, structure and management of the organization. Therefore, it is different for each organization. According to Momoh (2005), the internal auditor should ensure that all financial transactions comply with approved regulations and that there exists sufficient security in the undertaking.

As shown in Table 3, accountability was rated the highest with a mean score of 4.91 followed by disclosure and transparency with a mean score of 4.81. Leadership had a mean score of 3.98 while stakeholder's rights had a mean score of 3.40. This is an indication that all corporate governance factors considered in this study had impact on financial performance with accountability, disclosure and transparency and leadership taking the lead. The finding of this study reaffirms earlier study by Sani (2009), who concluded that leaders must be transparent and accountable. According to Fadzil et al. (2005), accountability is the whereby state corporations, organizations and the people within them, are made answerable for their decisions and actions, including how they manage public funds and all facets of performance, and yielding themselves to appropriate external scrutiny. Adeniyi (2004) noted that people in leadership positions are faced with different forms of accountability to their various stakeholders. Dittenhofer (2001) concluded that efficient use of resources, strengthened accountability, improved management and service delivery can be brought about by leaders who practice good governance, hence, contributing to reduction in poverty and improvement in people's lives. Bejide (2006) opined that transparency helps stakeholders have assurance in the decision-making processes and actions of parastatal organizations. Therefore, corporate governance essentially leads to accountability, disclosure and transparency and effective communication to various stakeholders.

As shown in Table 4, financial statements integrity was rated the highest with a mean score of 4.74 followed by

Table 2. Internal audit function.

Variable	N	Mean		Std. Deviation
	Statistic	Statistic	Std. Error	Statistic
Company's management has properly stated the mandate of internal audit function	57	4.5965	0.10871	0.82071
There is autonomy in work execution	57	1.8596	0.19460	1.46919
The management uses open door policy	57	4.5439	0.10931	0.82527
Appointment, removal, promotion and remuneration of all internal audit staff is by merit	57	2.60	0.194	1.462
The internal audit department authority is clearly stated	57	2.65	0.193	1.458
There are no restrictions to any part of the company or documents	57	1.49	0.146	1.104
internal audit reports and recommendations are acted upon by management	57	2.47	0.196	1.477
The internal audit department staff is adequate, qualified and experienced o	57	2.47	0.196	1.477
The internal audit reports are handled by top management reports rather than finance manager.	57	2.63	0.195	1.472
Valid N (listwise)	57	-	-	-

Table 3. Corporate governance and financial performance.

Variable	N	Mean		Std. Deviation
	Statistic	Statistic	Std. Error	Statistic
Disclosure and transparency	57	4.81	0.073	0.549
Leadership	57	3.98	0.213	1.609
Stakeholder's rights	57	3.40	0.239	1.801
Accountability	57	4.91	0.045	0.342
Valid N (listwise)	57	-	-	-

internal audit function with a mean score of 3.98. External auditor independence and risk management systems had a mean score of 3.32 and 3.05, respectively. The finding of this study concurs with Papadatou (2005), who stated that integrity comprises both straightforward dealing and completeness. He noted that integrity requires honesty and objectivity, and high level of morality in the management of public funds and resources, and management of an organization's affairs. According to Papadatou (2005) integrity relies on the control framework effectiveness and moral standards and professionalism of the

individuals within the organization and it is reflected both in the organization's decision-making procedures and in the quality of its financial and performance reporting. Internal audit function was also found to have major impact on financial performance which was reaffirmed by Roe (2004), who stated that "the audit function evolution is as a result of search for information by interested parties in order to assess performance of others in whom they have vested interest". He additionally argued that interested parties need audit function as a monitoring mechanism as it enforces accountability. A study by KPMG (2007)

found that the existence of internal audit function in organizations results in improved performance and helps in undertaking forensic audit in cases of corporate calamities like financial fraud. Thus, internal audit due to its nature of being a watchdog could protect the organization from the unethical practices and irregularities hence allowing the organization to achieve its objectives of ensuring high levels of productivity and profitability. According to Millichamp (2000), internal audit constitutes independence, staffing, training, relationship, due care, planning, controlling and recording, system control, evidence,

Table 4. Audit committee and financial performance.

Variable	N	Mean		Std. Deviation
	Statistic	Statistic	Std. Error	Statistic
External auditor independence	57	3.32	0.163	1.227
Financial statements integrity	57	4.74	0.089	0.669
Internal audit function	57	3.98	0.213	1.609
Risk management systems	57	3.05	0.169	1.274
Valid N (listwise)	57	-	-	-

Table 5. Corporate governance-financial performance.

Corporate governance (X ₁)		
Financial performance (Return on Investment)	Correlation (r)	0.665
	Sig. (2-tailed)	0.0322

Table 6. Audit committee-financial performance.

Audit committee (x ₂)		
Financial performance (Return on Investment)	Correlation (r)	0.518
	Sig. (2-tailed)	0.0079

and reporting. Essentially, then, internal audit cannot undertake its functions without these key elements. Bejide (2006) established that internal audit service will help reduce overhead, identify efficiency improvement ways and uncover possible losses as a result of insufficiently safeguarded company assets which result in reduced profitability. Similarly, Barrett (2002) had stated that internal audit is key in performance improvement. Fadzil et al. (2005) had established that internal auditors help in increasing shareholders value through running the company efficiently and effectively. Hermanson and Rittenberg (2003) had concurred with these findings that the existence of an effective internal audit function is associated with high levels of organizational performance.

Hypothesis testing

The null hypothesis stated that there is no relationship between the corporate governance and the financial performance of KMC. The study showed that there was a strong positive relationship between corporate governance and financial performance of the company as indicated by the correlation coefficient. These findings, as indicated in Table 5, can be generalized given that the significance level was below the acceptable level of 0.05 (p-value < 0.05). It was 0.0322, while the correlation coefficient was 0.665. Based on these findings, the null hypothesis was therefore rejected.

On whether audit committee influenced the financial performance of the company, the null hypothesis stated that there was no relationship between the audit committee and the financial performance. The study, however, revealed that there was a significant level of relationship between the two as shown by the coefficient of correlation, that is, 0.518. The p-value was less than the acceptable significance level of 0.05 (p-value < 0.05), meaning that these findings were acceptable and can be generalized. Based on the results presented in Table 6, the null hypothesis was rejected.

A model summary was used to predict the value of the dependent variable using independent variables. This study's dependent variable was financial performance of Kenya Meat Commission (Return on Investment), while the independent variables were corporate governance and audit committee. The R-value was 0.6721, as indicated in Table 7, meaning that there is a strong positive relationship between the dependent variable and the independent variables. The R Square was 0.5824 implying that 58.24% of the financial performance in KMC can be explained by the two independent variables covered in this study. The rest 41.76% of the financial performance can be explained by other factors that are not captured in the study. The regression model used was significant with the F statistic being 0.0298 (as shown in Table 7), which was less than the acceptable significance level of 0.05. This means that the independent variables do not only have positive influence

Table 7. Model summary.

Variable	Regression statistics
Multiple R	0.6721
R Square	0.3273
Adjusted R Square	0.5824
Standard Error	0.4104
Observations	50

Table 8. ANOVA analysis.

Variable	df	SS	MS	F	Significance
Regression	3	3.687086	1.229029	0.0298059	0.000433607
Residual	45	7.57822	0.168405	-	-
Total	48	11.26531	-	-	-

Table 9. Regression coefficients.

Variable	Coefficients	Standard Error	t Stat	P-value
Intercept	1.6125	0.282829134	5.701322128	8.64902E-07
X1 (Corporate Governance)	0.296666667	0.33506704	0.497412896	0.021319788
X2 (Audit Committee)	0.241306818	0.298145914	1.050050217	0.009301717

on financial performance but also the influence is significant. Based on this outcome, the prediction of the outcome of the study using this model was acceptable, that is, determination of financial performance (return on investment) the independent variables, namely, corporate governance and audit committee.

Using Excel, the values of the β s in the regression model ($Y=a+\beta_1X_1+\beta_2X_2+e$) used to determine the causal effect of the independent variables on the dependent variable were determined. The following are the values as extracted from Excel. From the tabulated aforementioned figures, the completed model was:

$$Y = 1.6125+0.29667X_1+0.24130X_2+e$$

This means that 29.7% of the financial performance was caused by corporate governance. Another 24.1% was caused by the effectiveness and efficiency of the audit committee. There was another portion of the financial performance of KMC that could be explained by other factors besides the factors covered in this study.

CONCLUSIONS

Generally, it is believed that the existence of internal auditing results in increased organizational financial performance. According to Bejide (2006), internal audit

service results to reduction in overheads, efficiency improvement ways and uncovering of possible losses due to insufficiently safeguarded company assets all of which lead to reduced profitability. According to Hermanson and Rittenberg (2003), internal audit function existence leads to increased organizational performance. Similar sentiments were raised by Prasad and Rao (2000), through their observation that the internal auditor protects the organization from unethical practices and irregularities due to their nature of acting as watch dogs. This ensures high levels of profitability and productivity which are actually the organizational objectives. The study findings however disputes the position stated earlier. The researcher found that the relationship between the existence of an internal audit function and financial performance at the Kenya Meat Commission was insignificant. This means, existence of internal auditing does not influence the profitability of an organization. This finding contradicts that of KPMG (2000) which established that internal audit function and financial performance have a positive association. A survey conducted on 201 senior company executives in the United States, the KPMG, established that the existence of internal audit function in organizations contributes significantly towards performance improvement and identifying profit improvement opportunities.

The findings in this study are at odds with those of Fadzil (2005) which established that stakeholders' value

is increased because internal auditors helps in managing a company in a more efficient and effective manner. However, these findings agree to that of Griffiths (2000) which found internal audit and performance are uncorrelated. The study established that there are negative attitudes to internal audit and that the function lacked qualified staff. The insignificant relationship between internal auditing and financial performance may result from the size of KMC. The staff members in the internal audit department are only five. The department lacked professional autonomy while undertaking their duties. From the findings, the internal audit department lacked independence to execute their work thus audit conducted by the department was limited in scope. Accessibility to the highest level of management was lacking. Under these circumstances the watchdog job of protecting the organization from unethical practices and irregularities is greatly undermined. Political influence was determined by number of government appointees in board. Prasad and Rao (2000) had eluded that political influence is normally shown by the appointments inboard members. The effect of political influence on the relationship between internal auditing and financial performance was significant.

RECOMMENDATIONS

Based on these conclusions, there should be regular management and performance audits. This will help identify the underperforming areas. Also, the government should offload some of its interest to private enterprises with a view to minimize political influence in decision making. The board of directors should be appointed by a well-defined public interest groups such as business community, professional bodies and customers. The internal audit department should have more independence so as to be effective and enhance financial performance. The recruitment systems should be streamlined so that recruitment is done of employees who are qualified in their respective areas regardless of their political affiliation. There should be adequate marketing campaigns; this will help to increase the company's turnover. There should be an independence oversight body to oversee the operations of state corporations.

LIMITATIONS AND AREAS OF FURTHER STUDY

This study was a case study limited to Kenya Meat Commission. A survey could be conducted over other public institutions. Also, the study focused on internal auditing and financial performance. Future study involving other factors that may influence financial performance of public institutions may be viable.

CONFLICT OF INTEREST

The authors have not declared any conflict of interest.

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