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# **Boosting knowledge & trust for a sustainable business**

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Full Papers***

*University of Bocconi, Milan*

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# **Boosting knowledge & trust for a sustainable business**

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## ***Referred Electronic Conference Proceedings***

**Full Papers**

edited by

*Sandro Castaldo - Marta Ugolini - Gianmario Verona*

# To be ethical let's think Bayesian

## A case study from management<sup>♦</sup>

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### Abstract

**Framing of the research.** Management deals with actions/decisions such as, for example, «supporting higher costs for environmental prevention and land conservation, even when it is not mandatory by law». What are the «conditions» that could favor these types of choices, which, as «common sense» suggests, are to be considered «ethical behaviors»? The existence of a range of tools (e.g. board of directors), levers (e.g. social example of direct manager) and rules (e.g. protocols, certifications), is challenging for the management that aims to select «ethical behaviors», perhaps in the form of «best practices, which are useful for running its business, just as the «common sense» of the manager or entrepreneur sometimes suggests.

**Purpose of the paper.** The scenario depicted above gives an idea of the importance of having methodology, as rigorous as possible, capable of allowing an overall assessment of various tools, levers, and rules. The introduction of this kind of methodology, and some preliminary experiments, is the purpose of this work.

**Methodology.** The methodology is based on «Bayesian belief networks», an implementation of the Bayesian paradigm. Starting from data collected through surveys, representing management's perception, it is possible to update beliefs and generate suggestions of «ethical behaviors», proposed in the form of simple heuristics.

**Results.** The emerging conceptual framework shows how, starting from a series of beliefs, belonging to the «common sense» of management, can emerge «conceptual maps» of belief and behaviors, under the form of «heuristics», data-driven, that can support management in its daily decision making.

**Research limitations.** The proposed methodology needs to be verified with managers decision making while acting in their daily workplace.

**Managerial implications.** The proposed models, readable in the form of simple «heuristics», may play a chief role for education and training purposes and work as reference best practice for human resource management units during the hiring processes.

**Originality of the paper.** In a nutshell, in the case dealt with in this paper, we could say that the paradigm introduced would allow us to have a method that, starting from the ethical management of common sense, would pass to the ethical management based on evidence, of which the common sense is the custodian.

**Keywords:** Management ethics; Common sense; Ethical dilemma; Causal models; Bayesian belief network; Experimental thoughts.

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## 1. Introduction: let's start with *common sense*

What does it imply to «be ethical» in the management of a business? In principle, as it is known, *ethics* deals with what is *good* and *evil*, or *right* and *wrong*.

In the case of *management*, these principles have the role of supporting the guidance and governance of the actions of people and/or groups, such as, for example, *behavioral rules* that can guide managers in their daily actions. And the «belief» that the interests of *shareholders* and other *stakeholders* no longer represent the company's only priorities has become «common sense». They are increasingly important, at least in the *common sense* of management, *attitudes* and *best practices* that take account of *customer relations*, adopting «values» such as *integrity*, *compliance* with *organizational expectations*, helping colleagues to cope with *ethical dilemmas*, or seeking the advice of others.

One of the objectives of *ethics*, applied to *management*, for instance, is to treat employees and customers *fairly* and *equitably*, with the aim of promoting an improvement in the business. Adherence to such a type of *business management* can also have the effect of stimulating the motivational climate of the work environment. Acting «ethically», when applied to business daily, implies, first, *respecting the law*, interacting with others *honestly* and without being *deceptive*.

Since companies have different *ethical standards* from each other, the management supports, more and more, to increase the sharing of the standard, under the form of an *unwritten code* or that of a *real document* (i.e., *written code*) shared within the business context.

Companies, increasingly aware of the importance of having «codes of conduct», sometimes written in the wake of some form of scandals, come to consider it so important that they update it periodically, sometimes on an annual basis. After updating their *code of conduct*, all staff of the company should read it so that they can make it their own, and adopt it in their *individual conduct*, when operating in the company or on its behalf with external stakeholders.

As mentioned above, the ethical component, in practice, concerns most of the decisions taken daily, both in public and private environments. And this is a fact well known to managers, who are called to set a good example for other employees. It is precisely this *attitude*, on the part of managers, that can stimulate other employees to follow a similar conduct. To foster this type of climate, more and more companies are resorting to *training programs* for their managers, both in-house, in the case of large companies, and outsourced, for companies that cannot satisfy these paths with their own internal units of *human resources*. It is a fairly canonical practice that companies offer managers training courses in *ethics*, even before being hired. Indeed, sometimes the hiring of the manager is even conditioned to the success of the training course attended.

*Common sense* is equipped when called upon to answer about what «ethical behaviors» are, as already mentioned above. For example, manager's *common sense* knows the case when can speak of «integrity behavior», in other words when exhibiting *personal honesty* and *courage* in making their own decisions. When managers are asked to exhibit «fairness», they know that this behavior contemplates a *tolerant attitude* and being *open to diversity*. Managers also know well how important it is to have «reliable behavior», that is, keeping *promises* and *commitments*. Managers and executives know how important it is trying not to *deceive* their interlocutors with *half-truths*, *omissions*, or other *underhanded means*. In other words, it is well known how important it is assuming an «honest behavior». When in their business practices managers follow state rules and laws, they know the importance of a «lawful behavior». *Respect* and *dignity* for one's interlocutor are two criteria that managers adopt, regardless of *gender*, *race*, or *ethnicity*, when they know the importance of a «respectful behavior». Many managers know well how important the other person is, even if they are not a direct collaborator (stakeholder) of their company. In other words, they know when it is important their willingness to *help people in need*, or that they achieve their business goals, causing *minimal damage* to people and property. In a nutshell they know the importance of «kind behavior».

Companies, even the smallest ones, and their management, have become so aware of the importance of *training* and *education* in ethical content that, by now, *training programs* centered on ethical issues for management are increasingly in demand.

Unfortunately, relying on *common sense*, even if it represents the starting point, and as such is should be always requested and welcome, for the daily management of a business *common sense* is not always enough. This is also true in the case of small businesses, where the owner's example can be more easily imitated, as the absence of complexity in the organization of the business allows for easier dialogue between entrepreneurs and collaborators. Even in such cases, however, it is becoming increasingly important to codify the «best practices» of *common sense*, so that the various *stakeholders*, both internal and external to the company, can interact through shared «codes of conduct» capable of favoring an activity more «sustainable» from a *social, economic, and environmental* point of view.

Section 2 introduces some proposals for models born as responses to the need to systematize and interpret good «ethical practices» that emerge from management's «common sense». First mention is made of *Carroll's pyramid* model. Then there are models inspired by Carroll's proposal, but which try to consider situations of everyday life in which the manager is called to decide (i.e., *ethical dilemmas*). As we will see, in this case the possibility of having data capable of capturing the «perception» of managers with respect to «ethical behaviors», or in any case considered as such, and how they could have given rise to more or less «sustainable choices», is of crucial importance (i.e., «I choose not to take profits to avoid firing collaborators»).

The simplicity of these interpretative models, according to the literature cases cited, also shows benefits when they must be adopted in management *training programs*. Section 3 proposes a preliminary experiment that tries to tackle a methodological problem. Starting from the examples of *common sense*, briefly mentioned above, it is understandable that the «perception» of ethical issues and the related behaviors to be adopted can change over time. A manager may perceive a «kind behavior» or an «integrity behavior» in a different way, perhaps because his set of *beliefs* has changed or because objective situations have changed, due to the introduction, for instance, of new *laws, regulations, or protocols*. In this case, it is necessary to update the *beliefs* and related «rules of conduct» based on new evidence. And here the solution proposed with the preliminary experimentation comes into play. Starting from data collected through surveys, it is possible to update *beliefs* and *behaviors*, proposed in the form of simple *heuristics*, using *Bayesian belief networks*, part of the broader homonymous *paradigm* proposed, for the first time, by the Reverend Thomas Bayes. Finally, Section 4 draws the conclusions, considering both the brief, and by no means exhaustive, literature cases of Section 2 and the preliminary results of the methodological approach of Section 3.

## **2. Beyond «common sense»: pyramids, experimental thoughts, and their simulations**

According to several scholars, from different disciplines, to overcome the current systemic crisis, it should be rethought the relationship between *economy* and *society*, based on the recovery of «ethical values». This vision has favored the affirmation of *corporate social responsibility (CSR)*, an area of «social conduct», which inquiries about *ethical implications* within the strategic vision of the company.

Companies can engage in CSR conduct for *strategic* or *ethical* purposes. According to the first point of view, the goal is, on the one hand, to increase *profits* in the long term, and, on the other hand, to strengthen stakeholder *confidence*. As regards the second point of view, however, the *ethical* one, companies could adopt CSR *policies* and *practices*, thanks to the ethical convictions of the management, such as, for example, in the case of a CEO who considers the damage to the environment ethically questionable.

What just mentioned above, can give an idea of the close connection between CSR and *business ethics*, the part of *applied ethics* that examines the *ethical principles* and *dilemmas* that emerge in the business environment.

## 2.1 The pyramid

The *pyramid of social responsibility* of Archie Carroll (Carroll, 1991), is an attempt to reorganize the «foundational» aspects of the CSR. The chief point of Carroll's work is the vision of «pyramidal structure» according to which CSR is organized. At the bottom of the *pyramid* is the concept of *economic performance*, named «be profitable». The *motto* of the next level of the *pyramid* is «obeying the law». «Be ethical» is the third level of Carroll's *pyramid* and translates the obligation to do what is right. «Be a good corporate citizen» represents the highest level of the *pyramid* produced by the vision of the American scholar. This last concept captures the idea of «philanthropic responsibility».

It is important to briefly mention another aspect that Carroll has developed in his work, concerning the *descriptive categories* of three «types» of managers or *management*: «immoral», «amoral» and «moral». The first *category*, the «immoral manager», is the one whose *behaviors* suggest an active opposition to what is considered «right» or «ethical». The second *category* identified is the «amoral management», that is not sensitive to the fact that his daily *business decisions* can have detrimental effects on others. The third *profile* traced by Carroll, the «moral management», which employs *ethical norms* that respect a high standard of behavior. Carroll, in his work, points out that the «goal is to accentuate the *moral management* approach by contrasting it with the other two types» (Carroll, 1991). When an *ethical dilemma* arises, the «moral manager» succeeds in assuming a *leadership* position for his company or organization (Carlson and Perrewé, 1995; Mihelic et al., 2010; Kaptein, 2019).

Some attempts have done nothing but look for a solution within the Carroll paradigm, perhaps moving the different levels of responsibility «up and down the pyramid», to testify the recognition and validity of Carroll's model. Others have highlighted the importance of the primacy of ethical responsibilities. Carroll, however, supports that the concept of «ethics» permeates its pyramid (Carroll, 2016).

One important aspect taken up by Carroll in this work is the «pyramid shape» of its model. Carroll argues that «the pyramid was selected as a geometric design because it is simple, intuitive, and built to withstand the test of time». Another important aspect relevant for this work, is represented by the «descriptive categories» of management mentioned above (Carroll, 1991), through which Carroll aims «to isolate the ethical or moral component of CSR and relate it to perspectives that reflect the three major ethical approaches to management». Thanks to them, Carroll supports the overall objective of managing with «stakeholders in an ethical or moral fashion» (Carroll, 1991) (p. 39).

The first aspect just mentioned above, is particularly suitable for *education* and *training programs*, as also supported by Baden, according to the *pyramid* proved to be strategic not only for management, but also for *educational* purposes (Baden, 2016). Meynhardt and Gomez (2019) are in line with the previous work when highlight the «heuristic» value of the pyramid, which, it is, in effect, a way «to replace mental shortcuts», allowing the transformation of complex problems into «intuitive» managerial actions, *à la* Simon (Simon, 1990), which, as a whole, looks as a very fertile ground for *corporate training programs*.

The second aspect mentioned above, concerning the «descriptive categories» of management, is particularly important for identifying *attitudes* and *behaviors* of managers aimed at fostering a climate that can allow interaction with «stakeholders in an ethical or moral fashion», just like advocated by Carroll. The definitions proposed by Carroll, despite representing a clear and well-defined picture of the various «descriptive categories», are not always sufficient to define a *conceptual framework* of reference to identify a management called to assume ethically relevant behaviors. «Ethical behaviors» that are even more complicated to identify in light of the complexity

that management faces, such as that made up, above all, in the light of the number of *tools*, *levers* and *rules* available.

Next paragraph briefly introduces an experimental framework that tries to overcome such a kind of issue, providing an empirical methodology to identify Carroll's «categories» of management, bottom-up, employing *tools*, *levers* and *rules* whose perception is captured through *data* collected from *survey* among managers.

## 2.2 *Experimental thoughts* and their simulations: «Ethical behaviors» in action

The existence of a fairly wide range of *tools* (e.g. *board of directors*, *organizational actions*), *levers* (e.g. *cultural*, *social example of direct manager*) and *rules* (e.g. *protocols*, *certifications*, *decrees law*), is challenging for the management that aims to select «ethical behaviors», perhaps in the form of *best practices*, which are useful for running its business, just as the «common sense» of the manager or entrepreneur sometimes teaches.

For instance, let's consider a possible *action/decision* the management is dealing with such as, for example, «supporting higher costs for environmental prevention and land conservation, even when it is not mandatory by law», or «apply safeguards to reconcile work/family actions». What are the «conditions» that could favor these types of *choices*, which, as «common sense» teaches, are certainly to be considered «ethical behaviors»? Surely, taking «responsibility» by the *board of directors* could represent an important response in this sense (i.e. one of the *tools* referred to above). It could be equally important to involve *top management*, where it exists, so that it can contribute with the *social example of direct manager* (i.e., one of the *levers* mentioned above). Not to mention, then, the contribution that some form of *certification* and/or *protocol*, the so-called *rules* mentioned above, could give. Even more interesting, then, would be to consider the multiple contributions of several *factors* among those just mentioned.

What has just been said, as well as the scenario introduced above, gives an idea of the importance of having methodologies, as rigorous as possible, capable of allowing an overall assessment of various *tools*, *levers* and *rules*, such as those introduced in the scenario above. Such a methodology should make it possible to intercept the *process* underlying the manager's *decision making*, also allowing the possibility of playing on the change in the *course of actions*. Such a methodological tool would thus allow us to explore plausible alternatives, to evaluate the contribution of factors that can trigger the different alternatives, all this allowing us to work with *models* that, starting from the *data* (e.g., survey data), could result in plausible *explanations* of these.

A work that has tried to follow this methodological approach is the one proposed by D'Avanzo, Franch and Borgonovi (2021). The authors employed a *structural equation modeling* approach (SEM) to test three *causal models*, which represent, in turn, *thought experiments* simulating «ethical dilemmas» that management deals with during *decision making*.

A first type of «ethical dilemma» taken into consideration can be exemplified with the following two instances: «keep the secret of known pollution effects for reasons of competitiveness to safeguard the survival of the company and the work of its employees» or «do not punish/sanction the behaviors of collaborators who have violated ethical rules not for their own interests but to bring more profits to the company».

These *choices* are triggered by «circumstances» based on *beliefs* such as «in Italy the corruption/bribery phenomenon is a widespread practice to obtain advantages in the relationships between companies and public administrations», or «there has been a lot of talk in Italy in recent years but little has been done to combat corruption/bribery». In essence, these are *circumstances* that can be enclosed in the Mozart's *formula* of «All Women Do It» (also known as «the School for Lovers»). In other words, since everyone behaves badly, in the same way, then there is nothing wrong with safeguarding our workplace or company, even if this implies a series of impacts on people and/or the environment.



It should be noted, in this first model reported by the authors, how the *belief* according to «the phenomenon of bribery/corruption is mainly linked to the culture of a country and is not strictly economic» plays a fundamental role. In other words, with the first *thought experiment*, the model states that when an «ethical dilemma» arises, the management probably will adopt «unethical behaviors» when these are believed useful for the company, as expected by the lowest level of Carroll's pyramid.

The second *thought experiment*, proposed by the authors, shows the existence of an «imitative behavior», but for a good purpose. In fact, in this case, the type of «ethical dilemma» taken into consideration can be exemplified with the following instances: «choose not to withhold earnings to avoid laying off some employees», «apply safeguards to reconcile work/family actions», «support higher costs for environmental prevention and land conservation, even when it is not mandatory by law», or «look for new markets to abandon markets that are recognized as ethically compromised even if they are at a high profit». It is worth taking a look at what are the *beliefs* of management, within the *thought experiment*, capable of *triggering* these choices. One is «the example of the behavior of a direct boss». In other words, management asks for a model to imitate. The presence of «social network», also represents a chief *belief*, based on *reputation*, able to trigger «ethical behaviors». «The spread of markedly corporate culture» is another *belief* that indicates the importance, once again, of the *educational* and *training* path within the company.

According to the second thought experiment when an ethical dilemma arises, if the appropriate *social* (i.e., reputational) and *cultural* conditions exist, the manager succeeds in assuming a *leadership* position for his company (Carlson and Perrewé, 1995; Mihelic, Lipicnik and Tekavcic, 2010).

*Models* above are readable in the form of simple «heuristics» and may play a chief role for *education* and *training* purposes. However, the management supports, more and more, the sharing of new *beliefs*, coming from «common sense» knowledge, and as such it emerges the need to easily update all *levers*, *tools* and *rules*, mentioned above, that are based on «new beliefs».

In this sense, the «Bayesian paradigm» and one of its increasingly widespread *tools*, namely the *Bayesian belief networks*, both introduced in the next Section, seems particularly promising.

### 3. How Reverend Bayes perceives ethics: modeling manager's *belief*

As known, the overall idea behind the *Bayesian paradigm*, also named as a *Bayes' theorem*, or *Bayes' rule*, is that many quantities, apparently unknown, possess a *probability distribution*, updateable based on *new evidence* soon as available.

*Bayesian paradigm*, allows to change the *belief* based on the *data*, then contemplating *falsifiability*, which is so «conjectural» and subject to change, *à la* Popper. The *Bayesian view* contemplates that the *probability* measures the strength of a *belief*, as, for example, «the diffusion of the ethical sense depends mainly on the culture of the countries». Unlike *frequentist view*, a *Bayesian* can treat individual events, such as, for example, «the diffusion of the ethical sense depends mainly on the individual values of people», even in the absence of sample data available with examples of the same type. This *belief*, however, could change over time. For example, a sudden socio-health situation could have changed the «conduct» of the majority of stakeholders, *internal* and *external* to their company, for better or worse, such as the tightening of the sense of competitiveness. Such a situation, in addition to inducing a change in the *beliefs* of the individual manager, or in the entire management of the company, could also require an update of «protocols», «codes of conduct» and reassessment of roles within the company.

*Bayesian paradigm*, thanks to the practical implications that it offers in different fields, attracts more and more interdisciplinary interests. It is considered a «normative» *model of rationality*, to be aspired to, perhaps through training courses. Some authors have even provided arguments in favor of the «cognitive plausibility» of Bayesianism, such as, for example (Gopnik et al., 2004), according to which children seem to use a Bayesian model of *learning*.

Today, however, the exponential growth of the data we use to *hypothesize* models on which decisions are based, including those adopted in management, makes the use of *decision support systems*, perhaps based on the *Bayesian paradigm*, more plausible. These systems, in fact, allow a rapid formulation of *hypotheses*, automatically. The resulting *decisions* can be easily explored and used by management.

Thanks to this paradigm, management has a methodology for making data-driven decisions, in a simple way, knowing that they can be updated as soon as the company network or the world around it changes.

In a nutshell, in the case dealt with in this paper, we could say that such a paradigm would allow us to have a method that, starting from the ethical management of common sense, would pass to the ethical management based on evidence, of which the common sense is the custodian.

The next section introduces an embryonic *conceptual framework*, based on «belief networks», which represent a particular implementation of the *Bayesian paradigm*. The aim is to show how, starting from a series of beliefs belonging to the «common sense» of management, it is possible to reconstruct «conceptual maps», or «heuristics», *data-driven*, because based on data from questionnaires, which, in turn, represent the «perceptions» of management, and that are able to support management in its daily *decision making*.

### 3.1 Method

In the preliminary experiments reported in the following It has been employed a Bayesian Network (BN) methodology. This kind of networks are graphical models of knowledge in an *uncertain* domain. They are probabilistic models structured as *directed acyclic graphs* (DAGs). BNs are widely used in cognitive science and the field of artificial intelligence. Such models are particularly suitable for reasoning tasks under uncertainty conditions, overcoming the limitations of traditional rule-based systems (Pearl, 1988), (Pearl, 1995), (Pearl, 2011), (Holmes & Lakhmi, 2008).

In a BN nodes represent the variables of interest, and directed links represent the causal dependence between them. Each node is associated with a table of conditional probabilities, given the parents' node.

As already mentioned above, BNs are handy whenever the problem cannot be wholly described due, for example, to a lack of information. Network's topology represents both the knowledge base of the environment, in which events may occur, and the general structure of the causal process in the domain without providing details about a specific element. Each node of the network, given its immediate ancestors, is conditionally independent of any other than its descendants.

Among the advantages of applying BNs there are the compactness of the representation, the causal dependency link, the fact that they are tools with well-defined semantics, and the possibility of making descriptions even when there is not enough deterministic-type information about how the system works. Furthermore, BNs can be used, once the model is determined, to make four kinds of inferences: 1) *Diagnostic* (i.e. from effects to causes), 2) *Causal* (i.e. from causes to effects) 3) *Intercausal* (i.e. between causes of a common effect), and 4) *Mixed* (i.e. a combination of the previous cases).

The structure of the BN is usually determined by an expert of the domain. However, over the time, automatic methods and heuristics have been proposed to induce it directly from the dataset. In particular, in the following experimentation, it has been used the *Bayesian search structure learning algorithm*, introduced by (Cooper & Herkovitz, 1992), and modified by (Heckerman, 1995), aimed at constructing a probabilistic network from a set of records. The overall procedure is implemented in the Genie Tool<sup>1</sup>. This algorithm is one of the earliest and widely used approaches for determining the structure of a BN. The procedure is based on a «hill climbing» procedure, exploiting a scoring heuristic that, in the case of the used tool, is the log-likelihood function.

The methodology gives as an outcome an *directed acyclic graph* (DAG) that achieves the highest probability, according to the heuristics score of the data, given the found structure of the graph.

### 3.2 Data

The *dataset*, obtained from the experimentation carried out by D'Avanzo, Franch, Borgonovi (2021), comes from a survey run among Italian managers.

The *survey* was run through the period of time among February 2015 and October 2015. The resulting dataset is made of 149 observations, and it is described by 72 variables. During the pre-processing step, 5 variables have been deleted because they were incomplete and with noise, so the final number of variables amounts to 67. The answers were given on a *Likert scale* from 1 to 7, in which 7 represents the highest degree of adhesion between «ethics» and related concepts.

During the pre-processing step, 5 variables have been deleted because they were incomplete and with noise, so the final number of variables amounts to 67. The answers were given on a *Likert scale* from 1 to 7, in which 7 represents the highest degree of adhesion between «ethics» and related concepts.

In particular, the list of the variables is shown in Table 1 .

Tab. 1: The table reports the variable of the dataset, with a short description for each of them. Adapted from D'Avanzo, Franch and Borgonovi (2021)

Observed variable/item name	Code	# of items
Degree of coincidence / coherence of the concept of ethics with the nouns proposed - <b>Correctness</b>	V55	39
Degree of coincidence / coherence of the concept of ethics with the nouns proposed - <b>Morality</b>	V56	40
Degree of coincidence / coherence of the concept of ethics with the nouns proposed - <b>Legality</b>	V53	37
Degree of coincidence / coherence of the concept of ethics with the nouns proposed - <b>Impartiality</b>	V58	42
Degree of coincidence / coherence of the concept of ethics with the nouns proposed - <b>Justice</b>	V57	41
Degree of coincidence / coherence of the concept of ethics with the nouns proposed - <b>Legality</b>	V54	38
Degree of coincidence / coherence of the concept of ethics with the nouns proposed - <b>Meritocracy</b>	V59	43
Keep the secret of known pollution effects for reasons of competitiveness, knowing however that there may be risks (not certainties) for the health of workers and / or inhabitants, to safeguard the survival of the company and the work of its employees	V44	30
Finding formally correct ways to get bribes or other forms of corruption to avoid the risk of bankruptcy of companies / organizations or to dismiss a significant number of employees (eg over 50%)	V35	21
In order not to pay back debts (eg debts to suppliers, debts to the tax authorities) decide to plan the bankruptcy of the company and then establish another	V40	26
Keep the secret on known pollution effects, which however have no direct impact on the health of workers and inhabitants, to safeguard the survival of the company and the work of its employees for reasons of competitiveness	V43	29
Finding formally correct ways to get bribes or implement other forms of corruption at international level when it is considered that this is the general practice	V42	28
Don't punish/sanction the behaviours of collaborators who have violated ethical rules not for their own interests but to bring more profits to the company	V37	23
Optimize / maximize results, given certain constraints, such as market constraints, competition for companies, laws and policy choices in public administrations, resources available from donations and contributions for non-profit institutions, etc.	V73	44
Board of directors	V75	46
The example of the behavior of direct boss	V84	52
Social network	V82	51
The spread of markedly corporate culture	V87	54
Organizational actions to spread the culture of ethics	V85	53
Application of laws/guidelines anti-corruption protocols	V77	48
Ethical certification SA 8000	V78	49
Social balance sheet, social impact indicators and other CSR instruments	V79	50
Specifically, the D.L. 231/2011 on corporate responsibility and 190/2012 for public administrations	V76	47
The lobbying activity would not in itself be negative when regulated and made transparent	V32	19
The regulated and transparent lobbying activity can be positive because, on complex problems, it brings to the attention both of those who decide public policies and of the interests of different stakeholders who can balance each other	V31	9
The diffusion of the ethical sense depends mainly on the culture of the countries	V19	9

The phenomenon of bribery-corruption is mainly linked to the culture of a country and is not strictly economic	V28	17
The diffusion of the ethical sense depends mainly on the individual values of people	V18	8
In Italy the corruption-bribery phenomenon is a widespread practice to obtain advantages in the relationships between companies (in general private subjects) and public administrations (tenders, supplies, concessions, authorizations, etc.)	V24	13
There has been a lot of talk in Italy in recent years but little has been done to combat corruption-bribery	V26	15
The debate on ethics is mainly of image and facade, often used in an instrumental way and does not substantially touch the real behavior of companies / organizations	V8	1
Indicate the degree of coincidence / coherence of the "ethical" concept with the proposed nouns, according to <b>your own conception - Impartiality</b>	V50	35
Indicate the degree of coincidence / coherence of the "ethical" concept with the proposed nouns, according to <b>your own conception - Justice</b>	V49	34
Indicate the degree of coincidence / coherence of the "ethical" concept with the proposed nouns, according to <b>your own conception - Meritocracy</b>	V51	36
Indicate the degree of coincidence / coherence of the "ethical" concept with the proposed nouns, according to <b>your own conception - Correctness</b>	V47	33
Look for new markets to abandon markets that are recognized as ethically compromised even if they are at a high profit	V41	27
Apply safeguards to reconcile work / family actions	V38	24
Choose not to withhold earnings to avoid laying off some employees	V36	22
Support higher costs for environmental prevention and land conservation, even when it is not mandatory by law	V39	25
In all sectors the presence of clear rules favors ethical behaviours	V20	10
The difficulties of adopting ethical behavior depend on the lack of clear and transparent rules	V16	7
The crisis has positively influenced the adoption of ethical behaviours	V23	12
The adoption of ethical behavior was negatively affected by the recent crisis	V14	6
In Italy the corruption-bribery phenomenon is a widespread practice in relations between private individuals/companies (companies' supply chains, credit concessions by banks, etc.)	V25	14
In the public sector, on average, there is a higher ethical sense than in the private sector	V22	11
The ethical sense is stronger in the non-profit sector compared to for-profit companies	V13	5

Source: D'Avanzo, Franch and Borgonovi (2021)

### 3.3 Simulation and results

The procedure exploits random restart and a set of *parameters* that have to be set. In particular, the maximum number of *parents* that a *node* can have has been set to eight. This parameter is important because the table of *conditional probability* associated with a given node grows exponentially with the number of parents of the node.

Since the *search space* is huge, a number of random restarts makes it possible to compare different solutions and to find a structure of the BN that fits the data better. In our case, the number of restarts of the algorithm has been set to 20.

The *size of the sample*, used in the scoring heuristics and representing the inertia of the parameters when new data are added, has been set to 50 elements.

The initial random number seed used to generate pseudorandom numbers has been set to zero.

The «Link Probability», which is a variable set when a new network is generated at the beginning of each iteration, has been set to 0.1. This parameter affects the connectivity of the network at the beginning.

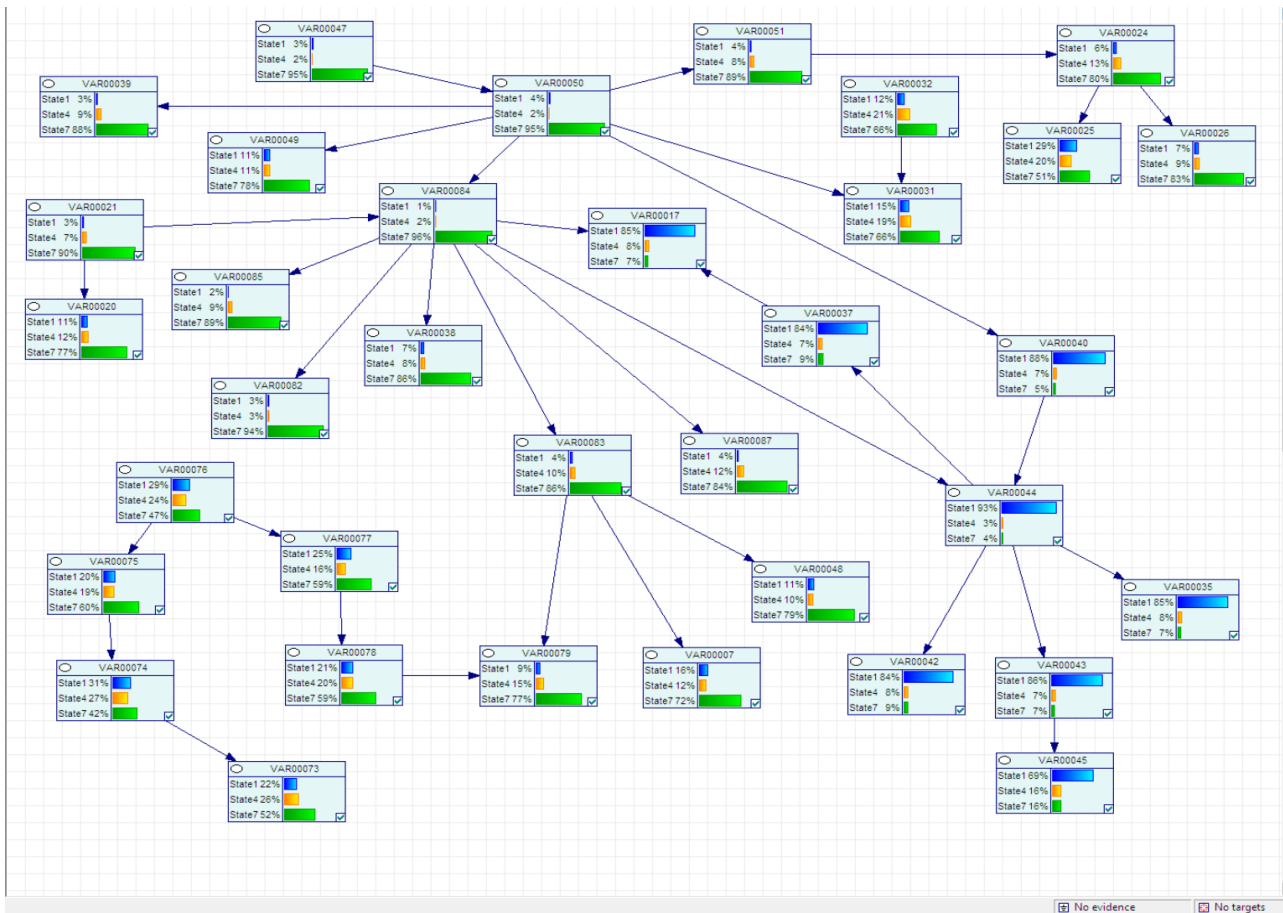
The «Prior Link Probability», which influences the priority of the edges, has been set to 0.001.

In the end, we did not set a maximum time limit to learn the structure of the network.

As a result of the procedure, the tool exploited 149 items of the dataset, i.e. those with non-missing data, and it found a set of seven BNs, each one named with a progressive number, involving different variables of the dataset. In particular, the first network, illustrated in Fig. 1, involves 35 variables associated with 35 specific answers of the respondents; the second network involves other seven answers. Other five networks have been induced, each one involving only two or three variables. Table 1 reports the association between the variable number and the specific answers of the respondents of the poll. All the seven networks are independent of each other.

The other 18 variables generated just 18 isolated, non-connected nodes, showing that no direct influence was found among them and the other variables in the dataset, for this reason they were neglected by the analysis in this phase.

Fig. 1: The Network 1 induced by data. No evidence has been set



Source: our elaboration

According to the Bayesian Network model, each node represents a variable and each state of the node is identified by the labels “1”, “4”, and “7”. In particular, we have associated the label “1” with the scores (1,2, and 3) of the Likert scale given by the interviewees; the label “7” is associated with the scores (5, 6, and 7) of the Likert scale given by the interviewees, while the label “4” is associated with the “neutral” score of 4 provided by the respondents.

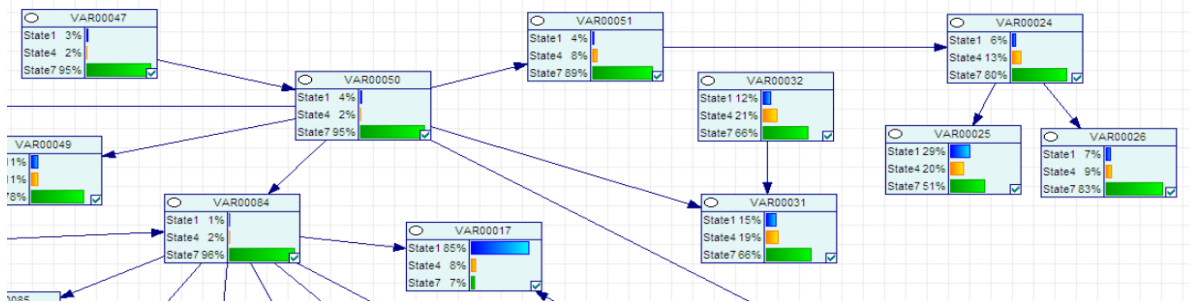
Fig. 1 illustrates the *beliefs* of each variable associated with the probability of each of its states when no evidence is provided. The network looks complex. However, following the paths in the network we can notice that the answers that mainly influence the other variables in terms of *beliefs* of relevance are those involving the concept of «Impartiality» (V50), «the will of keeping secrets about known pollution effects in order to safeguard only the competitiveness of the business» (V44), «the behavior of the direct boss» (V84) and «the presence of an official ethical certification» (V78).

Fig. 2 illustrates a portion of the Network 1 structure. It highlights the following direct influences that has been found by the structure inferencing algorithm implemented in Genie: the «Correctness» (V47) has a direct influence on State «Impartiality» (V50); on the other hand, the idea of «Impartiality» directly affects the perception that «the regulated and transparent lobbying activity can be positive» (V31). As if to say that «Correctness» and «Impartiality» are perceived as two important *beliefs* also for «lobbying», as long as it is regulated.

Furthermore, the «impartiality» (V50) directly influence the idea of «meritocracy» (V51), which, in turn, is directly linked to the perception that «In Italy the corruption-bribery phenomenon is a

widespread practice to obtain advantages in the relationships between companies and public administrations» (V24). Another evidence that can be read as the management that has a strong perception of «impartiality» and «meritocracy», perceives equally strongly the fact that in «In Italy the corruption-bribery phenomenon is a widespread practice to obtain advantages in the relationships between companies and public administrations».

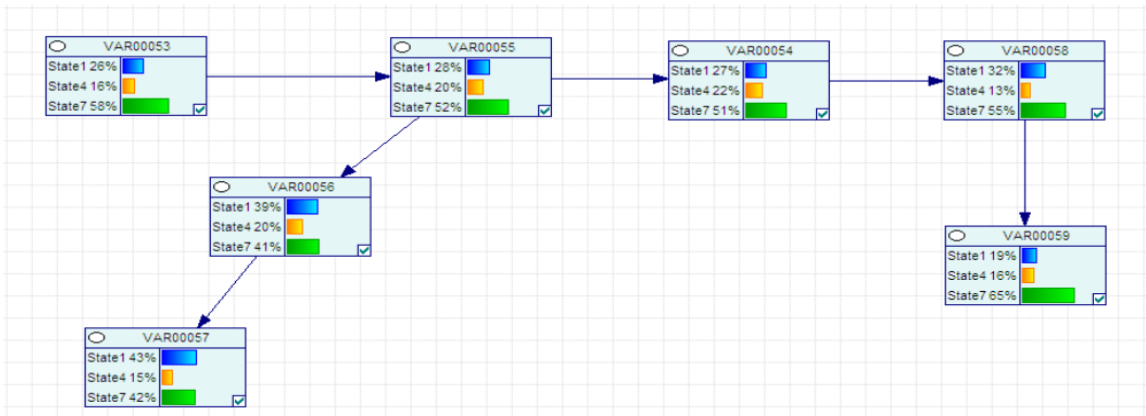
Fig. 2: A portion of Network 1



Source: our elaboration

Another interesting situation is illustrated by Network 2, which is depicted in Fig. 3.

Fig. 3: The Structure of Network 2

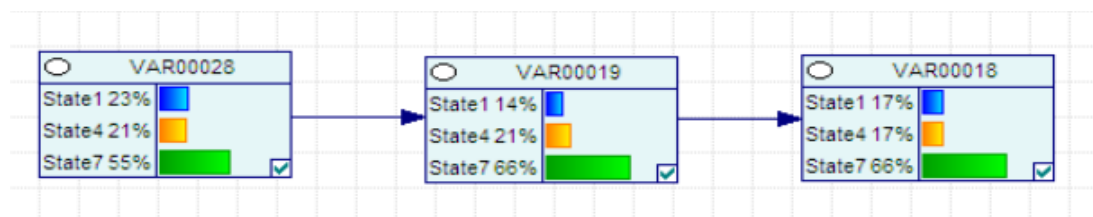


Source: our elaboration

In this network it is possible to observe that the parent node is associated to the idea of «legality» (V53) that directly influences the V55 node associated with the idea of «correctness», which, in turn, influences two paths: the first one is given by the chain «legality» (V54), «impartiality» (V58), and «meritocracy» (V59); the second one is identified by «morality» (V56) and «justice» (V57).

It is worthwhile to point out that all the nodes involved in Network 2 are related to the «moral profile» given by the “Factor 1 - Professional ethics perception” as suggested by D’Avanzo, Franch and Borgonovi in their work (2021).

Fig. 4: The Structure of Network 4



Source: our elaboration



Another influence relationship arising from data is given by Network 4, illustrated in Fig. 4. The outcome is that there is a direct influence path starting from the idea that «the phenomenon of bribery-corruption is mainly linked to the culture of a country and is not strictly economic» (V28), directly linked to the opinion that «the diffusion of the ethical sense depends mainly on the culture of the countries» (V19), which, in turn, has an impact on the individual values of people (V18). All these three variables account for the «moral profile» “*Factor 7 - Management awareness of bad practices*”, that are practice to be avoided when inspired by «ethical behaviors» emerged from the analysis proposed by D’Avanzo, Franch and Borgonovi (2021)

#### 4. Conclusion

Management deals with actions/decisions, among others, such as, for example, «do not punish/sanction the behaviors of collaborators who have violated ethical rules not for their own interests but to bring more profits to the company». Some of them are questionable, as the example before, while others are desirable decisions/actions, such as, for example, «supporting higher costs for environmental prevention and land conservation, even when it is not mandatory by law», or «apply safeguards to reconcile work/family actions».

The initial question was: what are the «conditions» that could favor these types of choices, which, as «common sense» suggests, are to be considered «ethical behaviors»? For instance, management’s «common sense» well knows what does mean when he is called to assume a «respectful» and/or a «kind» behavior. Both conducts useful for fostering actions and decisions such as those just mentioned above.

The existence of a range of *tools* (e.g. board of directors), *levers* (e.g. social example of direct manager) and *rules* (e.g. protocols, certifications), is challenging for the management that aims to select «ethical behaviors», perhaps in the form of «best practices», which are useful for running its business, just as the «common sense» of the manager or entrepreneur sometimes suggests.

This paper introduced a methodology that, starting from the ethical management of «common sense», would pass to the ethical management based on evidence.

A Bayesian network approaches allow a rapid and automatic formulation of hypotheses, obtaining effective data-driven decision support systems, which are also easily explorable, updatable, and, therefore, effectively used by management.

We have employed a dataset provided by D’Avanzo, Franch, Borgonovi (2021), regarding data acquired with a survey run among Italian managers. The dataset has been used as a source for inducing a Bayesian Network through the academic version of the Genie tool.

The experiments show very interesting links, for example, between “Impartiality” and “Correctness”, as well as “Meritocracy” and the corruption-bribery phenomenon and, among the others, the link between “Correctness”, “Morality”, and “Justice”.

This first experimentation, still in its embryonic state, seems to be an adequate methodology to accompany the «common sense» of management in the ethical management of the company. Managerial conducts such as «kind behavior» or «respectful» and so on, begin to take on an empirical basis, as well as plausible, as it was when entrusted only to the «common sense» of the manager.

Future work will regard a deeper understanding of the relationship between other features as well as the embedding of a proper user-centric computational system to support ethical decision in management. Furthermore, a deeper study will be conducted in order to understand the limitations of the approach and the influence of the missing data, as well as using different methodologies to learn the DAG structure to get a more effective reasoning system in the field of ethics in management.

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