IX SINGEP
Simpósio Internacional de Gestão, Projetos, Inovação e Sustentabilidade
International Symposium on Management, Project, Innovation and Sustainability
ISSN: 2317-8302
CYRUS Institute of Knowledge MAKE A DIFFERENCE
9TH INTERNATIONAL CONFERENCE

Contrastando metodologias de desdobramento de metas por meio de análise de performance estratégica e regressão em árvore de decisão

Contrasting goals deployment methodologies through strategic performance assessment and decision tree regression analysis

ÂNGELO BASTIANÉLLI SCARAMUSSA
UNIVERSITÀ DEGLI STUDI DI TRENTO

Nota de esclarecimento:
Comunicamos que devido à pandemia do Coronavírus (COVID 19), o IX SINGEP e a 9ª Conferência Internacional do CIK (CYRUS Institute of Knowledge) foram realizados de forma remota, nos dias **20, 21 e 22 de outubro de 2021.**

Agradecimento à orgão de fomento:
This research partnership between the Universidade Federal de São João del-Rei (UFSJ), Università degli Studi di Trento, and the firm Mereo Tech and Consulting was sponsored by the University of Trento within the program “International Mobility for Thesis Research/Final Examination Abroad”.

IX SINGEP
Simpósio Internacional de Gestão, Projetos, Inovação e Sustentabilidade
International Symposium on Management, Project, Innovation and Sustainability
ISSN: 2317-8302
CYRUS Institute of Knowledge MAKE A DIFFERENCE
9TH INTERNATIONAL CONFERENCE

Contrastando metodologias de desdobramento de metas por meio de análise de performance estratégica e regressão em árvore de decisão

Objetivo do estudo
Objetiva-se analisar quantitativa e qualitativamente os possíveis impactos dos diversos métodos de definição de metas adotados por quatorze empresas no seu desempenho estratégico global, ao mesmo tempo em que apresenta uma abordagem prática e compara elementos críticos das diferentes metodologias.

Relevância/originalidade
O estudo testa machine learning em dados gerenciais, aponta elementos relevantes de diferentes metodologias de definição de metas e introduz uma abordagem prática baseada em casos reais. Portanto, propõe-se uma discussão atualizada para profissionais e estudiosos de gestão estratégica.

Metodologia/abordagem
Valendo-se da análise de conteúdo (Bardin, 2016), apresenta-se uma abordagem alternativa para desdobramento de metas. Posteriormente, por um método estatístico descritivo denominado de regressão em árvore (James et al, 2013), um banco de dados com indicadores de performance é analisado.

Principais resultados
Observou-se a importância dos níveis hierárquicos baixo e médio para o desempenho corporativo. A regressão em árvore apresentada como uma ferramenta para análise gerencial. Elementos críticos das metodologias são diferenciados, enquanto BSC, MBO e Hoshin Kanri convergiram em impactos corporativos.

Contribuições teóricas/metodológicas
Enquanto apresenta uma visão geral sobre sistemas de controle de gerenciamento, com objetividade uma tabela contrasta os principais componentes dos métodos MBO, BSC, Hoshin Kanri e OKR. A contribuição continua ao testar estatisticamente experiências práticas com esses métodos no desempenho das empresas.

Contribuições sociais/para a gestão
Evidencia-se a importância do desdobramento de metas nos níveis hierárquicos intermediários e inferiores Apresenta-se o risco de aplicar metas ambiciosas, enquanto compara empiricamente os impactos de bonificação, sistemas de pontuação, metas individuais ou compartilhadas e evidencia métodos que desempenham com mais precisão.

Palavras-chave: Gestão de performance, Goals deployment methodologies , Regressão em árvores de decisão, Sistemas de controle e gestão

IX SINGEP
Simpósio Internacional de Gestão, Projetos, Inovação e Sustentabilidade
International Symposium on Management, Project, Innovation and Sustainability
ISSN: 2317-8302
CYRUS Institute of Knowledge MAKE A DIFFERENCE
9TH INTERNATIONAL CONFERENCE

Contrasting goals deployment methodologies through strategic performance assessment and decision tree regression analysis

Study purpose
This research aims to analyze quantitively and qualitatively the possible impacts of the diverse goals setting methods adopted by fourteen companies in their global strategic performance, while introducing a practical approach and comparing critical elements of the different methodologies.

Relevance / originality
The study tests a machine learning method to managerial data, pointing out relevant elements from different goals setting methodologies while introducing a hands-on approach based on real cases, thus it provides aa updated discussion to professionals and scholars in strategic management.

Methodology / approach
A content analysis (Bardin, 2016) expounds an alternative approach for goals deployment and complements the performance database with qualitative information. Then, relying upon descriptive statistical method called tree regression (James et al, 2013), such database is analyzed quantitively and qualitatively.

Main results
The importance of middle and low hierarchical levels for corporate performance was observed. Tree regression presented as a visual tool for managerial analysis. Methodologies' critical elements are differentiated, while BSC, MBO and Hoshin Kanri converged in attributes and corporate impacts.

Theoretical / methodological contributions
While briefly overviews management control systems framework, a crystal-clear table with key contrasting components of MBO, BSC, Hoshin Kanri and OKR is presented. The contribution goes on when testing statistically practical experiences from organizations with these methods on corporations' performances.

Social / management contributions
It sheds light on the importance of correctly cascading goals throughout middle and lower hierarchical levels, presents the risk of applying stretched goals, while contrasting empirically the impacts of bonuses, scoring systems, and finally evidences methods that performs more precisely.

Keywords: Performance management, Metodologias de desdobramento de metas, Decision tree regression , Management control systems

1. INTRODUCTION

Corporations face challenges from both internal and external environments. There are increasing competitiveness, uncertainty, and dynamism in markets and within complex and flatter organizational structures, and multifunctional teams are becoming quite common among companies, seeking agile answers to projects implementation as well as shifts in technologies and customers' demands. In this context, performance measurement systems might offer alternatives for more team participation and rapid adaptations in already defined goals while playing a central role in value creation.

Goal setting methodologies are increasingly going beyond purely financial indicators and reshaping the way organizations execute their strategy and mission. There are several specific management methodologies for the process of deploying performance indicators within organizations, for instance Management by Objective-MBO (Peter Drucker, 1954), Balanced Scorecard-BSC (Kaplan & Norton, 1992) and the Objectives and Key-Results-OKR (Grove, 1983). Such topics can include the possible conflicts between the short-term goals' orientation and the strategic long-term objectives of an organization, as wells as certain advancements in the operational performance with alignment to customer and financial performance, or even if there might be a preferable management system/methodology for a dynamic and digital market environment as many scholars are researching.

This research becomes pertinent considering the current debates on whether a specific management system can prevail among others with the power of having created detailed causal effects, directly or indirectly (Kaplan, 2010), on the strategic performance. Hence, it is going to be provided an overview on management control and the mentioned goals setting methodologies, an alternative model for goals deployment will be introduced, and statistical outcomes on the impact of those methods and their attributes on corporations are going to be discussed.

Considering that such range of methodologies for goals deployment is available, it could be common that organizations and scholars might question themselves whether some methods shall be preferable despite of others, or it could even be the case of combination of elements from different methodologies. Therefore, mapping key practices in place could reveal how the literature differentiates the goals deployment methodologies and how organizations are operating for reaching their strategic results. Hence, this article is querying if it would be possible to contrast statistically different goals setting methodologies – for instance OKR, BSC, MBO and Hoshin Kanri - by analyzing levels of achievement of strategic objectives from different corporations obtained from the execution of their performance appraisal systems, and to introduce an alternative model based on real cases.

Based on a qualitative assessment in the form of a *content analysis* (Bardin, 2016), this research aims to expound an alternative approach in place named Hybrid Model while complementing a database derived from a performance management platform with the observed information. Finally, from that database which contains either financial or non-financial indicators of fourteen Brazilian enterprises, relying upon a descriptive statistical method called *tree regression* (James *et al,* 2013), this research aims to analyze quantitively and qualitatively the possible impacts of the diverse goals setting methods adopted by the companies in their global strategic results.

2. THEORICAL BACKGROUND

2.1. An overview on management control systems (MCS) framework

MCS have become a relevant administrative tool in insuring organizations to determine what should be done and how it should be done by means of programs and policies and to get

people in the organization to do what they are minimally supposed to engage in. As defined by Anthony (1989), management control consists of "all methods, procedures, and devices, including management control systems, that management uses to ensure compliance with organization policies and strategies" and MCS as "an organized systematic process and structure that management uses in management control" (Anthony, 1989, p. 6), being composed of organizational arrangements, authorities, responsibilities and information that is collected and analyzed, evaluated and used to exercise of control and to process a set of action towards the institution's objectives (Anthony, 1989; Chapman *et al*, 2005)

With the rise of complexities inside and outside the entity, more questions put on the spot the idea of *controlling* and many other managerial elements. In this context, methodologies that align leading indicators of business performance are crucial for strategy execution (Drucker, 1999). The precise development of ideas for programs and their goals will influence the effective implementation of the strategy, and one first step can be having transparent and well communicated descriptions of the corporate strategies, that can take periods for the next three to five years, but it depends upon the company, and programming process should involve senior management, managers or other principals assisted by their staffs (Anthony, 1989; Fiterman & Silva, 2007; Strauß & Zecher, 2012).

A MCS embraces aspects of operations to keep all the companies' components in balance and in coordination by means of financial measures – monetary valuation as common denominator used to combine and classify different resources and activities –, or nonmonetary measures used to extend the scope and quality of the performance system. At least two general types of information flows must be processed: the planned data in the form of programs, budgets and standards, and actual data on what has happened or is actually happening, contrasting the actual performance with the planned performance (Anthony, 1989). It shall ensure, as well, feedback reporting information by which, over time and organizational units, the different objectives are reconciled for the company purposes, also by means of altering of behavior regularly and continuously (Fiterman & Silva, 2007; Strauß & Zecher, 2012; Chapman *et al*, 2005).

As mentioned by John Doerr (2018), organizations are "adopting robust, dedicated, cloud based management software […] [by which] with three or four clicks, users can navigate a digital dashboard to create, track, edit, and score their goals" (Doerr, 2018, p.82). Making progress measurable headway against a target or flag can be a key element in motivation and engagement, sometimes influencing more than by means of public recognition, monetary inducements or even by achieving the goal itself (Doerr, 2018). It is fundamental for the good functioning of a management control system people's familiarity with the nature of the structure, resources and goals of the organization, and the processes that will make this work. (Chapman *et at*, 2005; Strauß & Zecher, 2012).

Concerning goals duration (time span of the programs), if it is short, performance measurement should be frequent and actual result compared with short-run measures. The measurement of the performance should consider certain key activities of the organization that thrives the firm's profitability. Organizations can have specific ways of deploying such indicators and have also "pet" key variables that are developed based on specific internal or market needs, but also on past experiences and special strategies. Systems of performance appraisal focuses on performance measurement rather than strategy formulation, yet the strategy must be transposed into tactic actions. Such process requires methods with the appropriate techniques that align leading indicators of business performance for the strategy execution (Drucker, 1999; Tennat & Roberts, 2001a).

2.2 Four basic goals deployment models

Aiming to provide a framework review on MBO – Management by Objectives (Doerr, 2018; Hayes, 2020, Tosi *et al*, 1970), BSC – Balance Scorecard (Drucker *et al*, 1999; Kaplan & Norton, 2010), OKR – Objectives and Key Results (Cintra, 2019; Doerr, 2018; Marr, 2020a, 2020b) and HK – Hoshin Kanri (Tennat & Robert, 2001a) models descriptions, the Table 1 takes the form of a comparative visualization tool between elements that can be considered for the design and operation of key performance indicators (KPIs) in performance appraisal systems. The first column of Table 1 brings basic categories to be analyzed from the perspective of each methodology. These common topics constitute fundamentals that organizations should consider for differentiating each approach.

Table 1:
Contrasting goals deployment methodologies: MBO, BSC, OKR and Hoshin Kanri.[a]

	MBO	BSC	OKR	Hoshin Kanri
Key focus	Open ended model in measuring performance with quantitative or qualitative or both. It defines "what": preestablished targets needs to direct people actions to the whole organization. Usually, goals are challenging yet attainable.	Aligns financial measures with perspectives on customer satisfaction, internal processes and organization's innovation and improvement activities, aiming continuous improvements and value creation.	"What", an objective and "how", the key results goals. Can be extremely aggressive or aspirational, based on measurable, specific, and time-bond initiatives, aligned to qualitative gains. It may provide agile responses within the organization.	Applies the lean language: planning processes for quality management, prioritizing means for implementing a long-term vision. Teams' participations are expected in the process of defining tactical goals.
Targets cascading process and direction	Top-down, always requiring superior consultation and approval.	Considering the company's vision, executive teams and senior managers develop the goals, initiatives, and measures (top-down)	Bottom-up, sideways, and top-down. Often employees are expected to have autonomy in defining around half of their goals and measures.	Catching ball practice: bottom-up nature in the process of cascading goals. Managers with operational contribution in defining goals.
Time spam of goals	Goals with annual basis.	Annual goals, quarterly checks.	Quarterly or monthly targets duration.	Considering a 5-year horizon, one-year plan and monthly diagnostics.
Visibility	Confidential between employee and manager.	Shall be well communicated as a strategic map throughout the firm.	Publicly shared, totally transparent at all levels.	Partially public.
Review cycle	Feedback from executives' evaluation aiming to identify outstanding and bad performance.	Given by the learning and growth perspective by testing, analyzing, and adapting the hypothesis from the strategy.	It requires real-time reporting: keeping plans and focus on practical actions. Scoring, self-assessment and reflection as reviewing performance.	Feedback takes form of bottom-up and cross-functional inputs. Annual review based on reports concerning the implemented processes and issues into new goals for next cycle.
Definition of success	"Roof shot": a roof must be achieved – 100%.	Goals are usually expected to be reached in full.	60-70% defines success, meaning more stretched goals.	Fully attainment of the targets – 100% is success.

Linked to financial bonuses	Yes.	Can be associated to bonuses.	Mostly dissociated from compensation.	Possible.
Motivational tools	Being linked to financial compensation. Development of succession plans for employees with good performance.	Building consensus on strategy and vision rather than control. Importance of communication. Integration by individuals' behaviors and actions towards common vision.	Transparency for corporate alignment and cooperativeness. Individual autonomy, regular feedbacks, teams networking, emotional comfort for experimentation. Ambitious yet realistic goals.	Translating top management goals within the organization requires teams' members involvement and contribution, allowing strategic objectives to impact tactical daily management.
Drawbacks	Fear of failure in the job evaluation can often lead to ad-hoc implementation and troubleshooting; Less feasible for starting firms that do not have defined internal processes and to stablish measures; "Set it and forget it" issue due to low people engagement.	People have few freedom to design goals considering their own interests; Can suffer of "set it and forget it" issue; Different perspectives can give conflicting signals due to inherent trade-offs; It can take a long period to develop an appropriate scorecard.	Can lack of visual connection between objectives and key results; Conflicts may rise when aligning individuals' targets to the the corporation strategy and mission; Short-termism can damage long-term objectives; Limitations in applying the method to certain industries, usually traditional ones.	It relies on a lot on preconceived and long-term plans, becoming too rigid for quickly adaptations. Can be much restricted in developing processes improvements towards quality strategies despite of other perspectives.

Note. Constructed by the author, 2020. [a]Craddock, K. (2012, February 13), Kanbanize. (2020, November 21), Loyer, C. (2019, September 12), Nascimento, J. (2019, June 25), Pagano, R. (2019, April 17), Ruggieri, R. (2020, November 21), Siteware. (2018, July 16), Tennant, C., Robert, P. (2001b),

3. METHODOLOGY

The research takes two complementary forms of analysis, one exploratory and other statistical. First, based on a content analysis as proposed by Bardin (2016) which investigates a contemporary phenomenon in its real context by speeches analysis constituting cases studies. The assessment relied upon interviews and surveys methods (companies and specialists had either options to take part of the research) and they were based on the granularity of the obtained database, on the contribution given by the literature review about the topic and, finally, on the interview provided by Mereo Tech's partner, Ivan Cruz Jr., which introduced an alternative model and outlined critical elements for a performance appraisal system.

Table 2 presents a matrix of the manner the companies were assessed (by survey, interview, or experts' consultations who were Mereo consultants who supported implementing the performance management platform at its clients) and the respondents distribution belonging to each goal setting methodology (BSC, OKR, Hoshin Kanri, Hybrid, MBO or none specifically). Mereo Tech and Consulting, a company that in partnership with this research, beyond the interview with its partner, has also shared its KPIs management platform database which includes part of its clients' goals/targets. These customers are Brazilian enterprises of variable sizes, usually medium and big companies from diverse industries, from software and electronic payments provider to electronic retailer and dental health supplier, with national and international markets coverage. KPIs from fourteen different companies composed the

performance management database collected from a management platform where each organization kept and controlled its own stablished goals along different organizational levels.

Table 2:
Counting of companies by goal setting methodologies versus the inquiring method applied.

Goal setting methodology applied:	Inquiring method:			Total
	Survey	Interview	Mereo's Experts	
BSC		2	2	4
OKR			1	1
Hoshin Kanri	1	1		2
Hybrid	1	1	1	3
MBO	1		1	2
None specifically	1		1	2
Total	4	4	6	14

Note. Source: Author, 2020.

Subsequently, relying on the database which has been completed with extra information gathered through the surveys and interviews from the qualitative assessment, the empirical analysis turns to a statistical methodology called *tree-based* or *decision tree* method. It forms a common *machine learning* tool for markets and managerial analysis due to its approach to handle both qualitative variables - in the form of categorical observations without the need to create dummy variables - and quantitative variables and outcomes. *Tree-based* methods are expected to be more efficient for cases like this one in which the relationships between the predictors and the response variable are non-linear, non-continuous and complex, functioning as a descriptive method that is not ultimately designed to test hypotheses (James *et al*, 2013; Solvers, 2020; Eagland, 2018).

Therefore, this study resorts to a *tree-regression algorithm* that stratifies and segments a prediction space in a number of simple regions, then predictions for a given observation can be made typically by using the mean of the observations in the region to which it may belong, meaning that it is going from observations about an item (which are represented in the graphics by the tree branches) to conclusions about the item's target value (then represented in the leaves). In tree-regressions, the target variable takes the form of continuous values, usually real numbers, and the branches represent conjunction of features that lead to the specific means of those target variables (James *et al*, 2013). The statistical analysis will present the relations between the considered variables (trees' branches) and the outcomes (trees' leaves).

Aiming to simplify the exposition of the database, Table 3 illustrates its structure where the first row in blue refers to each variable name and the second row in yellow shares the possible manifestation for that predictor, which is always represented in its column, and then each new row concerns one specific goal that belongs to a specific firm – companies are identified in the first column with acronyms to protect their privacy rights – and the hierarchical level in that company – second column, going from top level management as letter 'A' and down to lower level staff until "E". Represented by the third row and on, a total of 12,525 goals sums up the observations of the database, divided into 2,457 observations for the year 2018 that belonged to three enterprises, and 10,068 goals for the fiscal year 2019 belonging to all fourteen companies in the database.

The content analysis was used to supplement the information contained in the database, for instance by allowing the addition of the goal setting methodology that each company has adopted (in the Table 3, the 5th column from left to right named "METHODOLOGY"), whether that specific company applies a scoring system to its goals or not (4th column, "SCORE

SYSTEM"), and if that company has linked all, part of or not linked its goal to financial bonuses (6th column, named "LINKED TO BONUS").

Table 3:
Format illustration that the performance management database takes, its variables, and possible categories.

FIRM ID	HIERARCHI-CAL LEVEL	WEIGHT	SCORE SYSTEM	METHODOLOGY	LINKED TO BONUS	TYPE	GOAL	ACTUALLY PERFORMED	GOAL ATTAIN-MENT
Company acronym	From top management 1, 2… to lower levels 4, 5.	0 to 100%	YES; NO;	MBO; BSC; OKR; Hoshin Kanri; Hybrid; None	YES - Some; YES - All; No	Individu-al; Shared; Project	Integer values	Integer values	(Actually performed/ target)-1
MM	C	15.00	NO	MBO	YES - All	Shared	32.00	124.00	-0.627
EO	A	5.00	YES	OKR	No	Individual	3.00	5.00	0.667
FM	D	18	YES	Hoshin K.	YES - All	Individual	1000	6644	5.644
BO	B	15.00	YES	BSC	YES - Some	Individual	274.19	1262.93	-0.009
PN	C	30.00	NO	MBO	YES - All	Project	100.00	94.20	-0.058
IU	E	50.00	NO	Hybrid	YES - All	Individual	1500.0	4718.00	2.145

Note. Source: Illustrative table created by the author. Data from Mereo Tech's Performance Management Platform, interview, and surveys, 2020.

Variables obtained directly from the database correspond to the weight of each goal (Table 3, 3rd column, "WEIGHT") going from 0 to 100%, which can represent the importance of that goal for composing a final grade or performance when averaged with other targets for an individual, team or project, belonging characteristic corresponding to another variable that is categorized in the column "TYPE" (7th). The variable "GOAL" (8th column) concerns the planned integer value that this specific goal should achieve in the end of the period. Yet, "ACTUALLY PERFORMED" (9th column) is the true value that was performed along the period, in which results could be below or above the aimed measure.

To assess the degree to which each goal was achieved, the variable "GOAL ATTAINMENT" (Table 3, last column on the right side) was created based in the proportion of the preestablished goal value (variable "GOAL") that was finally achieved by the "ACTUALLY PERFORMED" obtained result. The Equation (1) synthesizes the rationale behind the created variable, where the purpose is to zero the equation result when the goal is fully achieved, and either to present an integer number below zero for goals that were underperformed or to present a positive above one for performances that overreached their planned goals measures. This equation also evidences the proportion of the original target value that was obtained in the end of the considered period for that specific goal:

$$(1) \quad "Goal\ attainment" = \frac{"Actually\ performed"}{"Goal"} - 1$$

As it could be noticed, the database corresponds mainly to qualitative variables that can work as independent variables, or predictors in the case of a decision-tree analysis, which sometimes take the form of two or more categories, examples are "HIERARCHICAL LEVELS" with more five categories, "SCORING SYSTEM" that forms a binary observation with *yes* or *no* manifestations, "TYPE" with *individual*, *shared* or *project* goals. For the dependent variable, or the response that the regression might segment, there is the quantitative variable "GOAL ATTAINMENT", which expresses the degree to which the goals were reached.

4. RESULTS AND DISCUSSIONS

4.1.The Hybrid Model for goals deployment

The "Hybrid Model for Goals Deployment" has been shared by *Mereo Tech and Consulting*'s partner Ivan Cruz by phone call in May 2020, that is a management software developer and consultancy company in Brazil which has observed a mixed type of strategic goals setting methodology among different industries and enterprises, also referring to this model as an adaptable alternative for organizations that want to motive employees both by compensation plans and aspirational goals.

A particularly important starting point is to host employees that share the same culture as the organization has, and the employees' selection and retainment should consider the competences and attitudes expected from each collaborator in consonance with the vision the organization shares. Collaborators should be personally aligned with the organization *purpose* in business, and this alignment works by itself as one motivational driver for goals attainment (I. Cruz. Phone call. May 06, 2020).

The organization's strategic plan, which was defined by stakeholders about what the company ultimately aims to achieve, shall be well communicated and then broken down into each department with local employees' participation, meanwhile requiring superiors' validation, either from same areas or from higher hierarchical levels, phase when negotiations along the goals definition and the appropriate measures should take place. This concerns a *catching ball* practice similarly to the Hoshin Kanri method: goals deployment initiating from the corporation strategy in a top-down process, but negotiations taking place with the bottom-up participation, fact that also drives people motivation in attaining to the management control system.

Such catching ball deployment practice allows teams to know better the actions that contribute to achieve the planned goals and, thus, alignment is easier reached. Real cases have evidenced that in small companies it is easier to obtain alignment between organization levels, but once the company grows, it becomes particularly complex to build alignment between teams and hierarchical levels when each employee could create his/her own goals, and therefore the Hybrid Model suggests that *someone* with a whole view of the organization should run this process of targets development and validation, working as a managerial controller (I. Cruz. Phone call. May 06, 2020).

The Hybrid Model encompasses the concept of ambidexterity by allowing simultaneous adaptation of both stretched goals (aspirational) and achievable goals (Yoshikuni *et al*, 2018). The later aims particularly to pursue what shareholders desires just as profitability, financial streams from the core business, therefore they must be fully attained. Parallelly, stretched goals, challenging ones, can be running with focus on riskier activities that seek innovation and creativeness, for instance on products development or new markets entrance, with the ultimate objective of guaranteeing company's future positioning ahead of competition through technology and competitive advantage.

Those aspirational targets are usually not linked to bonuses or compensation payments since they count on very risk conditions for execution and their failure can be more perceived as a learning opportunity and will not impact the core business performance in the short run. However, the SMART measures (achievable goals) are expected to be entirely reached and can be associated with variable remuneration, which also works as a motivational element in a MCS (I. Cruz. Phone call. May 06, 2020). Likewise, all types of industries can adapt different proportions of SMART and stretched goals in accordance with their peculiarities, linking or not with compensation plans, but always coping with the organization's purpose.

The time cycle of a Hybrid goal depends on each type of indicator, business cycle, and company or product maturity. Though there is not exactly pattern, in many cases goals were set on an annual basis of closure but with monthly checks of their current performing state, thus mixing both temporal perspectives. In this last example, the review phase considering the next cycle takes place after the consolidation of the annual performance from each goal and area.

Indicators in this model focus mainly on *end* targets rather than *means* to achieve strategic objectives. The Hybrid Model is also more consistent with team performance measurement, as Ivan Cruz stated, "goals can never be considered to be fully belonging to an individual, because the performance of a specific area depends on everyone in it, and a manager's goal depends on everyone in his team" (I. Cruz. Phone call. May 06, 2020). Thus, the shared understanding is that the model embraces more an area or team and requires cooperativeness.

This been said, it can be noticed that the Hybrid Model requires strict monitoring on the attainment process towards the planned goals. By checking the ongoing progress, out-of-performance indicators shall be deeply analyzed and discussed to find alternative perspectives on the root causes for problems, as well as proposing and adopting countermeasures actions to rebound into the planned route. Moreover, the management control system requires smart informational devices that works as a car's dashboard display, letting employees effectively aware about what is important and the current state of their goals. This management routine for monitoring goals combined with the ritual of participation in the indicators' construction are critical elements of the "Hybrid Model for Goals Deployment".

4.2.Tree regression as a descriptive model in analyzing goals setting elements

The quantitative analysis presents a statistical modeling that could flag the importance of specific elements (explanatory variables) applied by the companies when relying upon one or another goals deploying method to their performance achievements (the response variable). The assumptions of continuity and normal distribution are missing because observations are mostly constituted by non-binary explanatory variables:

- HIERARCHICAL LEVEL takes the forms of letter 'A' (the higher hierarchical level to which the goal belongs as CEOs or presidents) to 'E' (the lower staff level a goal has belonged in this study);
- SCORING SYSTEM being a binary variable 'yes' or 'no', if applied, goals counted with upper and lower boundaries that validate their accomplishment;
- METHOLODOGY used for each observation (goal) represented by 'MBO', 'BSC', 'OKR', 'HK' for Hoshin Kanri, 'Hybrid', or 'None';
- BONUS in terms of 'Yes-all' goals, 'Yes-some' goals or 'No' goal linked to pay-for-performance tactic;
- TYPE meaning an 'Individual' goal, 'Shared' as a team target or goal referred to a specific 'Project';
- WEIGHT is the only explanatory variable that is not categorical, but it will always take values between zero and one hundred indicating the importance of the goal in a final performance grade composition.

Considering such data arrangement, it can be considered a case of supervised learning classification with a response variable that takes the form of continuous values, which is represented by the 'GOAL ATTAINMENT' variable. The regression was run considering the response variable in two manners: first, each observation (goal) had its own GOAL ATTAINMENT value considered as response to whatever hierarchical level the observation had belonged; second, the *average* of GOAL ATTAINMENT for the *top management level 'A'* of each company was considered as the response variable for all the hierarchical levels below

the top management (which are levels 'B', 'C', 'D' and 'E') of each company. Therefore, in this second case, goals (observations) belonging to level 'A' were excluded from the predictors space for that regression, aiming to consider how the middle hierarchical levels and their attributes could influence only the top management performance of those organizations.

4.2.1. Regression considering all goals attainment observations as response variable

The tree regression considering all observations and predictors obtained an overplotting tree due to its high numbers of slits/nodes and leaves (terminal nodes as responses), fact that disabled visualization. However, it was possible to obtain the R-Squared (the proportion of variance in the data that is explained by the regression model) of this tree regression and the sum of its squared errors (SSE corresponds to the difference between the observed/true value and the predicted value by the model), as well as the importance of each variable in predicting the response variable, which in the tree regression model corresponds to the predicted mean of variable 'goal attainment' within the obtained classes (Eagland, 2018; Halibisky, 2020).

This full tree regression presented a R-squared equal to 0.3525, meaning that around 35% of the data variability could be explained by the considered variables, while SSE was equal to 0.2444, such that the model would get wrong around 25% of its response variables. In this study, the SSE is the results of a 10-fold cross validation (CV) built-in by the Rpart package for R-Project software, and although the metric obtained does not seem to be incredibly significant numbers, humanities and social sciences studies might not have fixed threshold limit for R-Squared and SSE since human behavior is not accurately predicted.

It can be stated that the obtained values are still valid because they allow to get some key findings: Figure 1 presents the most relevant variables for determining goal attainment levels, such that the 'methodology' applied and the 'weights' goals had to form a general grade were the most relevant variables for correct classifying the observations into levels of goals achievement. The higher the value, the most important that variable was to predict the mean of the response variable, that is, the precise level of goal attainment from each observation. This happens because the Gini index was used as a measure to access the complexity of each new split for growing the tree and the importance of each variable is given by its contribution in reducing the Gini index (Dalpiaz, 2020).

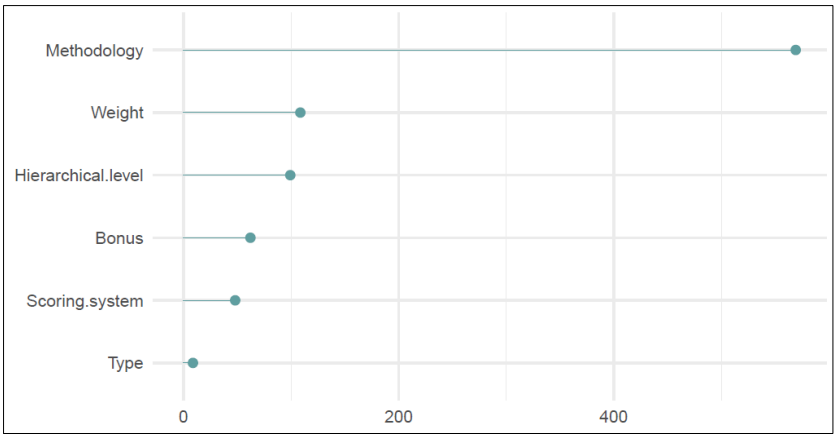

Figure 1: Explanatory variable importance in defining responses from a full tree regression.
Source: Author's elaboration. Data from Mereo's Performance Platform and companies' consultations, 2020.

One possible alternative to have a smaller tree (with fewer splits/regions, low variance and some bias) is to build the tree only so large as the decrease in the SSE due to each new split exceeds a usually high threshold, a statistical practice called pruning. The tree model displaced

in the Figure 2 was not the best one in terms of R-squared, however it was built considering only the key explanatory variables (Methodology and Weight), thus contributing to interpretability (having much fewer splits) with respect to the optimal model. This pruned tree obtained a R-Squared of 0.22 and the SSE equal to 0.0163, therefore it could generally predict more precisely the mean of goal attainment when a goal was based on a certain methodology and had a determined weight.

The tree outcomes can be read in the following manner considering the leaves (terminal nodes): the mean of goal attainment is -0.21 (meaning that on average goals reached 79% of their planned metrics) when Methodology was Hybrid or MBO or None; 0.056 (94.4%) when Methodology was BSC or HK & Weight < 12; 0.160 (116%) when Methodology was BSC or HK & Weight >= 19; 0.402 (140.20%) when Methodology was BSC or HK & Weight is 12 to 17; 0.672 when Methodology was HK & Weight was 17 to 19; 0.677 when Methodology was OKR; 98.989 when Methodology was BSC & Weight was 17 to 19, but only two observations out of the 12.525 provided this mean working as outliers in the model.

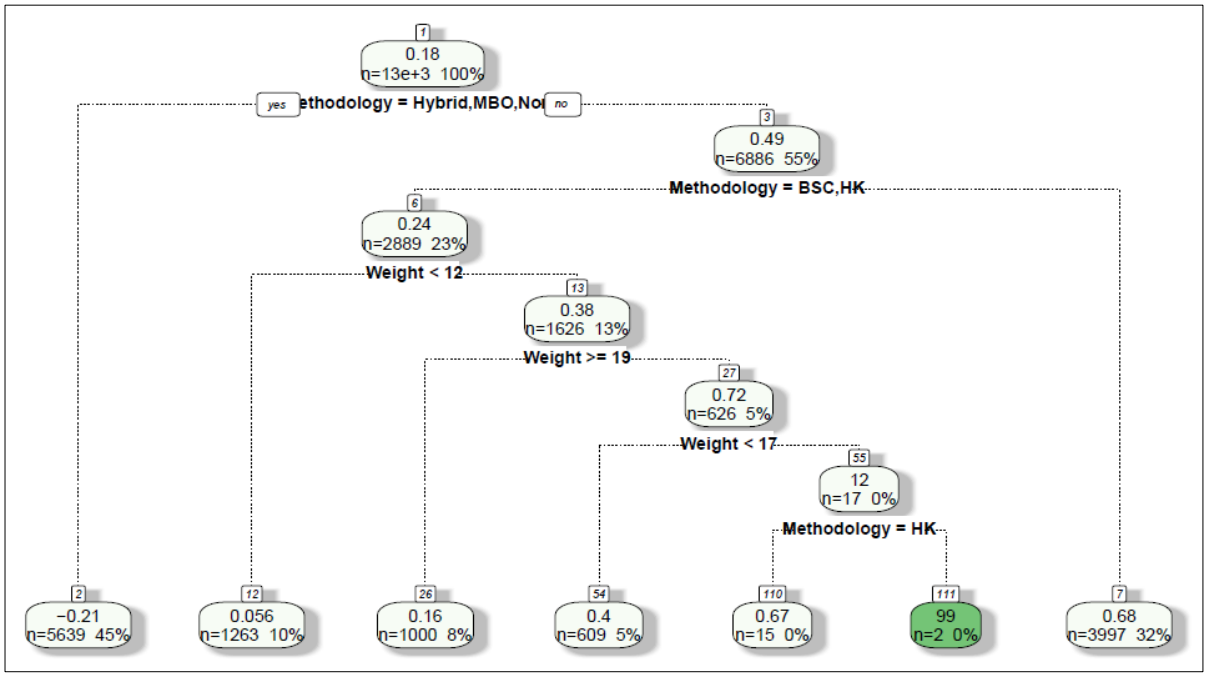

Figure 2. Pruned tree regression: Methodology and Weight as explanatory variables predicting goal attainment.
Source: Author's elaboration. Data from Mereo's Performance Platform and companies' consultations, 2020.

It could be observed that the organizations which applied the BSC or Hoshin Kanri as their goals deployment method and for whose goals with a weight lower than 12%, goals were achieved more in consonance within the estimated metric value (goal attainment was close to zero, thus goals were reached in around 100%); goals were overreached more when their weight was between 12 and 19%, but goals with weights equal to or higher than 19% have not induced higher goals performance as did the weight range of 12-19%. Pushing too much on few relevant goals might not generated the expected performance.

It can be said that in this regression, Hybrid, MBO and organizations that did not apply any specific methodology had their goals underreached by a mean of 21p.p. (-0.21), perhaps by setting too high goals measures; on the other side, the organization that applied OKR on average have overreached goals substantially, fact that contradicts the literature about stretched goals often considered by the Objective and Key Results framework.

4.2.2. Tree regression with average of goal attainment from top management as response variable

In this part of the statistical analysis, the outcome variable corresponds to the average of goals attainment from the top management of each organization, which were then considered as response value to all other goals below hierarchical level 'A' in that company. This change in the response variable aims to consider the impacts of goals' elements belonging to lower staff levels to the prior objectives of the organization, considering that top executives' goals have usually been linked to corporate objectives, for instance by adopting indicators as EBITDA, market shares and company's grades, levels of cash flows, losses or economies, social and environmental responsibilities, or impacts.

In this turn, the unpruned tree regression considering all predictors for all observations below hierarchical level 'A' has resulted in a R^2 of 0.938, which might explain around 93% of data variability, however such R^2 was reached by obtaining an SSE of 0.933, indicating that the means of goal attainment predicted by the model present great variability and bias. Now, again, the most relevant variable for defining the average level of goals achievement that top managers obtained is the goal setting methodology that companies have adopted, followed by the goals' weights and then, remarkably close in importance, the hierarchical levels below top management (Figure 3). Hierarchical levels are expected to influence top management performance if goals were designed and estimated considering cause and effect links between the staff levels and corporate objectives, meaning a correct cascading mechanism.

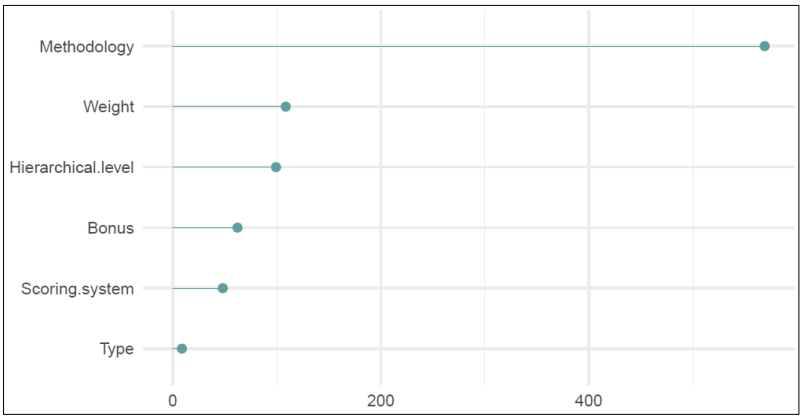

Figure 3. Explanatory variable importance in an unpruned tree considering top level management
Source: Author's elaboration. Data from Mereo's Performance Platform and companies' consultations, 2020.

Aiming to obtain a visualization of the tree regression and reducing the SSE, the tree was pruned yet considering all the variables as illustrated by the tree regression in Figure 4. Surprisingly, the variable 'Type', which consisted of whether the goals belonged to an individual, a team, or a project, has presented the lower importance in the model for estimating the average goal attainment of top executives, being automatically out of the graphic visualization. In this case, R^2 corresponds to 0.899, while the SSE was still remarkably high, around 0.896. What may justify this high SSE is the response variable that only take fourteen different values: each of them represents the average of goal attainment in the top management for each company in the database.

In the Figure 4, it could be noticed again that the company that used OKR method was isolated with goals reaching 138% (0.38) of the planned targets for the top management targets (last terminal node on the right). Such observed outcome might be quite biased because the database contained only one company that used OKR as its goals setting approach. On the other side, Hybrid model adopters that relied on a scoring system and their goals had a weight lower than 9% in the grade composition, the top executives' goals achieved 58% on average (-0.42), far below the aimed targets (last terminal node on the left), and when goals were weighted more than 9%, they reached around 16% below (goals metrics got on average 84%). Those organizations that used Hybrid model and did not recur to a scoring system on average overreached top management goals in 12% (goals reached in 112%). Perhaps, giving freedom to people to pursue a target whatever its level of attainment will be under the Hybrid methodology is a good way to engage people to overreach it.

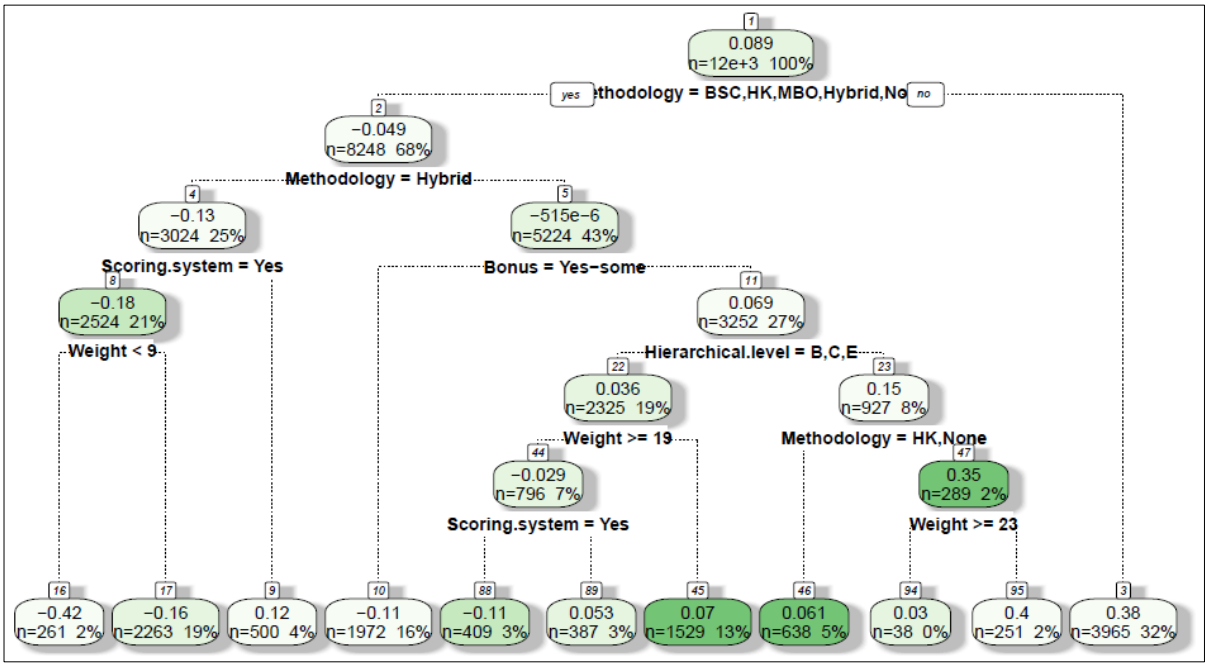

Figure 4. Pruned tree regression: all explanatory variables predicting average of goal attainment for top management.
Source: Author's elaboration. Data from Mereo's Performance Platform and companies' consultations, 2020

Taking into consideration an internal node where the variable 'hierarchical level' was the splitting criteria, it can be observed that the staff levels 'B', 'C' and 'E' might have influenced the top-management performance to be around 103,6% of the planned goal (branch on the left side), while the organizational level 'D' is a factor for the top executives to have overreached goals with 115% of average in goals attainment (branch on the right side of that node). In this last case, when goals owned by level 'D' in BSC appliers had a weight higher or equal to 23%, top executives overreached their goals by achieving in 140% the established metrics (terminal node on the right), at the time that Hoshin Kanri and no specific model adopters got on average 106% of their measures.

Such finding and results could be an effect of validation in the BSC adopters my correctly aligning the middle and low managers goals to the strategy of firms. Therefore, it can be understood that 'D' and 'E' staff levels' results have mattered for the achievement of corporate performance more than the direct impact of higher managers as from levels 'B' and 'C', as the tree regressions could evidence. In this study, the MBO adopters linked all goals to

financial compensation, and this might have driven the actual performance to be remarkably close to the planned targets. Such inference corroborates the literature framework about MBO and Hoshin Kanri.

For levels 'B', 'C' and 'E', goals weighted equal or higher than 19% have guaranteed a narrower attainment to their targets, around 107%. These figures may evidence that alignment between goals from lower staff levels in the MCS (as middle managers and analysts) with corporate objectives, coupled with high goals weights, can drive top management performance to be more successful, whereas the adoption of scoring systems might not always positively influence executives results since observations that counted with scoring boundaries presented a prediction of top executives goals attainment lower than from those goals that did not have a scoring system. It may be supposed that people might have been less devoted to their goals when they expected to have lower or upper boundaries to leverage their performances.

A last tree regression also considering top management performance as an outcome variable concerns the pruned tree displaced in the Figure 5, where only the explanatory variables 'methodology' and 'hierarchical level' were added. This tree regression obtained a R^2 of 0.787 and the SSE of 0.784, evidencing the degree to which these two components of the performance appraisal system can still influence executives' and, ultimately, corporations' performance. Moreover, it can be noticed that Hybrid methodology adopters might have had lower levels of achievement of top management goals than the organizations that used other goals setting systems. One possible explanation for it could have been the proposal of too stretched goals since its framework suggests part of the goals to be challenging. Meanwhile, those Hybrid firms that did not rely on a scoring system for their goals have reached better goals actual performance in the end of the period, perhaps because people in those organizations gave more attention to goals that did not count with any boundary, or "limitations".

The center node tells again that organizational levels 'D' and 'E' in the performance appraisal systems were linked to higher top management performance (114% in executives goals achievement) against the influence of levels 'B' and 'C' (tied to an average of 96,3% in

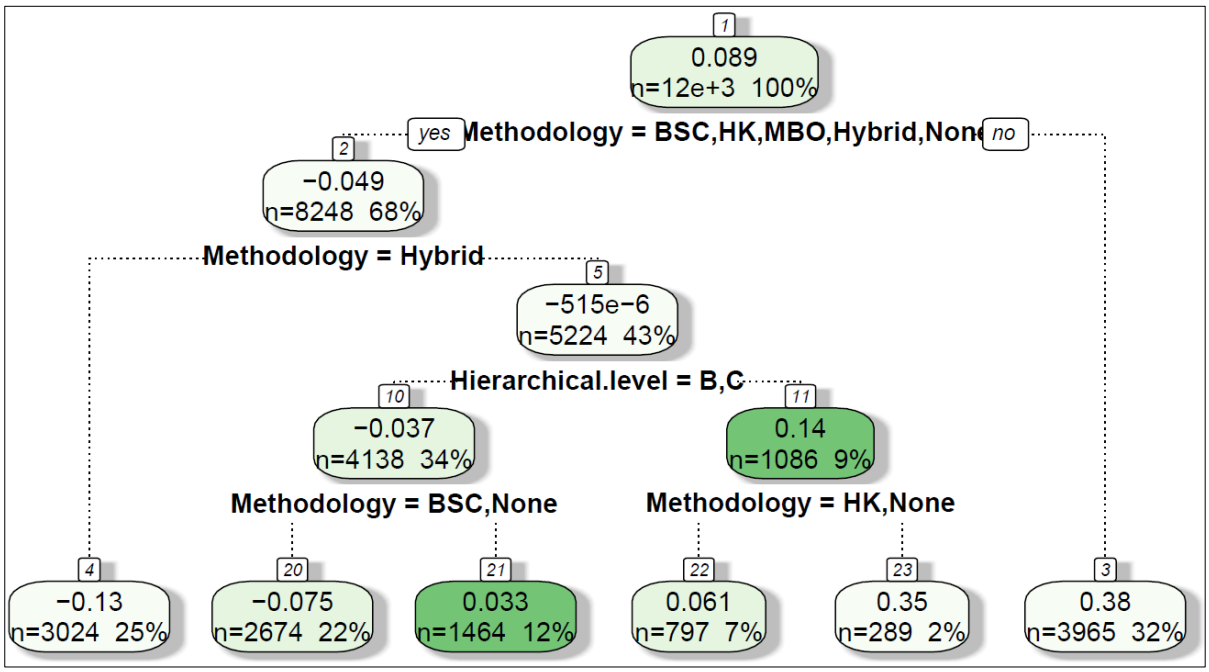

Figure 5. Pruned tree regression: methodology and hierarchical level as explanatory variables predicting average of goal attainment for high executive.
Source: Author's elaboration. Data from Mereo's Performance Platform and companies' consultations, 2020

the top management performance). For these last two organizational levels, when the companies adopted Hoshin Kanri or MBO, the goals were again more precisely attained (or primarily and correctly estimated) with a level of attainment around 96,7%. In the meantime, for the levels 'D' and 'E', when methodology was BSC, top managers had the best performance among BSC, MBO, Hoshin Kanri, Hybrid and none specific method adopters, with a top management goal achievement level of 135%. Adopters of any methodology should also give strong attention to the cascading and alignment practices in the lowest staff levels included in their appraisal system, or even consider incorporating into the MCS the factory floor employees, analysts, and interns as a management strategy.

In sum, it was surprising that the variable "type" and "bonus" did not influence the decisions trees splits, such that it can be inferred that to whoever a group or individuals a certain goal has belonged, it may not influence the whole MCS or the indicators' performance, or the financial compensations could just be *expected* to be in place. A great surprise brought by the tree analysis was the persist isolation of the OKR adopter's performance with high levels of goals overachievement. This basically contradicts the theory about how companies should adopt the OKR methodology: by setting goals that are stretched and not easily attainable.

5 FINAL CONSIDERATIONS

This study aimed to provide a debate around different goals setting methodologies based on the literature about management control systems. By practical evidence from a set of companies, throughout content assessment, and from a corporate performance database analysis, key elements that compose either management control system and five different goals setting methodologies were discussed, including an alternative approach that was introduced. The goals deployment methods analyzed were: Management by Objectives (MBO), Balanced Scorecard (BSC), Hoshin Kanri (HK), Objectives and Key Results (OKR) and the Hybrid Model for Goals Deployment shared by Mereo Tech and Consulting and presented in this research.

The choice to use tree regression was based on its descriptive methodology that allows even non experts to understand the visual outcomes, moreover it is a logarithm that aligns quantitative predictions with either qualitative or quantitative explanatory variables that do not require hypothesis validations. Among the handy variables in the database, the methodology applied by the companies and the weight goals have presented were the most determinants elements in defining the actual performance goals would reach, evidencing their importance to the statistical models, been then followed by the hierarchical levels to whose those goals have belonged.

It was observed that Hoshin Kanri was often categorized together with MBO and BSC adopters by sharing similarities with their degrees of goals accomplishment and with the literature framework, such that these methodologies might converge in their attributes. A following finding regards the importance that the lowest hierarchical levels may have in positively influence the top management performance, particularly for BSC, Hoshin Kanri and MBO cases, meaning that correctly aligning goals with the corporate strategy with lower hierarchical levels might induce higher strategic performance.

It can finally be said that there is no *one-fits-all approach* between the discussed methodologies for implementing a strategic and tactical business management. Nevertheless, some composing elements from each of those methods can converge or diverge considering specific industries conditions, markets shift or organizations' culture. Hence, each company might have their own criteria in choosing one model instead of another, and surely in combining different elements. From the statistical analysis, organizations can also consider how the

combination of certain aspects as goals' weights, scoring systems, bonuses, or hierarchical levels importance, can best suit their corporate culture and, ultimately, the corporate strategy.

The limitations faced by this research begin with the restricted sample of companies analyzed and, so, they cannot be taken as a universal example but as a reference for management practices. Lastly, concerning the statistical analysis, the questionable robustness of the tree regressions occurs mostly due to the great variability of the data components and the behavioral patterns that stand behind any managerial observation, although the logarithm has shown great potential for managerial analysis.

REFERENCES

Anthony, R. N., Dearden, J., Bedford, M. N. (1989). *Management control systems*. 6. ed. Homewood, Ill.: Irwin. Retrieved from http://www.cbt.biblioteche.provincia.tn.it/oseegenius/resource?uri=928240&v=l&dcnr=4

Bardin, L. (2016). *Análise de conteúdo*. Edições 70.

Chapman, C. S. (2005*). Controlling Strategy: Management, Accounting, and Performance Measurement.* 1. Ed. Oxford University Press, New York

Cintra, L. P. (2019). Utilizando o método Objectives and Key-Results na gestão de projetos. *14º Congresso de Gestão, Projetos e Liderança do PMI-MG,* 2019 October 25-26. Belo Horizonte, MG, Brazil

Craddock, K. (2012, February 13). Beyond Management by Objective: A Look at Hoshin Kanri (Part 2). *Process Excellence Network.* Retrieved from: https://www.processexcellencenetwork.com/lean-six-sigma-business-performance/columns/instead-of-management-by-objective-a-look-at-hoshi

Doerr, J. (2018). *Measure What Matters: How Google, Bono, and the Gates Foundation Rock the World with OKRs*. Portfolio/Penguin. New York, 2018.

Drucker, F. P. *et al.* (1999). Business review on measuring corporate performance. *Harvard business school press*. Boston, Mass. Retrieved from: http://www.cbt.biblioteche.provincia.tn.it/oseegenius/resource?uri=3682864&v=l&dcnr=9

Dalpiaz, D. (2020). Chapter 26 – Trees, 26.3 rpart Package. *R for Statistical Learning, 2020-10-28*. University of Illinois at Urbana-Champaign. Retrieved from https://daviddalpiaz.github.io/r4sl/trees.html#rpart-package

Eagland, C. (2018, December 6). ISLR8 - Decision Trees in R (Regression). *RPubs by RStudio.* Retrieved from: https://rstudio-pubs-static.s3.amazonaws.com/446972_323b4475ff0749228fe4057c4d7685f5.html

Fiterman, L., Silva, B. A. (2007). A utilização de modelos de avaliação de desempenho no suporte à tomada de decisão. *ENEGEP, 2007,* Foz do Iguaçu, Brazil

Grove, A. (1983). *High Output Management*. Random House

Halibisky, B. (2020, November 22). Error Sumo f Squares (SSE). *The Huguenard Lab.* Retrieved from https://hlab.stanford.edu/brian/error_sum_of_squares.html

Hayes, A. (2020, November 21). Management by Objectives (MBO). *Investopedia.* Retrieved from https://www.investopedia.com/terms/m/management-by-objectives.asp

James, G., Witten, D., Hastie, T. and Tibshirani, R. (2013), An Introduction to Statistical Learning - with Applications in R. Springer. Retrieved from http://www-bcf.usc.edu/gareth/ISL/

Kanbanize. (2020, November 21). Hoshin Kanri: Connecting Strategic Planning to Project Execution. *Kanbanize – Lean Management.* Retrieved from https://kanbanize.com/lean-management/hoshin-kanri/what-is-hoshin-kanri

Kaplan, R.S. and Norton, D.P. (1992). Translating strategy into action. *Harvard Business Review*, *83*(7), 71–79. Retrieved from http://www.cbt.biblioteche.provincia.tn.it/oseegenius/resource?uri=3668239&v=l&dcnr=5

Kaplan, R. S. (2010). *Conceptual Foundations of the Balanced Scorecard*. Harvard Business School. Retrieved from: https://hbswk.hbs.edu/item/conceptual-foundations-of-the-balanced-scorecard

Loyer, C. (2019, September 12). Hoshin Kanri - OGSM - OKR: A case of apples and oranges? *i-nexus.* Retrieved from: https://blog.i-nexus.com/hoshin-kanri-ogsm-okr-apples-oranges-comparison

Marr, B. (2020a, November 21). What Are The Pros And Cons Of Using OKR?. *Bernard Marr & Co.* Retrieved from https://www.bernardmarr.com/default.asp?contentID=1461

Marr, B. (2020b, June 16). OKRs Vs BSC: What Is The Difference?. *Bernard Marr & Co.* Retrieved from https://www.bernardmarr.com/default.asp?contentID=1458

Nascimento, J. (2019, June 25). Medir é importante, mas como medir? [OKR; BSC; MBO; Hoshin Kanri]. *LinkedIn.* Retrieved from: https://www.linkedin.com/pulse/medir-%C3%A9-importante-mas-como-okr-bsc-mbo-hoshin-kanri-nascimento/

Pagano, R. (2019, April 17). BSC ou OKR?. *Intellinsights.* Retrieved from http://blog.intelligentia.com.br/bsc-ou-okr/

Ruggieri, R. (2020, November 21). Gerenciamento pelas diretrizes ou Hoshin Kanri. Retrieved from https://www.tiespecialistas.com.br/gerenciamento-pelas-diretrizes-ou-hoshin-kanri/

Silva, A. H., Fossá, M. I. T. (2015). Análise de conteúdo: exemplo de aplicação da técnica para análise de dados qualitativos. *Qualit@s Revista Eletrônica, 17*(1). Retrieved from http://revista.uepb.edu.br/index.php/qualitas/article/view/2113/1403

Siteware. (2018, July 16). Quais os modelos de gestão empresarial mais adequados para o seu negócio?. *Blog Siteware.* Retrieved from: https://www.siteware.com.br/metodologias/quais-sao-os-modelos-de-gestao-empresarial/

Solvers, F. (2020, November 21). *Regression Trees.* Retrieved from https://www.solver.com/regression-trees

Strauß, E., Zecher, C. (2012). Management control systems: a review. Retrieved from: https://link.springer.com/content/pdf/10.1007/s00187-012-0158-7.pdf

Tennant, C., Robert, P. (2001a). Hoshin Kanri: A tool for strategic policy deployment. *Knowledge and Process Management 8(*4), 262-269. September 2001. DOI: 10.1002/kpm.121

Tennant, C., Robert, P. (2001b). Hoshin Kanri: Implementing the Catchball Process. *Long Range Planning 34*, 287-308. Elsevier Science Ltd. PII: S0024-6301(01)00039-5

Tosi, H. L., Rizzo, J. R., Carroll, S. J. (1970). Setting Goals in Management by Objectives. *California Management Review, 12*(4), 70-78. July 1, 1970. Doi: https://doi.org/10.2307/41164307

Yoshikuni, A. C., Favaretto, J. E. R., Albertin, A. L., & Meirelles, F. de S. (2018). The Influences of Strategic Information Systems on the Relationship between Innovation and Organizational Performance. *Brazilian Business Review, 15*(5), 444-459. Retrieved from https://doi.org/10.15728/bbr.2018.15.5.3.