A congruence analytic hierarchical process (COAHP) approach for public decision making: theory and an empirical case[+]

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ABSTRACT
The purpose of this study is twofold. The first purpose is to propose combining Congruence Organizational Modeling, used to manage organizational change and innovation, and the Analytic Hierarchy Process, a multi-criteria decision-making methodology, into an integrated framework (COAHP) for public decision-making. The second purpose is to illustrate, with an empirical case, how this integrated framework can be used in practice. While AHP is widely used in Fortune 500 companies, its use in public decision-making is still new, and a systematic process for its use along with organizational frameworks is still incipient. This study contributes to the development of a formal methodology by proposing the use of an integrated framework (COAHP) for the analysis of decisions dealing with organizational innovation and change.
Keywords: Analytic Hierarchy Process, AHP, COAHP, Public Decisions, Congruence Modeling, Congruence AHP.

El Modelo de Congruencia Sistémica en el Proceso de Análisis Jerárquico para la toma de decisiones públicas: teoría y caso empírico

Resumen

El objetivo de este artículo es doble. Primero, se propone combinar el Modelo de Congruencia Sistémica Organizacional, que se utiliza para manejar el cambio y la innovación organizacional, con el Proceso de Análisis Jerárquico (AHP en inglés), una metodología para la toma de decisión basada en una multiplicidad de criterios. El resultado es un marco integrado para la toma de decisión pública. En segundo lugar, ilustramos como se puede usar ese marco integrado de manera práctica a través de un caso empírico. El AHP se utiliza con frecuencia en las empresas que pertenecen al ranking de la revista Fortune 500, pero todavía es poco frecuente en la gestión pública. El proceso sistemático para su uso en el contexto de diferentes marcos organizacionales es incipiente. Este artículo contribuye al desarrollo de una metodología formal en base a un marco integrado de análisis decisional para la innovación y cambio organizacional.

Palabras clave: Proceso de Análisis Jerárquico; AHP, COAHP; Decisiones públicas; Modelo de Congruencia; Congruencia AHP.

1. Introduction

Public management decisions are by definition decisions made in the public eye; i.e., they are susceptible to public scrutiny even after the decision has been made. For this reason, the decision process must be such that it can be easily explained and open to public examination.

There are numerous organizational frameworks to assist strategic management in organizations. One framework, which is particularly useful for organizational innovation, is the congruence modeling approach proposed by Tushman and O'Reilly III (2002). This approach allows managers to identify the key organizational factors needed to implement the desired strategic choice.

However, congruence modeling is rather qualitative in nature as is the case with many other organizational frameworks. While the key organizational factors can be identified, it is not possible to quantify their weights or importance or use them as criteria to make a quantitative-based decision analysis. For this reason, we propose combining congruence organizational modeling with the Analytic Hierarchy Process to create an integrated decision-making framework (COAHP) which yields quantitative results, as will be shown in this study. The approach will be demonstrated with an empirical real case.

2. The Nature of Management and Innovation in the Public Sector

While there are many commonalities in the management of private and public organizations, innovation in the public sector is far more difficult. There are important differences in public organizations that make this true such as: a) less inclination to invest in risky innovations; b) divided authority over decisions due to legal, bureaucratic, and political constraints which makes it harder to manage public projects; c) the presence of multiple stakeholders with conflicting goals; d) one-year budgets, which make it more difficult to plan long term; e) highly regulated procurement through the bidding of competitive contracts and Requests for Proposals (RFPs); and f) many other factors, such as inter-agency linkages that make it difficult to undertake changes without affecting other agencies (Rocheleau, 2005).

The most salient difference in the public sector is the presence of multiple stakeholders with conflicting goals. A stakeholder in an organization denotes any group or individual who can affect the achievement or is affected by the achievement of the organization's objectives (Freeman, 1984; Thompson, 1967). Stakeholder management has a long tradition in public administration

and policy at large (Buchholz and Rosenthal, 1994). There is evidence that a stakeholder's opposition may lead to the failure of public innovative deployments and/or policies. For example, in a case titled «The perils of unidentified stakeholders», Mu and Stern (2012) narrate how the failure to identify and engage stakeholders early in the process led a wireless downtown initiative to falter. In general, there is evidence that factors such as mistrust, forming of opposition coalitions and other similar political factors may lead organizational stakeholders to create obstacles to initiative implementation (Pan and Flynn, 2003). These factors may also lead the general public to oppose a specific IS project, sometimes to the point of closing it, as was the case with the government's proposed public policy electronic market which was labeled a 'terrorism's futures market' by its opponents (Hulse, 2003).

In summary, the multiplicity of actors or stakeholders with conflicting goals is one of the key characteristics of decisions in the public sector as shown in Table 1. For this reason, the decision-making process must be rigorous while open and transparent to allow the engagement of stakeholders (Bryson, 2004). This study proposes an integrated approach that allows management to engage stakeholders in the decision-making process while being transparent with respect to the process that leads to the organizational decision.

Table 1. Summary of Public Administration Characteristics

Public Administration Characteristics	Source
Risk adverse management approach requires thorough risk assessment.	Glicken (2000).
Divided authority over decisions, time-bound budgets and highly regulated procurement.	Rocheleau (2005).
Multiple stakeholders with conflicting goals need to be engaged in the decision-making process. The extent of their involvement needs to be decided on a case by case basis.	Mu and Stern (2012), Burns et. al. (1995); Clayton (1990).
Public mistrust requires openness and transparency	Pann and Flynn, 2003; Bryson, 2004

3. Congruence Organizational Modeling

When the environment changes gradually, it is possible for managers and organizations to learn and adapt steadily, almost unnoticeably, to the environment. Critical tasks are mastered, suitable structures are established, people develop, or are hired with expertise according to the existing needs and a supportive culture emerges over a long period of time. An organization is at its

peak when there is congruence, that is, a synergetic interaction of all these organizational factors.
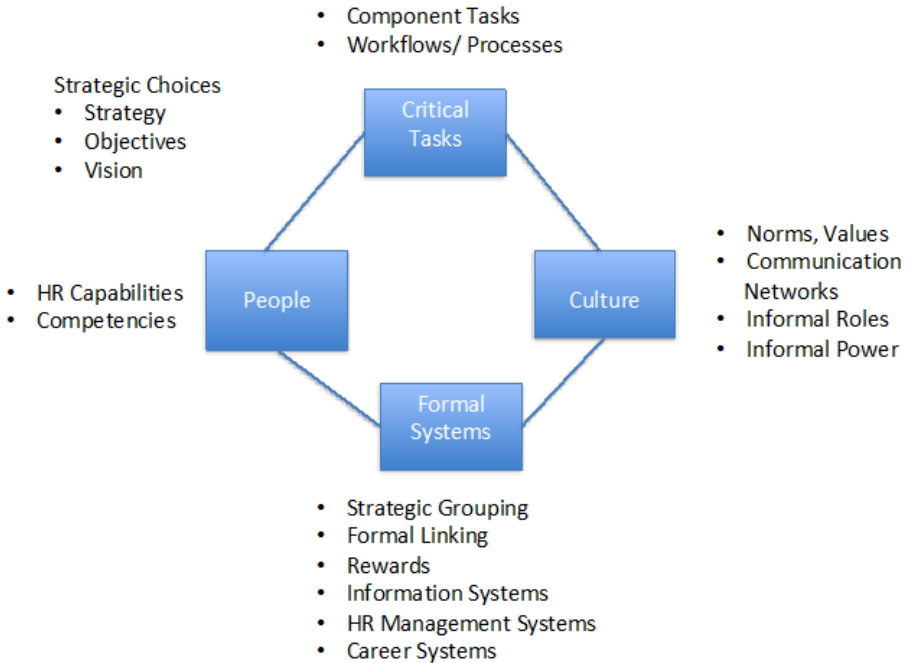
Problems arise when there is a discontinuous change in the environment. Suddenly, the congruence of different organizational factors in terms of critical tasks, formal systems, people and culture obtained through a long and costly process becomes a problem. In this case, the organization faces the urgent need to change and innovate for survival. What is urgently needed is to re-evaluate the strategic choices (mission, vision and objectives) within the context of the changed environment and the new opportunities and problems it presents. Suddenly, the organization is in need of radical innovation and change, and the question is what to change. Congruence modeling is proposed to address this question. The discussion of this approach is based on Tushman and O'Reilly III's (2002) treatment of the topic.

The first step in congruence modeling is to derive the new strategic choices (e.g. strategy, mission, vision and objectives) based on the strategic context (e.g. environment, resources, history). The environmental context is made up of the competition, legal, political and social situation, technological environment and most importantly, the customer which we can refer to as a stakeholder in the context of public management.

Once a clear strategy with objectives and vision has been established, a public manager must assess how the organization is doing in reaching these goals and identify either performance or opportunity gaps. Winning through innovation, as proposed by Tushman and O'Reilly III (2002), starts with a clear identification of these gaps followed by performing a congruence organizational assessment to take action on filling in the selected gap(s).

A congruence model (Figure 1) views organizations as being made up of different factors which could be grouped into four dimensions: Tasks/Processes, Formal Systems, People (competencies, HR) and Culture (e.g. norms, values). These factors must all be congruent, and the strategic choices and leadership must be in place to ensure optimal organizational performance. To do so, Tushman and O'Reilly III (2002) have proposed the following process for organizational problem solving and learning.

Figure 1. Congruence Model of Organizations

- Component Tasks
- Workflows/ Processes

Strategic Choices
- Strategy
- Objectives
- Vision

Critical Tasks

- Norms, Values
- Communication Networks
- Informal Roles
- Informal Power

- HR Capabilities
- Competencies

People

Culture

Formal Systems

- Strategic Grouping
- Formal Linking
- Rewards
- Information Systems
- HR Management Systems
- Career Systems

Source: Tushman and O'Reilly III (2002)

Figure 2. A Process for Organizational Problem Solving and Learning

Identify Performance or Opportunity Gap(s)

Step 1

Observe Response and Learn

Step 5

Step 2

Describe Critical Tasks and Work Processes

Develop Solutions and Take Actions

Step 4

Step 3

Check Org. Congruence:
Task – Formal Systems
Task – People
Task - Culture
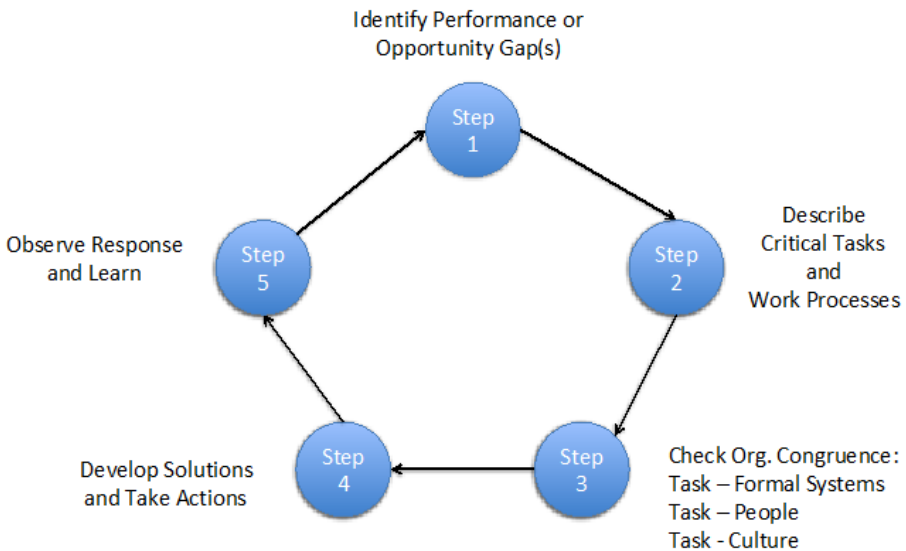
Source: Tushman and O'Reilly III (2002)

The congruence modeling process proposed in Figure 2 allows the identification of the following organizational tasks: a) Critical Tasks and Work Processes, and b) Critical Factors in the other three organizational dimensions: formal systems, people and culture. For the organization to have the desired performance, the critical tasks and work processes must be congruent with the critical factors in the other three organizational dimensions.

What we propose in this study, which may be considered as a follow up to Tushman and O'Reilly's analysis, is that any organizational strategic decision must use, as criteria for evaluation, the identified organizational factors corresponding to each of the four organizational dimensions. When making a strategic decision, these factors will not be equally important for the organization but will depend on the decision itself; therefore, a way to determine the criteria importance (weights) is needed. Also, alternatives may vary at different degrees in their fulfillment of the decision criteria; therefore, a prioritization mechanism is needed. For this purpose, we propose the Analytic Hierarchy Process, a multi-criteria decision-making methodology that allows the weighting of criteria and the prioritization of alternatives in a rigorous but intuitive way.

4. The Analytic Hierarchy Process and its use in Organizational Analysis

The Analytic Hierarchy Process (AHP) is a multi-criteria decision-making (MCDM) methodology developed by Thomas L. Saaty (1980). Its main characteristic is that it is intuitively easy to understand while still mathematically rigorous. This is an important advantage because many mathematical decision-making techniques require specialized knowledge, not only to calculate the results, but to even participate in the decision-making process. The simplicity of AHP allows the decision-maker to participate in and understand the process. The mathematical part can be hidden for the layman. This is the reason for its popularity and why it was chosen for this study. To perform a comparison of AHP with respect to other MCDM methods that are available (more than 30 in a recent study) would constitute a study in itself and this is not the right place to do that (Saaty, 2015). Fortunately, comparative studies have been performed in the past and the advantages of AHP over other MCDM techniques have been recognized as well as its growing popularity (Sarkis and Sundarraj, 2005; Triantaphyllou, 2000). The general benefits of AHP when compared to

other MCDM methods can be summarized as follows (Taslicali and Ercan, 2006; Sarkis and Sundarraj, 2005):

- Compared to other MCDM methods, AHP is not proportionately complicated.
- Possible to mix quantitative and qualitative criteria.
- Easy to combine with other MCDM methods.
- Uses a hierarchical structure which is natural to solving complex problems.
- Decomposing the decision into pairwise decisions simplifies the decision making process and decreases errors.
- Has been validated from an empirical point of view.
- Facilitates group decision-making.

A detailed explanation of the AHP methodology is given in the appendix, and its use will be discussed in the empirical case study. The reader is referred to the appropriate introductory literature on this topic such as Saaty (1980) and Mu and Pereyra-Rojas (2017) for additional references.

To explore the extent to which AHP has been used with strategic and organizational analysis frameworks, we performed a search of the university library data base for the combination («join» or «AND» operation) of the two key terms «AHP» and «Strategy» asking only for peer-reviewed papers from 1997-2019 (May 5, 2019). This search resulted in 296 papers. Similarly, a search of the combination of the two key terms «AHP» and «Organization» for peer-reviewed papers for the same time period provided 139 results. The term «Analytic Hierarchy Process» joined with «strategy» and «organization» provided 413 and 248 results, respectively. Upon reviewing the results, we found that when AHP is used in combination with strategic organizational frameworks, it is mainly used with SWOT (Kahraman et al, 2006; Yavuz and Baycan, 2014); Balanced Scorecard (Poveda-Bautista et al, 2012; Wu et al, 2011), and critical success factors (Chen and Wang, 2010; Salmeron and Herrero, 2005). This is consistent with the findings of the most recent and comprehensive AHP literature review by Emrouznejad and Marra (2017) who, after reviewing more than 8,000 published works from the Web of Science index, found that the use of AHP in business and management has been consistently growing, and that there is a long tradition of studies which use the AHP-SWOT combination to select management studies (Zavadskas et al, 2011; Tavana et al, 2016).

Given that our main objective is the integration of the congruence model of organizations with AHP (which we call COAHP in this study), we specifically searched for the combination of either «AHP» or «Analytic Hierarchy Process»

with «Congruence» or «Congruence Model» as key terms, but there were no relevant results. Similarly, our review of the previous results did not identify any study related to the integration of the congruence organizational modeling approach with the Analytic Hierarchy Process as proposed in this study. This proposal is based on the authors' experience using the model in organizations like the target in this case study.

5. Congruence Organizational Modeling and Analytic Hierarchy Process Analysis (COAHP)

The public sector strategic decision-making COAHP approach proposed here is particularly useful when a specific strategic decision (i.e. one affecting the whole organization) is needed and it involves the following steps:

- Develop strategic choices (strategy/mission/vision/objectives) and select performance/opportunity gaps to address and justify the change initiatives.
- Identify organizational key factors within the dimensions of *critical tasks, people, culture and formal systems* that need to be in congruence to achieve the new strategic goals/objectives.
- Use the newly identified critical tasks as key criteria in strategic organizational decisions.
- Given a specific strategic decision, use AHP to first determine the relative importance of the criteria, then evaluate and prioritize the alternatives (potential decisions) against the derived criteria, and finally to obtain the overall priorities of the alternatives (the alternative with the highest priority is the best decision).

5.1. The Development of Strategic Choices

As shown in Figure 1, the first step of congruence analysis is to derive strategic choices based on a thorough analysis of the strategic context. Attention to stakeholders is crucial in defining the strategy because they constitute the key to success in the government or public sector (Bryson, 2004; Rainey, 1997). For this reason, strategies are often developed based on polling the stakeholders, as the recent BREXIT political events show (Hunt and Wheeler, 2018). It is also very important to identify financial, technological and similar resources to determine what is doable (or not) for the organization. Finally, it is important to consider the history of the organization since defining events and major

figures in the past may cast a shadow on the manager's decisions. Among the strategic choices, the vision is particularly important since it can serve as a strategic anchor for an organization. The core ideology of the organization must be translated into the organizational goals, strategies, tactics, etc., in other words, into everything the organization does (Collins and Porras, 1994). We would add here, it must also be translated into every decision the organization makes. Managers must identify the performance and/or opportunity gaps that need to be addressed. Once this choice has been made, it is possible to analyze the key organizational factors to address this gap.

5.2. Use of Congruence Modeling to Identify Key Organizational Factors

Congruence modeling was introduced by Tushman and O'Reilly III (2002) and constitutes an easy way to analyze the changes needed in an organization when new strategic choices are required. The collection of strategy, vision and objectives are called strategic choices which are made to either address a performance gap or, even better, to take advantage of an opportunity. The key idea is that an organization develops objectives based on their strategy and vision. To reach these objectives, the organization will need to master certain critical tasks. For this purpose, the organization must ensure the congruence of its formal systems, people and culture with the needed critical tasks. Tushman and O'Reilly III (2002) propose a process for organizational problem solving and learning (Figure 2) which consists of checking for the organizational congruence of the critical tasks and work process with respect to the other organizational critical factors in the formal organization, people and culture dimensions, respectively.

5.3. Using AHP for Prioritization/Selection of Alternatives

While all the identified organizational critical tasks must be considered in a strategic decision, their relative importance may vary depending on the strategic decision at hand or because the organization may be much weaker (or stronger) in some factors than others. Similarly, alternatives in a given decision may be quite comparable, and for this reason a simple way to weight the criteria importance and prioritize the decision alternatives is needed. In this study, the use of AHP is proposed for this purpose and is demonstrated in an empirical case.

6. Empirical Case: Strategic Analysis of a Decision to Relocate Organizational Headquarters

To illustrate our proposed strategic analysis, we addressed the situation of an actual organization, which we will refer to as our *target organization*[1] for the purposes of this case. This target organization is a U.S non-profit organization focused on promoting healthy habits through the diffusion of healthy food and exercise habits among high school students. This campaign is carried out through their affiliate members who can be school officers, teachers or students. Traditionally, the main focus has been to diffuse the information through teachers (e.g. physical training) and school officers. The organization is currently based in Cleveland, OH and an annual event is held with the purpose of networking and program diffusion. This association has recently engaged in a major revision of their strategic plan. Among the different initiatives to address the new strategic choices, the organization has decided to evaluate if the current location of their headquarters (HQ), which exists based on historical reasons, is still adequate or whether another location would be more convenient. A few cities were initially pre-screened and as a result three candidates were identified: Cleveland, OH (current HQ location), New York, NY and Orlando, FL. We will use this important strategic decision as a case study for how to apply the proposed COAHP approach and will discuss it within the context of this case.

6.1. Developing Strategic Choices

The strategic team organized focus groups and administered a survey to all its members with the purpose of understanding their needs. As a result, the following findings were obtained[2]:

- A great majority of the survey respondents consider that health promoting activities are interdisciplinary and should not be limited to physical training (PT) teachers.
- A majority of survey respondents think that the organization should have more networking activities in addition to the annual meeting.
- More than half the members believe that the organization should embrace teachers of diverse disciplines beyond PT instructors.

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[1]   For confidentiality purposes, the organization will be referred only as the «target» organization. Also, the specifics of the organizational decision at hand have been changed for the same reason.
[2]   We have withheld % values and provide rather qualitative assessments for confidentiality purposes.

- Only a third of the members believe the organization engages well with students at large.
- Only a quarter of the members believe the organization engages well with its members.

As a result of these findings, the strategic team has determined that the *mission of the target organization* is: a) to diffuse health habits among high school young people, b) to promote the interests of diverse high-school teachers and students, and c) engage civic communities at large in the effort.

Also, the following *vision* was proposed for the target organization: To become an institution which

- Increases the diffusion of good health habits through the use of technology.
- Engages students directly in addition to traditional high school teachers and officers.
- Improves communication with its members.
- Further engages civic communities in the effort.

Based on this, it was determined that the following *organizational objectives* were needed:

- Improve communications with members and external stakeholders.
- Develop ways to engage students.
- Achieve the mission of healthy habits for young students in innovative ways.
- Adapt the administration to be consistent with program and membership expansion.

The combination of organizational mission, vision and objectives constitutes what is referred to as the strategic choices of the organization.

6.2. Using Congruence Modeling to Identify Critical Organizational Factors

First, we need to identify which critical tasks must be mastered to reach the proposed organizational objectives (previous section). The strategic committee had a discussion that led to the identification of the following critical tasks to be mastered by the target organization:

- Critical Task 1 (CT1): Develop marketing communications & institutional research (to address the first 2 objectives above).
- Critical Task 2 (CT2): Foster student engagements.
- Critical Task 3 (CT3): Develop innovative forms of managing the organization.

Remember that these critical tasks are the new tasks that are needed for the organization. Before adding them into the mix, it is convenient to analyze the current congruence model of the organization.

6.2.1. Current Organization Congruence Model

The current organization can be depicted as shown in Figures 3a and 3b.
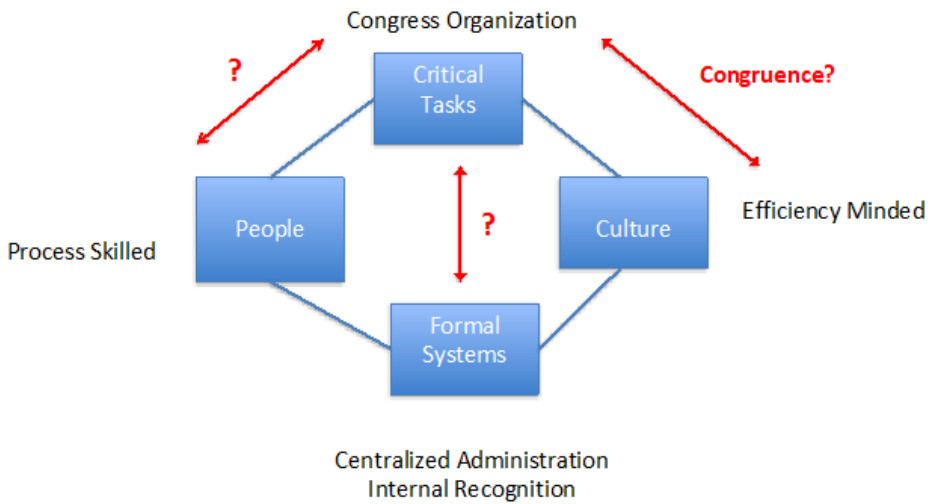
Figure 3a. Current Organization
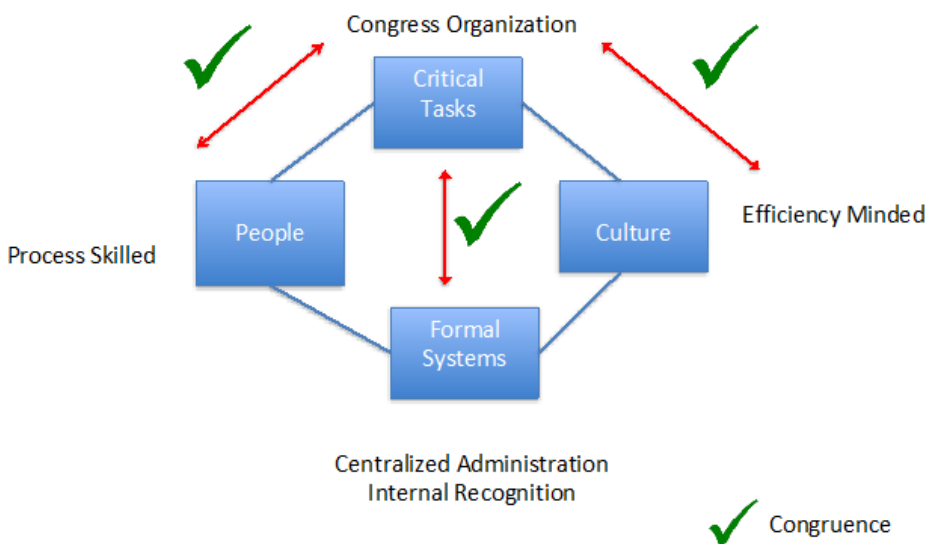

Figure 3b. Current Congruence

Figure 3a shows the current salient organizational factors. The critical task for the organization is the congress organization, while the other current salient factors are a centralized administration where internal recognition is rewarded, people with high process skills, and an efficiency minded culture. Figure 3b illustrates the fact that these salient dimensional factors are fully congruent with the critical current task of organizing the congress. In other words, the organizational critical factors are congruent for the existing critical task. Let's explain this in more detail.

Formal Systems

All the monitoring and control systems are fundamentally oriented toward the successful execution (on time, on budget) of the organizational processes. There is no extrinsic recognition for successful completion of tasks.

People

People are highly process-oriented and they are recruited based on their skills in performing complex operations with accuracy and speed. People with administration degrees are usually preferred. They are also more inclined to following protocols that have been successful in the past rather than trying new ones. While highly efficient in the current situation, this approach is insufficient for new challenges.

Culture

The organizational culture has centered around getting things done on time and on budget. Most of staff people do not know, interact with or understand high school teachers or students.

6.2.2. Proposed New Organizational Congruence Model

Next, we proceed to insert the new critical tasks as shown in Figure 4a, and we need to analyze whether the current organizational factors in the other dimensions are congruent with these new tasks. Figure 4a illustrates the fact that they are not, while Figure 4b shows what new organizational factors (in blue) are needed. We will discuss this in more detail.

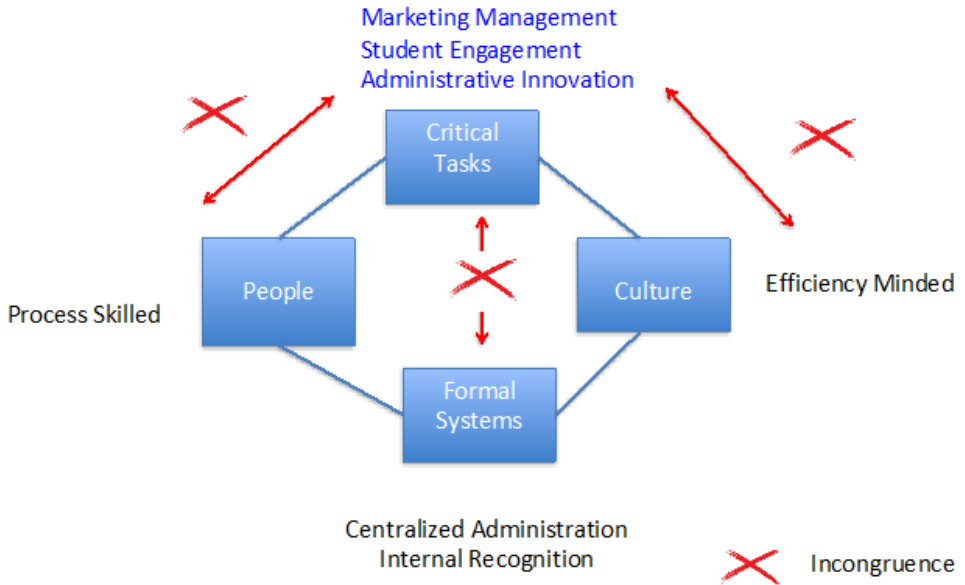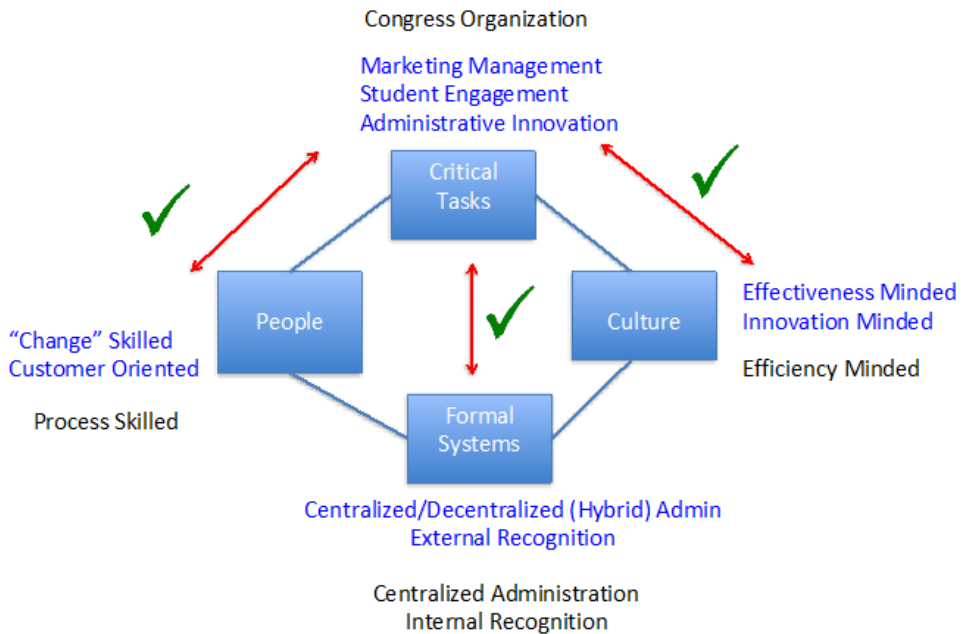**Figure 4a. New Critical Tasks with Current Organizational Factors**

Figure 4b. Proposed Congruence Model with New and Needed Organizational Factors

Critical Tasks - Formal Systems

Currently, the people in the organization are process-oriented and they interact with and know little about the members. There is a high level of automation in the organization. While there is no extrinsic recognition, in general, successful process completion is recognized as desirable. On the other hand, «*engaging in marketing activities*» and «*fostering student engagement*» requires an outward orientation and the extrinsic and intrinsic recognition of positive actions of the organizational members. In addition, the «*development of novel forms of management*» requires a greater decentralization while the assembly of a whole new team requires closer centralized supervision. Therefore, a hybrid approach to management (centralized/decentralized) may be needed.

Critical Tasks - People

The people skills that are expected are related to process and project management. The organization is task-oriented and highly professional. «*Engaging in marketing activities*» and «*fostering student engagement*» will require hiring additional people with marketing, communication and customer service skills. Also, «*development of novel forms of management*» requires people (at all levels) to become more change oriented. Some change management training and the use of facilitators may be required. Fortunately, assembly of a new team may favor people accepting change (since they were not committed to the old ways).

Critical Tasks - Culture

As previously mentioned, the existing mentality of the organization was «if it's not broken, don't fix it». This approach has proven unsuccessful given that the huge growth of members has made many of the old processes ineffective. Therefore, there is a need to foster a culture of embracing change rather than maintaining the status quo, and to become more customer (teachers and students) oriented rather than remaining inside the organization and being process oriented. One possible way to do this could be to program activities in which the organizational staff may have a chance to meet their «clients»; that is, the members worldwide.

6.3. Using CO Critical Tasks as Decision Criteria

As previously indicated, the proposed new congruence organizational model is shown in Figure 4b. The organizational factors that need to be congruent to obtain the peak performance of the organization along each of its dimensions are as follows:

In critical tasks/processes: marketing management, student engagement and administrative innovation.

In formal systems: Centralized/de-centralized (hybrid) administration.

In people: Process skilled, change skilled and customer-oriented.

In culture: Efficiency (for congress processes), effectiveness and innovation minded.

We have identified, along each organizational dimension, the factors that need to be in congruence with the critical tasks to reach our strategic objectives. These critical tasks are key for successful strategic innovation, and for this reason they will constitute the criteria to evaluate the different possible HQ city candidates. Table 2 shows a summary of the CO analysis.

Table 2. Summary of CO Analysis

Organizational Dimension	Dimension Factors
Critical Tasks	• Marketing Communication • Student Engagement • Administrative Innovation
Formal Systems	• Hybrid structure • External Recognition
People	• Communication Skills • Customer Orientation • Change Orientation
Culture	• Effectiveness Minded • Innovation Minded

6.4. Using AHP to Prioritize HQ Candidate Cities

As previously stated, management has been tasked with evaluating the different city alternatives for the HQs of the organization. Organizations move their HQs in response to changes in the internal configuration of their unit's activities or due to the demands of their external stakeholders (Birkinshaw, Braunerhjelm, Olm and Tierjesen, 2005). In the case of our target organization, this is the case since the question arises whether or not a HQ relocation could help develop the required new organizational factors (Figure 4b). This is a strategic decision because geographical location affects the organizational ability to function effectively and is very important for its future success. In effect, it is well known that proximity to resources such as specialized labor,

suitable suppliers and knowledge spillovers is very important for the success of an organization (Porter, 1990). Different cities were initially considered as HQ candidates. Top management pre-screened these cities and as a result only three (Cleveland, New York and Orlando) were left as leading candidates for the HQ location. The CEO of our target organization was the final person responsible for providing the insights and judgments for the analysis, although these were a result of internal consultation with the top three directors in the organization.

The discussion, summarized in Table 2, can be formalized using the Analytic Hierarchy Process as shown in Figure 5. In this hierarchy, the goal is to evaluate the different HQ city candidates using the critical tasks as organizational decision criteria. Tushman and O'Reilly (2002) indicated that the formal systems, people and cultural dimensions of the organization must be aligned with the critical tasks required to reach the strategic objectives. Based on this, the rationale for the selection of the proposed strategic HQ alternatives (Cleveland, New York, Orlando) would be to identify which city is most likely to contribute to (i.e. be congruent with) the success of the critical task(s). For this reason, critical task factors will constitute the criteria for the decision of selecting a HQ location for the target organization as shown in Figure 5.

Figure 5. Using Critical Tasks as AHP Decision Criteria

The critical tasks may vary in terms of their relative importance for the decision at hand. First, each task criterion may have different importance in terms of the specific decision. Second, the organization may consider that it has a stronger grasp of certain critical tasks than others. For these reasons, the initial proposed selection AHP hierarchy could have the goal of selecting a HQ

city, with the decision criteria consisting of the three critical tasks from Table 2 (marketing communication, student engagement and administrative innovation). The alternatives are the three candidate cities: Cleveland, New York and Orlando. In principle, we would be looking to choose the city that is most beneficial for the mastery of the required critical tasks (Figure 4a).

However, making a decision based only on the expected benefits for the organizational critical tasks may be misleading since there are also costs and risks (as well as opportunities) associated with the decision. For this reason, it was decided that an AHP BOCR model was much more convenient than a single benefits model. AHP BOCR models have often been used in managerial decisions (Forbes et al, 2018; Mu, 2016; Mu & Stern 2018) Figures 4a and 4b correspond to the B/C part of the current case analysis, and Table 3 shows the complete B*O/C*R calculations.

AHP BOCR Analysis

For BOCR analysis, four hierarchies corresponding to benefits, opportunities, costs and risks are needed. The priorities of the alternatives in each hierarchy are derived using AHP (Mu and Pereyra-Rojas, 2017). A comparative assessment of all the anticipated benefits and projected costs was made in order to help decide where to locate the target organization HQ. A similar comparative assessment process was done with the opportunities and risks. One important problem faced in BOCR analysis is the difficulty involved in assigning a value (monetary perhaps) to benefits, opportunities, costs and risks. The solution to this problem was to consider both tangible and intangible factors for the assessment process; the ability to do this is also one of the strengths of the AHP (Wijnmalen, 2007).

Next, we will provide a very brief explanation of the methodology by using the Benefits hierarchy (Figure 6a) as an example. First, the decision should be modeled as a hierarchy consisting of a goal, criteria and alternatives. The goal (i.e. selecting the best alternative in terms of benefits) is the intended decision, and the criteria (i.e. marketing communication, student engagement and administrative innovation) will be used to evaluate the alternatives (i.e. Cleveland, New York and Orlando).

To determine the relative importance of the criteria, they are compared pairwise with respect to the goal (e.g. with respect to the goal of evaluating cities in terms of their potential to yield the desired benefits, which criterion is more important: improving marketing communications or fostering academic engagement?). The relative importance is coded as a number from Saaty's

intensity scale that ranges from 1 to 9 (1- equally important, 3 - moderately more important, 5 - strongly more important, 7 - very strongly more important and 9 - extremely more important; values 2, 4, 6 and 8 are used as intermediate values as needed). For example, the decision-maker could consider that for the purpose of selecting a HQ city, marketing communications is strongly more important than administrative innovation. This would lead to recording a 5 in the corresponding cell of the pairwise comparison matrix (PCM) that tallies their pairwise relative importance values[3]. This process is repeated for the remaining comparisons. By raising the resulting PCM to powers to obtain the eigenvalues of the matrix, it is possible to derive the relative overall priorities of the criteria. In this case, it was found that student engagement has 50% of the overall importance, followed by marketing communications and administrative innovation, which has 25% each, as shown in Figure 6a.

After the criteria have been weighted, the relative importance of the alternatives with respect to each criterion will be determined following the same pairwise comparison procedure. These priorities are called local priorities (not shown in Figure 6a), and the final overall priorities for the alternatives are calculated by a weighted sum of the local priorities with respect to the criterion weights. This process yields the overall priorities shown in Figure 6a: Cleveland (0.12), New York (0.31) and Orlando (0.58). This indicates that Orlando has 58% of the overall preference, followed by New York which has 31% and trailed by Cleveland which only has 12%.

The same process is repeated for each of the hierarchies taking into account that the higher priorities of alternatives in the benefits and opportunity hierarchies reflect the more beneficial/opportunistic alternatives while higher priorities in the cost and risk hierarchies reflect higher costs/risks. For example, the cost decision hierarchy (Figure 6c) shows that Orlando (0.7) is the most costly city to locate the HQ of the target organization.

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[3]   Rather than using Excel, the calculations were made using the software Super Decisions (2018) provided by the Creative Decisions Foundation.

Figure 6. AHP BOCR Hierarchies
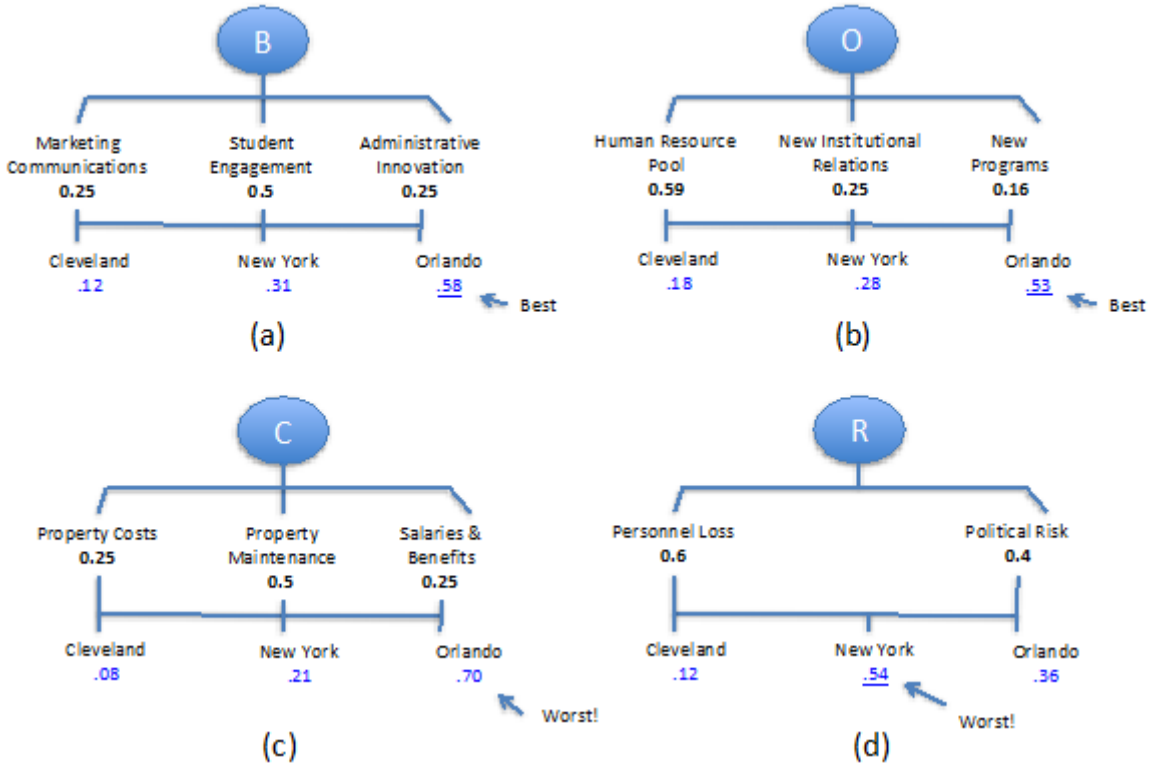
Finally, Table 3 combines the results of our analysis. A B/C analysis involves dividing the benefit value by the cost value.

Table 3. BOCR Results

	B	C	B/C	Normal	O	R	B / C*R	Normal	B*O / C*R	Normal	
Cleveland, OH	0.12	**0.08**	1.44	0.39	0.18	**0.12**	**12.50**	0.71	**2.25**	0.53	1st Option
New York, N.Y.	0.31	0.21	**1.45**	**0.39**	0.28	0.54	2.69	0.15	0.75	0.18	
Orlando, FL	**0.58**	0.70	0.83	0.22	**0.53**	0.36	2.33	0.13	**1.24**	**0.29**	2nd Option

The highest B/C quotient, as shown in Table 3, determines the best alternative and as can be seen, New York is the best alternative, followed by Cleveland and then Orlando, which trails far behind. Still, a BOCR analysis involves considering benefits (B) and costs (C), but also opportunities (O) and risks (R) as shown in Figure 6. Looking at Figure 6b the *Opportunities* hierarchy, Orlando (0.53) offers almost twice as many opportunities as New York (0.28), while New York offers approximately one and a half (.28/.18) more opportunities than Cleveland. However, in terms of risks, the *Risk* hierarchy (Figure 6d) shows that New York is the riskiest, followed by Orlando. Again, notice that the opportunities the target organization looks for are based on the congruence analysis, but the risks that can be faced have been obtained externally because they are inherent to the environment. The final overall result is obtained by calculating the formula B*O/C*R as shown in Table 3. This final analysis incorporating B,O,C&R, shows that the best overall alternative is Cleveland (0.53) followed by Orlando (0.29).

7. COAHP Method Assessment

In summary, congruence modeling (CO) consists first in identifying the critical tasks needed in the organization to accomplish the proposed strategic objectives and second, identifying the key factors in the organizational dimensions corresponding to people, culture and formal systems that need to be in congruence with the critical tasks.

We have proposed here that CO falls short in terms of giving the same importance to all the critical tasks. Their relative importance will vary depending on the specific decision at hand and can be derived using AHP. This integrated COAHP approach to make strategic decisions has been demonstrated using a real case of selecting a suitable city as organizational headquarters. Our next step is to assess the advantages and limitations of this approach, based on our experience with this case study.

Let's start with the COAHP advantages. First, the COAHP approach allowed the measurement, in a tangible way, of the relative importance of the different critical tasks for the specific decision. This is an improvement over CO which (implicitly) considers them to be equally important. Second, the AHP portion provided a visual and intuitive framework for discussion among top management. Third, being able to quantitatively prioritize the alternatives allowed the closeness of different options to be determined (as can be seen in

Table 3, the first option,53% of the overall preference, is far better than the second option, 29% of the preference). Establishing the closeness of the different alternatives is not possible when using ranking approaches (how close is one option to the other?). Finally, and very important in public decision-making, the CEO's presentation of the analysis facilitated consulting with, as well as buy-in from, both internal (top collaborators) and external (directors) stakeholders. Openness and transparency are useful features in public management, as discussed at the beginning of this study.

On the other hand, the main challenge to the application of the COAHP approach is that the decision-makers need to approach the decision work as a process with a set of steps that need to be done sequentially (and iteratively if needed). This requires a management that is disciplined to allocate resources (people and time) since having an important single meeting to make a decision is not possible using our proposed approach.

8. Conclusions

Public and government decisions are difficult because they require stakeholder engagement either to make the decision or to explain it, and therefore openness and transparence is required. Many organizational frameworks such as the popular congruence organizational modeling for change and innovation management are intuitively easy to use but lack mathematical rigor and the ability to quantify results which is important when decision preferences are very close (Tushman and O'Reilly III, 2002). On the other hand, the Analytic Hierarchy Process offers a simple way to measure tangible and intangible elements in an intuitive but rigorous way (Saaty, 1980). Our study proposes an integrated COAHP approach that first uses congruence modeling to identify the factors needed in the dimensions corresponding to formal systems, people and culture. These factors need to be congruent with the critical tasks/workflows needed by the new strategic choices. Given a specific strategic decision, an AHP analysis is performed in which the identified organizational factors (including critical tasks) are used as criteria for the strategic decision. The process has been illustrated using an empirical case study involving the decision to select the best location for organizational headquarters. This study contributes a theoretically solid and useful tool for the management of innovation in organizations, and is particularly suitable for the public and government sector.

References

Birkinshaw, J., Braunerhejelm, P., Holm, U. & Tierjesen, A. (2006). Why do some multinational corporations relocate their headquarters overseas? *Strategic Management Journal, 27*(7), 681-700. https://doi.org/10.1002/smj.541

Burns, D., Hambleton, R. and Hoggett, P. (1995). The Politics of Decentralization, *Community Development Journal*, 30(2), 224-227. https://doi.org/10.1007/978-1-349-23397-7_2

Bryson, J. M. (2004). *Strategic management for public and non-profit organizations: A Guide to strengthening and sustaining organizational achievement. 3*rd *Edition*. San Francisco: Jossey-Bass.

Buchholz, R. A. & Rosenthal, S.B. (1994). Stakeholder theory and public policy: How government matters. *Journal of Business Ethics, 51*(2), 143-153. https://doi.org/10.1023/B:BUSI.0000033608.61005.1f

Chen, M. K. & Wang, S. (2010). The Critical Factors of Success for Information Service Industry in Developing International Market: Using Analytic Hierarchy Process (AHP) Approach. *Expert Systems with Applications*, 37(1), 694-704. https://doi.org/10.1016/j.eswa.2009.06.012

Collins, J. & Porras, J. (1994). *Built to last*. New York: Harper Business.

Emrouznejad, A. & Marra, M. (2017). The state of the art development of AHP (1979-2017): A Literature Review with a *Social Network Analysis, International Journal of Production Research*, 55(22), 6653-6675, https://doi.org/10.1080/00207543.2017.1334976

Forbes, J., Hebb, A. & Mu, E. (2018). Ethical Decision Making in Action: Evaluating Hospital Care Attendance Approaches. International Journal of the Analytic Hierarchy Process, 10(3), 313-347. https://doi.org/10.13033/ijahp.v10i3.592

Freeman, R.E. (1984). *Strategic management: A stakeholder approach*, Boston: Pitman.

Glicken, J. (2000). Getting stakeholder participation 'right': a discussion of participatory processes and possible pitfalls. Environmental Science & Policy, 305-310.

Hulse, C. (2003). Threats and responses: Plans and criticisms: Pentagon prepares a future market on terror attacks. *The New York Times*, July 29, 2003.

Hunt, A. & Wheeler, B. (2018). Brexit: All you need to know about the UK leaving the EU. *BBC News*. Retrieved from: https://www.bbc.com/news/uk-politics-32810887

Kahraman, C., Demirel, N. & Demirel, T. (206). Prioritization of e-Government Strategies using a SWOT-AHP Analysis: The Case of Turkey, *European Journal of Information Systems, 16*(3), 284-298. https://doi.org/10.1057/palgrave.ejis.3000679

Mu. E. (2016). Using AHP BOCR Analysis for Experiential Business Education and Prioritisation of International Opportunities. *International Journal of Business and Systems Research, 10*(2/3/4), 364-393. https://doi.org/10.1504/IJBSR.2016.075749

Mu, E. & Pereyra-Rojas, M. (2017). *Practical decision making: An introduction to the Analytic Hierarchy Process (AHP) using Super Decisions v3*. Springer International Publishing. https://doi.org/10.1007/978-3-319-68369-0_2

Mu, E. & Stern, H. (2012). A structured stakeholder self-identification approach for the deployment of public information systems: The case of surveillance technology in the city of Pittsburgh, *Journal of Information Technology Management, 23*(4), 50-66.

Mu, E. & Stern, H. (2018). A Contingent/Assimilation Framework for Public IS Inter-Organizational Decisions. *International Journal of Information Technology and Decision Making, 17*(6), 1611-1658

Pan, G.C. & Flynn, D. (2003). Information systems project abandonment: A case of political influence by the stakeholders. *Technology Analysis & Strategic Management, 15*(4), 2003, 457-466. https://doi.org/10.1080/095373203000136042

Porter M. E. (1980). *Competitive strategy*. New York: Free Press.

Poveda-Bautista, R., Baptista, D. C. & García-Melón, M. (2012). Setting Competitiveness Indicators Using BSC and ANP. *International Journal of Production Research,* 50: 4738-4752. https://doi.org/10.1080/00207543.2012.657964

Rainey, H. G. (2003). *Understanding and managing public.* 3rd Edition. San Franciso: Jossey-Bass.

Rocheleau, B. (2005). *Public management information systems.* Hershey, PA: Idea Group Publishing. https://doi.org/10.4018/978-1-59140-807-9

Saaty, T.L. (1980). *The Analytical Hierarchy Process: Planning, priority setting, resource allocation.* New York: McGraw-Hill. https://doi.org/10.13033/ijahp.v7i1.321

Saaty, T.L. (2015). About a hundred years of creativity in decision-making. *International Journal of the Analytic Hierarchy Process, 7*(1), 138-143.

Salmeron, J. L. & Herrero, I. (2005). An AHP-Based Methodology to Rank Critical Success Factors for Executive Information Systems. *Computer Standards & Interfaces, 28*(1), 1-12. https://doi.org/10.1016/j.csi.2004.09.002

Super Decisions (2018). Retrieved from https://superdecisions.com/

Tavana, M., Zareinejad, M., Di Caprio, D. & Kaviani, M. A. (2016). An Integrated Intuitionistic Fuzzy AHP and SWOT Method for Outsourcing Reverse *Logistics. Applied Soft Computing*, 40, 544-557. https://doi.org/10.1016/j.asoc.2015.12.005

Thompson, J.D. (1967). *Organizations in action.* New York: McGraw-Hill.

Tushman, M. L. & O'Reilly III, C. A. (2002). *Winning through innovation: A practical guide to leading organizational change and renewal.* Boston, MA: Harvard Business School Press.

Wijnmalen, D.J.D. (2007). Analysis of benefits, opportunities, costs, and risks (BOCR) with the AHP-ANP: a critical validation. *Mathematical and Computer Modeling, 46*(7-8), 892-905. https://doi.org/10.1016/j.mcm.2007.03.020

Wu, C.-R., Lin, C.-T. & Tsai, P.-H. (2011). Financial Service Sector Performance Measurement Model: AHP Sensitivity Analysis and Balanced Scorecard Approach. *The Service Industries Journal*, 31, 695-711. https://doi.org/10.1080/02642060902852908

Yavuz, F. & Baycan, T. (2014). Application of Combined Analytic Hierarchy Process (AHP) and SWOT for Integrated Watershed Management. *International Journal of the Analytic Hierarchy Process, 6*(1), 3-34. https://doi.org/10.13033/ijahp.v6i1.194

Zavadskas, E. K., Turskis, Z. & Tamosaitiene, J. (2011). Selection of Construction Enterprises Management Strategy Based on the SWOT and Multi-criteria Analysis. *Archives of Civil and Mechanical Engineering*, 11, 1063-1082. https://doi.org/10.1016/S1644-9665(12)60096-X

APPENDIX

The AHP Method Explained

The AHP method consists of four steps: First, the problem has to be structured as a hierarchy consisting, basically, of a Goal, Criteria and Alternatives. Each of them is called an element in the model. To explain the method, we will use the classic example of buying a car proposed by Mu and Pereyra-Rojas (2017) as shown in Figure A.1.

As a second step, a pairwise comparison matrix is filled in with the decision-maker pairwise comparison judgments (using a scale from 1 to 9 as shown in Fig. A.2) of the relative importance of the criteria with respect to the goal, verifying that its degree of consistency ratio (CR) , which is a measure of how much the judgments respect transitivity and depart from randomness, is within the common practice of less than 0.1. Once this is completed, the criteria priorities are derived by calculating the eigenvalues of the matrix as shown in Fig. A.3. For this, the matrix is raised to powers until a limit matrix in which all its columns are equal is obtained. In this limit matrix, any of the columns provides the desired priorities.

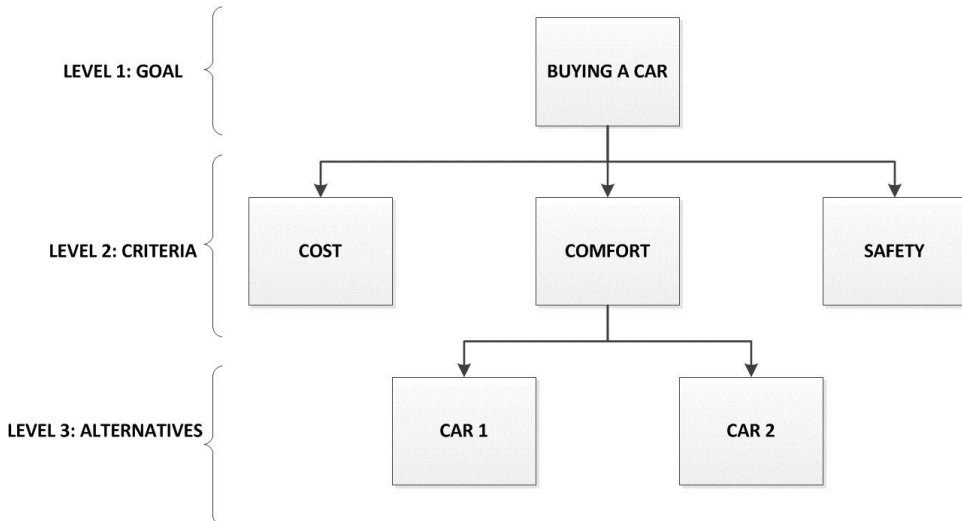**Figure A.1. Basic AHP hierarchy for Buying a Car.**

Figure A.2. Saaty's pairwise comparison intensity scale

Verbal Judgment	Numeric Valué
Extremely important	9
	8
Very Strongly more important	7
	6
Strongly more important	5
	4
Moderately more important	3
	2
Equally important	1

Figure A.3. Criteria comparison matrix and priorities
(CR = 0.006 < 0.1)

Buying a Car	Cost	Comfort	Safety	Priority
Cost	1	7	3	0.669
Comfort	1/7	1	1/3	0.088
Safety	1/3	3	1	0.243

The third step consists in repeating the previous process to derive the local alternative priorities with respect to each of the criteria. The resulting local priorities of the alternatives are shown in each of the three columns (under the criteria headings) in Fig. A.4. The fourth and final step, called model synthesis, consists in calculating the global (overall) priorities of the alter- natives by using a weighted sum of their local priorities weighted with their respective criteria priorities, as shown in Fig. A.4

Figure A.4. Model synthesis with global priorities.

	Cost	Comfort	Safety	Global Priority
Criteria Weights ->	0.669	0.088	0.243	
Car 1	0.875	0.167	0.100	0.624
Car 2	0.125	0.833	0.900	0.376