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The topic of this paper is the environmental sustainability of vineyards within Australia. The context of this resear
Title A Bayesian Network Model based decision support tool for Environmental Sustainability in the Australian W
Abstract
Environmental sustainability in the Australian winegrowing industry involves complex, interacting factors. To addr
Introduction
The imperative for environmental sustainability in agriculture has intensified as the sector strives to balance produc
Bayesian Networks are probabilistic models that effectively capture and analyse the interactions between multiple f
This research is guided by several fundamental inquiries aimed at enhancing our understanding of environmental su
The industry panel was used as a catalyst in the early stages of this research to help explore these multifaceted que
Methods
In agriculture, the consideration of environment is critical to the success of the industry. The question of environme
Collaboration between experts from different perspectives is a useful method to reconcile opinions of the significanc
Methods for measuring sustainability comprise a wide variety of approaches with the use of index systems being co
Literature Review
The literature review was a crucial component of this study, designed to establish a comprehensive understanding o
A systematic search strategy was employed to ensure a thorough review of the literature. The search included mult
[language=] (Water OR Agrochemical OR Chemical OR Ground management OR Pest OR Disease OR Manageme
To ensure the relevance and quality of the literature reviewed, specific inclusion and exclusion criteria were applied.
Once relevant articles were identified, data extraction was conducted to gather information on the key factors influe
An expert panel comprising specialists in viticulture and environmental sustainability was engaged throughout the
Bayesian Networks
A Bayesian Network is a graphical model, being comprised of nodes and edges. Uniquely, Bayesian Networks contai
The use of a Bayesian Network allows for the ability to include perspectives from industry experts and create a cau
The calculations of a Bayesian Network are based on Bayes' theorem, shown as follows

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Where we calculate the probability of an event A given an event B, as demonstrated by [**?**]. Within a Bayesian Net

, for a selected node i given the parents and their local conditional distributions.

The iterative nature, or the ability to show the difference in probable outcomes of different sets of events and their
One of the greatest abilities within this style of inference is Marginalization. In which, the outcome of a particular
Bayesian Networks created in this study were created using BayesFusion bayesfusionGeNIeModelerUSER2022 to ca
Elicitation
The Bayesian Network was constructed using a mixture of data and expert elicitation. The format followed recomm
Not understanding the problem context
complexity without value
Getting arc directions wrong
too many parent nodes
Bias expert estimates
Inconsistent probabilities
Being absolutely certain
To address these issues, experts were kept well-informed of them, as well as variable definitions and problem scope. Ope
Each workshop had a primary focus such as: scope, structure or parameterisation; with, prior concepts being built
To introduce new concepts and how they interacted, preliminary simplified versions (strawman examples) were prov
CPT interpolating
As is often the case, the most arduous endeavour is to attribute probabilities to events defined within the Bayesian
This method utilised interpolation between two anchored points. One point represented the case of all factors being
Using this method, any given probability can be calculated using

, for n number of true or contributing factors and m false or not contributing factors. We know the solutions for when a

. From here values for x and y are able to be derived using the sum of the provided weights.

Validation
The method for validation sought to address concerns presented by pitchforthProposedValidationFramework2013; w
The Face and content validity of the network was questioned directly by the expert panel through the structure and
Similarly, the convergent validity of the model was accomplished through the broader discretisation of nodes into th
The discriminant validation of the model was the most difficult, as the definitions of each node changed over the co
The structure of the model itself was similar to other models in the presence of variables but differed in some of the
Sensitivity analysis
The sensitivity analysis conducted in this study utilised the Bayesian Network software GeNie, implementing the al
The process utilises two outward and an inward propagation across a junction tree, a data structure representing th
These coefficients are used in determining evidence through