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Balancing clean and quality production goals: A multi-analytical approach to scrutinizing the influencing factors in China's manufacturing industry

Abstract

Under the strategies of "high-quality development" and "dual carbon goals", the manufacturing industry in China is confronted with the simultaneous challenges of ensuring the production of high-quality goods and adopting environmentally friendly production practices. The integration of cleaner production and quality management has received widespread attention; however, existing research cannot comprehensively identify the interactive factors between quality management and cleaner production and analyze their mechanism of action. This research employed a multi-faceted approach involving meetings, interviews, and online data to access primary materials, and complemented by grounded theory and quality tool (5M1E), a total of 18 quality factors that exert a substantial impact on the attainment of clean production objectives were ultimately identified. To meticulously assess the interrelationships among factors, this study employed the interval value hesitant preference relationship DEMATEL-AISM technique. The findings of the study emphasize the significance of Employee Quality Skill Level (F1) and Production Environment Quality (F15) as critical quality factors that should be given priority and careful consideration by managers aiming for a cleaner production process. The results of this study have the potential to enhance the manufacturing industry's ability to predict and prevent quality and environmental issues, thereby ensuring the long-term sustainability of clean production and effective quality management.

Keywords Cleaner production; Quality management; 5M1E; Grounded Theory; IVHFS; DEMATEL-AISM

1. Introduction

China's national economy relies heavily on manufacturing, making it a critical sector for the country's economic development. Over the years, China's manufacturing industry has predominantly operated at the lower end of the global value chain, leading to challenges such as inadequate innovation, limited brand influence, and suboptimal quality and productivity. In the simultaneous instance, the manufacturing sector in China has persistently operated under an inefficient mode characterized by "excessive pollution, extensive energy consumption, and substantial emissions." This sector has yet to establish a worldwide competitive edge concerning the efficiency of environmental energy utilization (Cao et al., 2020). Therefore, the question concerning how to promote cleaner production and quality production in China's manufacturing industry has important theoretical value and practical significance.

Cleaner production and environmental management systems exhibit resemblances and are rooted in the insights acquired from conventional industrial pollution prevention and control frameworks (Avrampou et al., 2019). Both approaches prioritize addressing the root causes of pollution, focusing on managing the entire production process, and promoting continuous improvement and employee participation. Cleaner production is a key component of an environmental management system, utilizing various methods such as process flow analysis and material and energy balance to identify the primary sources of pollution and determine the most effective improvement measures (Aldieri et al., 2021). The integration of environmental management standards by companies, which includes activities like auditing, labeling, and performance evaluation, is influenced by quality management principles (Ammenberg, 2003). Research conducted by To et al. (2012) illustrates that organizations employing integrated management systems for quality and environmental management exhibit superior performance compared to those that depend solely on quality management systems in terms of corporate performance, quality, and marketing. The integrated development of cleaner production and quality management has garnered significant attention as an all-encompassing environmental strategy.

However, existing research cannot comprehensively identify the interactive factors between quality management and cleaner production and analyze their mechanism of action. The complex nature of industrial processes gives rise to environmental and quality issues, as multiple factors influence them (Guimarães et al., 2017). It will be of great benefit to the organization's decision-making capabilities and ability to generate synergy to thoroughly identify the interactive factors and mechanisms of action between the two systems. The majority of current research concentrates on the effects of integrating two systems on organizational performance. Only few previous studies suggest that quality tools can facilitate the adoption of cleaner production practices. They propose a method that combines the PDCA (Plan-Do-Check-Act) cycle with cleaner production, emphasizing continuous improvement through planning, execution, inspections, and actions within the cycle. It is not possible to provide a comprehensive identification and analysis of the interactive factors and mechanisms that exist between quality management and cleaner production based on existing literature.

To fill the above gap, the following research questions are posed: (1) How can the influencing factors of cleaner production and quality production be comprehensively ascertained? (2) What is the correlation among the influencing factors? Given this quandary, this investigation amalgamates the quality management instrument 5M1E (Man, Machine, Material, Method, Measure, Environments) and Proceduralised Grounded Theory (GT) to comprehensively determine the influencing factors. Moreover, interval hesitant fuzzy sets (IVHFS) were introduced as a means to articulate the preferences of experts. The integration of DEMATEL (Decision-making Trial and Evaluation Laboratory) and AISM (Adversarial Interpretive Structural Modeling) was undertaken to undertake a quantitative analysis of these influencing factors. This analysis serves to facilitate decision-making processes and empower investors to adopt enhanced measures to enhance the manufacturing industry's capabilities for cleaner production and sustainable development.

This study is structured in the following manner. The subsequent section primarily examines the pertinent body of literature on cleaner production and high-quality production, in addition to the systematic progression and enlargement of integrated methodologies. The third segment introduces the research methodology. The fourth segment identifies 18 interactive factors, further scrutinizes the interplay between the factors, and formulates a series of antagonistic hierarchical models. The fifth segment presents a discourse and implications. The concluding section summarizes the entirety of the paper and offers a lucid projection for future research.

2. Literature review

This section commences by engaging in a thorough and methodical examination of the literature that currently exists. The study regarding the amalgamation of cleaner production and quality management has been elucidated. Lastly, the amplification of the DEMATEL-ISM method has been provided with a detailed explanation.

2.1 Systematic literature review

This study utilized a rigorous literature review methodology to aid in the determination of the present state of the literature. The extensive findings reported in exploratory searches conducted on the SCOPUS scientific database were employed. The main research topics of this study are clean production, quality management, manufacturing, and sustainable development. The terms used in the Boolean search include all topics as follows: a) Clean production and sustainable development b) Clean production, sustainable development, and manufacturing c) Quality management, sustainable development, and manufacturing d) Quality management, sustainable development, manufacturing, and China. Among these, the search programs for all key terms are TITLE-ABS-KEY and (LIMITED TO (DOCTYPE, "ar"), (LIMITED TO (language, "English")), and (LIMITED TO (SRCTYPE, "j")). Furthermore, the papers were evaluated based on the predefined criteria for inclusion and exclusion outlined in Table 1. The findings of the systematic literature review (Table 2) demonstrate that a significant portion of the available research on clean production and sustainable development has been disseminated through relevant academic publications. However, when the focus shifts to manufacturing, the research domain decreases significantly to a mere 54 papers. There are only 218 articles available on quality management and sustainable development in the manufacturing industry, and when attention is directed towards emerging economic contexts such as China, the availability of research is even more restricted, amounting to just 20 articles. After analyzing the correlation between all the key terms employed in the Boolean search, the results demonstrate that there is no existing research that can comprehensively encompass all the topics that this study aims to cover.

The subsequent portion deliberates the approaches to administration linking cleaner production and quality management, predicated on the relevant literature reviewed.

Table 1. Inclusion and exclusion criteria.

Inclusion and exclusion criteria
1.The literature is focused on cleaner production and quality management;
2. The literature is focused on Chinese manufacturing industry;
3. Peer reviewed journal articles, i.e. not conference papers, reports, press releases, etc;
4. Literary works published in English.

Table 2. The review results of the systematic literature.

Key Terms	Total Number of Papers	Top Three Journals (total number of papers)	Top Three Most Cited
"Clean production" "sustainable development"	2020	1) Journal of Cleaner Production (239)	1) Jain et al., 2010 [969]
		2) International Journal Of Hydrogen Energy (67)	2) Edwards et al., 2008 [861]
		3) Sustainability Switzerland (60)	3) Barreto et al., 2003 [748]
"Clean production" "sustainable development", and"manufacturing industry"	54	1) Journal of Cleaner Production (12)	1) Helleno et al., 2017 [182]
		2) International Journal of Advanced Manufacturing Technology (3)	2) Dangelico et al., 2013 [180]
		3) ACS Sustainable Chemistry and Engineering (2)	3) Gupta et al., 2021 [174]
"Quality management" "sustainable development", and"manufacturing industry"	218	1) Sustainability Switzerland (17)	1) Ibn-Mohamme et al., 2021 [472]
		2) Journal of Cleaner Production (15)	2) Abbas, 2020 [240]
		3) International Journal of Production Economics (6)	3) Domenech et al., 2019 [214]
"Quality management" "sustainable development" "manufacturing industry", and "China"	20	1) Resources, Conservation and Recycling (2)	1) Ibn-Mohammed et al., 2021 [472]
		2) Applied Energy (1)	2) Ma et al., 2022 [51]
		3) Australia and New Zealand Health Policy (1)	3) Shang et al., 2015 [46]

2.2 Integration of cleaner production and quality management

Cleaner production is a comprehensive environmental strategy that aims to minimize waste and emissions and achieve sustainable development (Russell et al., 2018). Quality management and environmental sustainability are closely interconnected, as evidenced by the "Our Common Future" report put forth by the Brundtland Commission in 1987, which broadened the scope of sustainable development to encompass environmental, social, and economic dimensions. The merging of quality management and cleaner production generates a synergistic effect and contributes to the sustainable progress of businesses. Boltić et al. (2016) established a correlation between quality assurance and the implementation of cleaner production in the pharmaceutical industry. By instituting a quality assurance mechanism, companies can ensure that their products adhere to regulatory standards within the market. Concurrently, the adoption of cleaner production practices aids in mitigating environmental risks and enhancing corporate sustainability. Silva (2013) posits that the utilization of quality tools facilitates the adoption of cleaner production. Within the realm of current research, the PDCA cycle is predominantly employed in conjunction with cleaner production to pursue ceaseless enhancement of both products and processes. Oliveira et al. (2020) devised a novel approach to management by amalgamating cleaner production with PDCA, thus applying a quality management phase to the procedure. The focus of PDCA is on the improvement of processes and the continuous enhancement thereof, with an emphasis placed on the continuous amelioration of planning and execution through the utilization of inspection and action within a cycle. The intricate nature of industrial processes assumes responsibility for the emergence of both environmental and quality predicaments, which are influenced by multiple factors (Guimarães et al., 2017). As a result, a comprehensive analysis and optimization of production factors becomes imperative for the manufacturing industry to accomplish both clean and quality production. The framework known as 5M1E offers a comprehensive structure that aids organizations in analyzing and optimizing the key elements within the production process, thereby ensuring stability and consistency (Su et al., 2022). 5M1E underscores the significance of focusing on five elements, namely people, machines, materials, methods, and measurements, while also taking into consideration the external environmental factors that exert an influence on these elements (Fig.1).

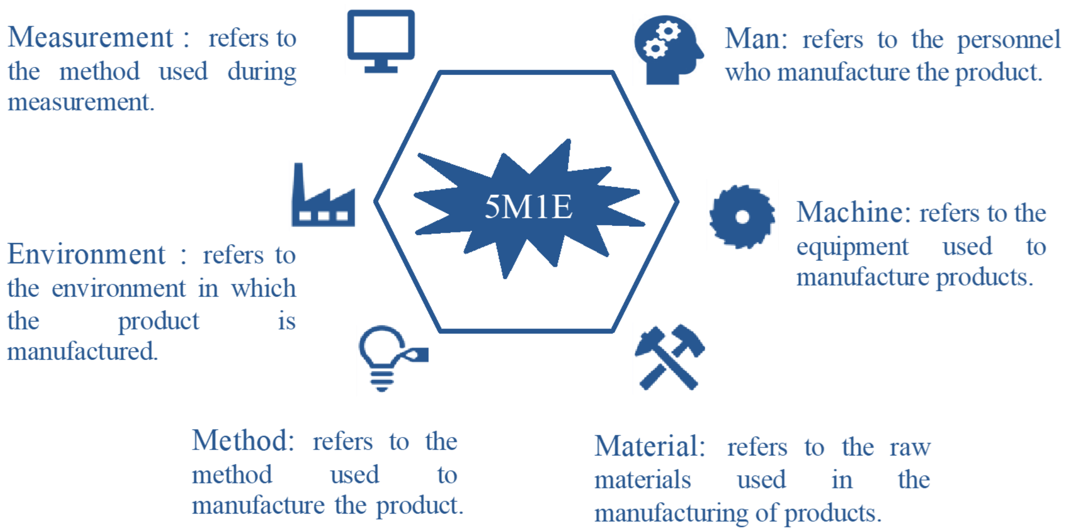

Fig. 1. 5M1E principle.

2.3 Extension of DEMATEL-ISM method

The combined utilization of the DEMATEL-ISM technique has emerged as a significant instrument for system analysis and decision-making (Trivedi et al., 2021; Yadav et al., 2020). DEMATEL-ISM is frequently employed to examine the interplay among the factors that influence a given system. However, the DEMATEL-ISM method assumes that the relationship between influencing factors is symmetrical and will be affected by expert selection and data quality. To address the issue of DEMATEL's inability to accurately evaluate the intricate and ambiguous relationships between system factors, certain scholars have expanded the model to compensate for the deficiencies of the conventional DEMATEL.

For instance, the DEMATEL technique has been extended to encompass binary semantics, as well as to encompass triangular fuzzy numbers, among other variations. The inclusion of intuitive fuzzy numbers enables the expression of decision-making experts' preferences, while an intuitive fuzzy preference matrix is constructed to facilitate pairwise comparisons and judgments between factors. Zahedi et al. (2023) introduce intuitive fuzzy numbers as a means of expressing experts' preferences and hesitations. However, the utilization of intuitive fuzzy numbers necessitates experts to furnish three indicators, namely membership degree, non-membership degree, and hesitation degree, which proves to be exceedingly inconvenient in a real-world implementation. Moreover, interval fuzzy numbers fail to accurately encapsulate the assessments of multiple expert collectives within a decision-making milieu. In this context, the implementation of IVHFS serves to rectify the aforementioned deficiencies, while simultaneously offering enhanced operational feasibility within practical applications (Asan et al., 2018). Therefore, this study applies IVHFS to represent the uncertainty of expert information. In addition, AISM is based on ISM, adds cause priority hierarchical extraction rules, and establishes a set of adversarial hierarchical topology maps (Liu et al., 2022). This can more clearly represent the hierarchical relationship between factors.

On this basis, this study proposes a DEMATEL-AISM technology based on IVHFS to analyze the interaction between influencing factors.

3. Research methodology

This research is focused on investigating the mechanism of integrated cleaner production and quality management systems from an elemental perspective. The correlation between quality management and cleaner production, which has not yet been systematically examined, requires further scrutiny regarding the underlying concepts and logical relationships between the two. The grounded theory, as a qualitative approach, is highly suitable for delving into concepts that are still in the process of being fully articulated in both meaning and scope when compared with other qualitative methodologies. The grounded theory is well-suited for conducting interactive research at a granular level, emphasizing action, and holds the potential for providing a comprehensive and in-depth understanding, as well as the identification of potential influencing factors. The choice of utilizing this methodology is dependent on the specific issue under investigation in the study. Therefore, the Proceduralised Grounded Theory approach is employed to pinpoint factors that exert influence.

Given the intricate network of interconnections among the recognized key elements, an organized method for structural analysis is crucial for this research. Scholarly research has illustrated that the combined application of DEMATEL-AISM/ISM offers an efficient approach to examining the factors impacting the system. The DEMATEL methodology is employed for the identification of causal links. In comparison to alternative methodologies (e.g., AHP/ANP, GRA, TOPSIS, VIKOR, and ELECTRE), DEMATEL technology is more proficient in recognizing causal relationships (Si et al., 2018).

Based on this, the AISM method is used to establish a hierarchical structure diagram, which can intuitively represent the transmission relationship of each element and make up for the shortcomings of using the DEMATEL method alone to analyze problems (Liang et al., 2022). The utilization of expert ratings is essential in the application of the DEMATEL-AISM method. IVHFS has been introduced in this study as a tool for articulating the preferences of experts. An interval number is employed by experts to indicate their preferences when conducting pairwise comparisons of factors. The complementary analysis of these methods provides us with a comprehensive perspective to deeply understand the degree of influence and interaction between elements relation, as shown in Fig.2.

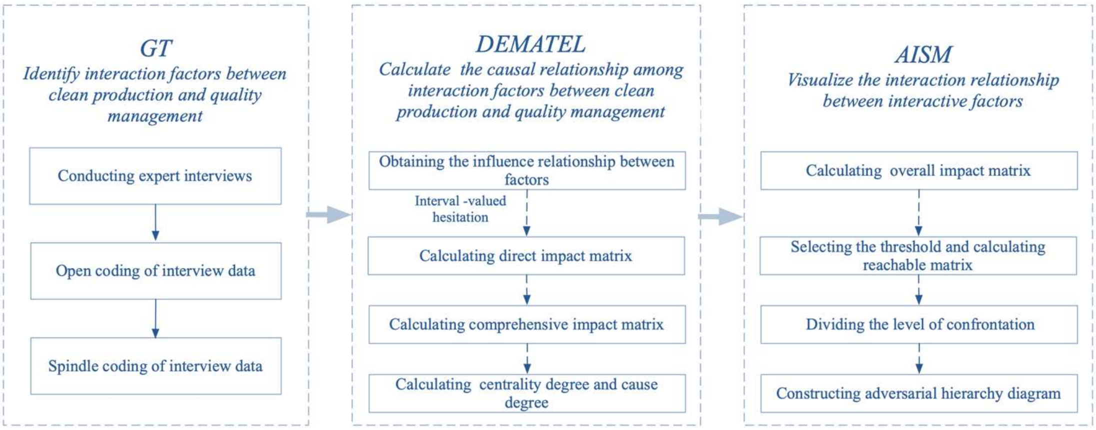

Fig. 2. Research design.

3.1 Relevant theoretical basis

3.1.1 Proceduralised grounded theory

Grounded Theory, a research method in the field of social science, was collaboratively developed by two scholars, Glaser and Strauss, who were affiliated with the University of Chicago and Columbia University, respectively. This particular method is commonly employed in qualitative research, particularly in the realm of sociology, to address micro-level issues. The essence of Grounded Theory lies in its ability to construct theory, offering a scientific approach. Building upon this foundation, two variations of Grounded Theory emerged, namely proceduralised grounded theory and constructive grounded theory. In the present study, Proceduralised Grounded Theory was employed to identify various factors employing open coding, axial coding, and theoretical saturation testing.

3.1.2 Interval hesitant fuzzy sets

As one of the important extension forms of fuzzy sets, IVHFS can simultaneously express the preferences of decision-makers with multiple interval numbers. The relevant definitions are as follows:

Definition 1

Suppose X is a reference set, and define the hesitant fuzzy set A of X as a function in the form of $h_A(x)$, this function returns a subset on the interval [0,1]. Where $A = \{< x, h_A(x) > | \ x \in X\}$. Here $h_A(x)$ represents a set of different values on [0,1], representing the possible membership degree of $x \epsilon X$ to A.

Definition 2

Suppose X be a reference set, and D [0,1] be the set composed of all closed subintervals on [0,1]. The interval hesitation fuzzy number IVHFS of X is defined as $\tilde{A} = \{\langle x_i, \tilde{h}_{\tilde{A}}(x_i)\rangle | x_i \epsilon X, i = 1,2,\cdots,n\}$, where $\tilde{h}_{\tilde{A}}(x_i)$: $X \rightarrow D[0,1]$ represents X on set $\tilde{A}$ All interval membership degrees; Generally referred to as $\tilde{h}_{\tilde{A}}(x_i)$ is the interval-valued hesitant fuzzy element (IVHFE), which is a set of interval fuzzy numbers and the basic unit of IVHFS, in the form of $\tilde{h}_{\tilde{A}}(x_i) = \{\tilde{\gamma} | \tilde{\gamma} \epsilon \tilde{h}_{\tilde{A}}(x_i)\}$. Among them, $\tilde{\gamma} = [\tilde{\gamma}^L, \tilde{\gamma}^U]$ is an interval fuzzy number, $\tilde{\gamma}^L$ and $\tilde{\gamma}^U$ represents the lower and upper bounds of $\tilde{\gamma}$ respectively.

3.1.3 DEMATEL

DEMATEL is often used for factor analysis of complex systems and is an effective way to solve complex and difficult problems (Chen et al., 2013). The algorithm steps mainly include: constructing the direct impact matrix, calculating the comprehensive impact matrix, calculating centrality and cause degree.

3.1.4 AISM

AISM is a stereotype analysis method (Zhang et al., 2021). It is used to reveal the interaction and influence mechanism between various elements in the system. The algorithm steps mainly include: determining feature sets, establishing Boolean matrices, establishing reachability matrices, dividing hierarchical structures, and drawing hierarchical diagrams.

3.2 Building process

According to the theoretical basis, the specific steps are as follows:

Step 1: Construct a set of influencing factors $F = \{f_1, f_2, \cdots, f_n\}$ based on the grounded theory.

Step 2: There are m experts in the team, expressed as $P = \{p_1, p_2, \cdots, p_m\}$. This study invited the ten experts interviewed to give scores. Each expert judges the importance of the influencing factor f_i to the cleaner production goal, and uses the interval number to express the expert's preference for pairwise comparisons of factors. Suppose the judgment result of the k expert is $ij^k(k = 1, 2, \cdots, m)$, then the direct influence matrix can be expressed as $\tilde{h}_{ij} = \{ij^1，ij^2，ij^m\}$, then the decision-making results of m experts constitute the hesitant fuzzy preference decision matrix $R = (\tilde{h}_{ij})_{n\times n}$, i、$j = 1，2，\cdots，n$.

Step 3: Transforme the direct impact matrix R. The direct influence matrix R is transformed using the evaluation function of IVHFE to obtain R'. This study draws on the approach of Liu et al., (2019) and uses the weighted comprehensive weighted evaluation function (formula (1)) of IVHFS to convert R into the form of interval fuzzy numbers. where λ_k represents the weight of the kth expert. This article assumes that the ten experts have the same weight, that is, λ_k=0.1.

$$\tilde{x}_{ij} = \oplus_{k=1}^{p} \left(\lambda_k \tilde{h}_{ij}^{k}\right) = \left\{\left[1 - \prod_{k=1}^{K} \left(1 - \left(\tilde{\gamma}_{ij}^{k}\right)^{L}\right)^{\lambda_k}, 1 - \prod_{k=1}^{K} \left(1 - \left(\tilde{\gamma}_{ij}^{k}\right)^{U}\right)^{\lambda_k}\right]\right\} (1)$$

$$\tilde{\gamma}_{ij}^{1} \in \left[\tilde{h}_{ij}^{1}\right]_{n\times n}, \cdots, \tilde{\gamma}_{ij}^{k} \in \left[\tilde{h}_{ij}^{k}\right]_{n\times n}, k = 1,2,\cdots,K$$

For each $\tilde{h}_{ij}$ in R, calculate using formula (1) to obtain the converted direct impact matrix $R' = (\tilde{x}_{ij})_{n\times n} = ([ij^L, ij^U])_{n\times n}$.

Step 4: Calculate the comprehensive influence matrix T. First, the row and column sum maximum method (Formula (2)) is used to obtain the normalized matrix N. Then, this study draws on the ideas and methods of Asan et al., (2018), and based on the summation and multiplication operation rules (Formula (3)), the calculation method of the approximate comprehensive impact matrix based on IVHFS is given (Formula 4).

$$N = Norm(\mathrm{R}')([ij^L / Max\left(Max\left(\oplus_{i=1}^{n} ij^L\right)，Max\left(\oplus_{j=1}^{n} ij^L\right)\right)，ij^U /$$
$$Max\left(Max\left(\oplus_{i=1}^{n} ij^U\right)，Max\left(\oplus_{j=1}^{n} ij^U\right)\right)])_{n\times n} (2)$$

$$\tilde{h}_1 \oplus \tilde{h}_2 = \{\tilde{\gamma}_1^L + \tilde{\gamma}_2^L - \tilde{\gamma}_1^L\tilde{\gamma}_2^L, \tilde{\gamma}_1^U + \tilde{\gamma}_2^U - \tilde{\gamma}_1^U\tilde{\gamma}_2^U\}, \tilde{h}_1 \otimes \tilde{h}_2 = \{\tilde{\gamma}_1^L\tilde{\gamma}_2^L, \tilde{\gamma}_1^U\tilde{\gamma}_2^U\} (3)$$

$$T = \tilde{N} \oplus \tilde{N}^2 \oplus \cdots \oplus \tilde{N}^m, \lim_{m\to\infty} \left(\tilde{N}\right)^m = \tilde{0} (4)$$

$$T = \begin{bmatrix} \{[\tilde{t}_{11}^L, \tilde{t}_{11}^U]\} & \{[\tilde{t}_{12}^L, \tilde{t}_{12}^U]\} & \cdots & \{[\tilde{t}_{1n}^L, \tilde{t}_{1n}^U]\} \\ \{[\tilde{t}_{21}^L, \tilde{t}_{21}^U]\} & \{[\tilde{t}_{22}^L, \tilde{t}_{22}^U]\} & \cdots & \{[\tilde{t}_{2n}^L, \tilde{t}_{2n}^U]\} \\ \vdots & \vdots & \ddots & \vdots \\ \{[\tilde{t}_{n1}^L, \tilde{t}_{n1}^U]\} & \{[\tilde{t}_{n2}^L, \tilde{t}_{n2}^U]\} & \cdots & \{[\tilde{t}_{nn}^L, \tilde{t}_{nn}^U]\} \end{bmatrix} (5)$$

Step 5: Calculate the cause degree and centrality. This study draws on the approach of Asan et al., (2018), and uses formulas (6) to (7) to calculate the influence degree (sum of each row R_i) and the influenced degree (sum of each column E_j) of each factor. Afterwards, according to the defuzzification obtained according to Formula (8) to (9), the centrality Z_i and cause degree Y_i of each influencing factor are calculated. The results are defuzzified according to Formula (10), and a cause-result diagram is drawn to visualize the quadrant distribution of influencing factors.

$$R_i = \oplus_{i=1}^{n} t_{ij} = \oplus_{i=1}^{n} \left[{t_{ij}}^{L}, \ {t_{ij}}^{U}\right] = \left[\oplus_{i=1}^{n} {t_{ij}}^{L}, \ \oplus_{i=1}^{n} {t_{ij}}^{U}\right], (i = 1,2,\cdots,n) (6)$$

$$E_j = \oplus_{j=1}^{n} t_{ij} = \oplus_{j=1}^{n} \left[{t_{ij}}^{L}, \ {t_{ij}}^{U}\right] = \left[\oplus_{j=1}^{n} {t_{ij}}^{L}, \ \oplus_{j=1}^{n} {t_{ij}}^{U}\right], (j = 1,2,\cdots,n) (7)$$

$$Z_i = R_i + E_i (8)$$

$$Y_i = R_i - E_i (9)$$

$$x_{ij} = \frac{\tilde{x}_{ij}^{L} + \tilde{x}_{ij}^{U}}{2} (10)$$

Step 6: Calculate the adjacency matrix B and the reachable matrix K. Firstly, obtain the comprehensive impact matrix T' for deblurring. By setting a threshold λ, Construct an adjacency matrix B that represents the direct relationship between factors. According to the Boolean operation rule, by adding the adjacency matrix B to the identity matrix, the reachable matrix K is obtained when the formula $K = (\mathrm{B} + \mathrm{I})^{\mathrm{n}+1} = (\mathrm{B} + \mathrm{I})^{\mathrm{n}} \neq (\mathrm{B} + \mathrm{I})^{\mathrm{n}-1} \neq \mathrm{B} + \mathrm{I}$. The reachable matrix represents the indirect influence relationship between factors (Liang et al., 2022).

$$\lambda = a + b, \ \lambda \in [0,1] \ (11)$$

A and b, which represent the mean and standard deviation of all elements in the comprehensive impact matrix T'.

$$B_{ij} = \begin{cases} 1, b_{ij} \geqslant \lambda \\ 0, b_{ij} < \lambda \end{cases} (i,j = 1,2,\cdots,n) \ (12)$$

Step 7: Division of adversarial levels. According to equation (13) and the reachable matrix K, establish the reachable set $K(F_i)$, antecedent set $A(F_i)$, and common set $L(F_i)$ for each factor F_i, and divide the resistance hierarchy according to the rules of result priority ($L(F_i) = R(F_i)$)and cause priority ($L(F_i) = A(F_i)$) respectively.

$$\begin{cases} R(F_i) = \{F_i \mid F_i \in F, k_{ij} = 1\} \\ A(F_i) = \{F_i \mid F_i \in F, k_{ji} = 1\} \\ L(F_i) = \{F_i \in F \mid R(F_i) \cap A(F_i) = R(F_i)\} \end{cases} \quad (13)$$

Step 8: Construct adversarial hierarchy graph. A multi-level hierarchical structure model diagram of the confrontation is drawn by utilizing the outcomes of the hierarchical analysis of the confrontation.

4. Results

This research was conducted in two main phases. First, 18 interactive factors were identified using Proceduralised Grounded Theory. Then the IVHFS-DEMATEL-AISM method was used to identify key factors and interaction frameworks.

4.1 Identification of interactive factors between cleaner production and quality management

4.1.1 Data collection

This study strictly followed the evidence triangle in qualitative research to collect data (Yin, 2003), i.e. by using multiple channels and diversified methods to collect information as much as possible. The data sources are mainly expert consultation and conference exchanges. It is supplemented by academic reports, expert interpretations, and policy documents on scientific research platforms, search engines, and social media. In addition, this article adopts the 5M1E principle in the field of quality management to formulate a series of questions that are consistent with the research ideas. This is to ensure the comprehensiveness of the identification of influencing factors.

For expert interviews, this study selected participants of the "China-Korea Bilateral International Conference on Quality". This conference has been successfully convened nineteen times. The participants encompass distinguished specialists within the realm of quality management in China. Diverse research orientations were considered in the selection of interviewees, following the 5M1E principle. A final roster of ten individuals was established, comprising three experts in quality management, two experts in industrial engineering, two experts in human resources, two experts in manufacturing, and one expert in strategic management. According to statistical data, the duration of interviews varied from 15 to 60 minutes for each of the interviewees.

4.1.2 Coding process

This article first reads and marks the interview data word for word, and modifies the spoken expressions. Secondly, the study used Nvivo12.0 to standardize the interview text and establish a preliminary material structure. Then, the interview data was coded to obtain thematic classification and keywords related to the text. Then, a comparative qualitative analysis of the relevance and similarity of keywords was undertaken, and the initial concepts related to cleaner production and quality production were extracted. Third, the initial concepts were clustered, corresponding topic categories were set, and careful elimination of short and vague words was performed. Finally, after reading through the initial concepts, integrating or deleting overlapping, repetitive, and contradictory concepts, and labeling them according to relevance, 41 initial concepts and 18 categories were obtained (Table 3).

For open coding, axial coding coordinated the analog data in the interview records, further summarized and rearranged the 18 categories extracted from the open coding, and developed 6 core categories (see Table 4).

Table 3. Basic and main categories of code formation.

Main Categories	Basic Categories
F1 Employee Quality Skill Level	F11 Skills of Grassroots Employees
	F12 Multiple Skill Levels
	F13 Skills Training
	F14 Skill Appraisal
F2 Quality Work Experience	F21 Working Hours
	F22 Business Proficiency Level
F3 Working Attitude	F31 Job Satisfaction with Human Factors
	F32 Turnover
F4 Basic Equipment	F41 Processing Equipment Status
	F42 Original Equipment Manufacturer
	F43 Device Selection
F5 Total Productive Maintenance (TPM)	F51 Health Status Monitoring
	F52 Health Status Prediction
	F53 Preventive Maintenance
F6 Data Acquisition	F61 Identification of Critical to Quality Steps
	F62 Sensor Applications
F7 Equipment Upgrade	F71 Sensors and Measurement Systems
	F72 User Interface and Visualization
F8 Bill of Material (BOM) Accuracy	F81 Effective BOM Management
	F82 BOM Evaluation
F9 Material Specification	F91 Material Characteristics
	F92 Performance Requirement
	F93 Quality Standards and Certification Requirements
F10 Material Traceability	F101 Construction of Traceability System
F11 Quality Process Standards	F111 Establishment of Process Standards
	F112 Assessment of Compliance with Established Processes
F12 Quality Inspection Guidelines	F121 Design Quality Inspection Procedure
	F122 Select Quality Inspection Program
F13 Quality Culture	F131 Employee Quality Awareness
	F132 Product Quality Orientation
F14 Quality Training	F141 Field Visits and Learning
	F142 Continuous Training and Learning Plan
F15 Production Environment Quality	F151 Environmental Condition Control
	F152 Resource Management
	F153 Energy and Equipment
F16 Independent Software Development	F161 Quality Management System Software Design
	F162 Data Management and Storage

F17 Mobile Internet Application	F171 Network Communication F172 Data Interaction
F18 Technical Transformation	F181 Automation and Robotics Technology F182 Algorithm Optimization

Table 4. Axial coding.

Core Categories	Main Categories	Source
Personnel Quality Initiative	F1 Employee Quality Skill Level	Wang et al., 2022.
	F2 Quality Work Experience	Moon et al., 2023.
	F3 Working Attitude	Kreye, 2016.
Automation Infrastructure	F4 Basic Equipment	Krolczyk, 2019.
	F5 Total Productive Maintenance (TPM)	Zonta, 2020.
	F6 Data Acquisition	Chowdhury and Quaddus, 2017.
	F7 Equipment Upgrade	Qiao et al., 2023.
Quality Bill of Material (QBOM)	F8 BOM Accuracy	Han et al., 2012.
	F9 Material Specification	Shaigan et al., 2021.
	F10 Material Traceability	Wang et al., 2022.
Quality Technical Specification	F11 Quality Process Standards	Chen and Chou, 2018.
	F12 Quality Inspection Guidelines	Genta et al., 2020.
Quality Operating Environment	F13 Quality Culture	Salimian et al., 2021.
	F14 Quality Training	Bilanakos et al., 2018.
	F15 Production Environment Quality	Kwon and Chiou, 2009.
Quality Intelligent Inspection Technology Applications	F16 Independent Software Development	Jiao, 2011.
	F17 Mobile Internet Application	Zhu et al., 2013.
	F18 Technical Transformation	Ortt and Kamp, 2022.

4.1.3 Theoretical saturation test

Based on the interview records and relevant information collected, 1/4 of the original data was randomly selected for theoretical saturation testing. The study considered that when test results cannot reflect any new conceptual categories, it is conferred that the sample has reached theoretical saturation. At the same time, the six main categories formed by the main axis coding correspond to the "5M1E" principle in the field of total quality management, which verifies the theoretical saturation from the side.

4.2 Analysis of interactive factors between cleaner production and quality management

4.2.1 Results of interval-valued hesitant preference relations DEMATEL

After obtaining 18 interactive influencing factors, the scoring results of ten interview experts were analyzed. The judgment value is given in the form of the hesitant fuzzy number, and the comprehensive hesitant fuzzy preference decision matrix R is obtained (As shown in Table 11 in Appendix A). Using the formula (1), R is converted into the form of an interval fuzzy number, and the converted direct influence matrix R' is obtained (As shown in Table 5).

Table 5. Direct impact matrix R'.

Factor	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18
F1	[0,0]	[0.429,1]	[0.39,1]	[0.346,0.542]	[0.435,1]	[0.407,1]	[0.585,1]	[0.386,0.561]	[0.427,1]	[0.488,1]	[0.414,1]	[0.321,0.496]	[0.505,1]	[0.431,1]	[0.484,1]	[0.583,1]	[0.511,1]	[0.456,1]
F2	[0.373,0.567]	[0,0]	[0.392,1]	[0.349,0.539]	[0.476,1]	[0.339,0.529]	[0.55,1]	[0.41,0.621]	[0.446,1]	[0.414,1]	[0.417,1]	[0.302,0.486]	[0.478,1]	[0.442,0.654]	[0.477,1]	[0.544,1]	[0.506,1]	[0.448,0.664]
F3	[0.421,1]	[0.474,1]	[0,0]	[0.386,1]	[0.467,1]	[0.442,1]	[0.6,1]	[0.468,1]	[0.459,1]	[0.501,1]	[0.45,1]	[0.361,1]	[0.521,1]	[0.488,1]	[0.517,1]	[0.584,1]	[0.535,1]	[0.509,1]
F4	[0.379,0.578]	[0.436,1]	[0.386,1]	[0,0]	[0.467,1]	[0.402,1]	[0.6,1]	[0.429,0.633]	[0.459,1]	[0.466,1]	[0.41,1]	[0.315,0.502]	[0.521,1]	[0.451,1]	[0.482,1]	[0.584,1]	[0.535,1]	[0.474,1]
F5	[0.335,0.531]	[0.438,1]	[0.34,0.531]	[0.34,0.531]	[0,0]	[0.409,1]	[0.557,1]	[0.388,0.564]	[0.353,0.555]	[0.49,1]	[0.409,1]	[0.294,0.471]	[0.464,1]	[0.425,1]	[0.464,1]	[0.555,1]	[0.478,1]	[0.458,1]
F6	[0.388,0.587]	[0.379,0.568]	[0.395,1]	[0.352,0.553]	[0.482,1]	[0,0]	[0.578,1]	[0.414,0.619]	[0.467,1]	[0.412,0.619]	[0.419,1]	[0.296,0.484]	[0.495,1]	[0.459,1]	[0.468,1]	[0.542,1]	[0.522,1]	[0.482,1]
F7	[0.22,0.374]	[0.247,0.399]	[0.208,0.36]	[0.208,0.36]	[0.292,0.467]	[0.229,0.383]	[0,0]	[0.281,0.463]	[0.258,0.431]	[0.289,0.463]	[0.239,0.403]	[0.186,0.326]	[0.288,0.477]	[0.263,0.423]	[0.342,0.521]	[0.359,0.536]	[0.322,0.492]	[0.272,0.439]
F8	[0.345,0.532]	[0.413,1]	[0.388,1]	[0.345,0.532]	[0.445,1]	[0.379,1]	[0.573,1]	[0,0]	[0.422,1]	[0.429,1]	[0.413,1]	[0.298,0.47]	[0.496,1]	[0.414,0.628]	[0.413,0.62]	[0.529,1]	[0.475,1]	[0.446,0.66]
F9	[0.346,0.542]	[0.436,1]	[0.349,0.539]	[0.349,0.539]	[0.372,0.572]	[0.409,1]	[0.549,1]	[0.409,0.613]	[0,0]	[0.474,1]	[0.417,1]	[0.293,0.468]	[0.454,1]	[0.394,0.584]	[0.448,1]	[0.525,1]	[0.442,0.634]	[0.427,1]
F10	[0.365,0.562]	[0.353,0.548]	[0.364,1]	[0.319,0.509]	[0.462,1]	[0.308,0.498]	[0.542,1]	[0.381,0.587]	[0.429,1]	[0,0]	[0.389,1]	[0.26,0.433]	[0.452,1]	[0.392,0.582]	[0.383,0.578]	[0.469,1]	[0.463,1]	[0.418,0.611]
F11	[0.353,0.548]	[0.413,1]	[0.361,1]	[0.315,0.51]	[0.445,1]	[0.378,1]	[0.553,1]	[0.406,0.606]	[0.436,1]	[0.444,1]	[0,0]	[0.287,0.466]	[0.501,1]	[0.428,1]	[0.46,1]	[0.567,1]	[0.516,1]	[0.452,1]
F12	[0.467,0.672]	[0.489,1]	[0.459,1]	[0.421,0.619]	[0.529,1]	[0.451,1]	[0.652,1]	[0.489,1]	[0.502,1]	[0.509,1]	[0.481,1]	[0,0]	[0.578,1]	[0.517,1]	[0.516,1]	[0.627,1]	[0.573,1]	[0.542,1]
F13	[0.299,0.48]	[0.327,0.488]	[0.27,0.431]	[0.27,0.431]	[0.355,0.543]	[0.289,0.451]	[0.451,1]	[0.353,1]	[0.307,0.476]	[0.345,0.522]	[0.346,1]	[0.238,0.391]	[0,0]	[0.32,0.486]	[0.401,1]	[0.423,0.615]	[0.375,0.548]	[0.347,0.531]
F14	[0.326,0.515]	[0.405,1]	[0.362,1]	[0.316,0.504]	[0.422,1]	[0.379,1]	[0.541,1]	[0.372,0.578]	[0.379,1]	[0.413,1]	[0.387,1]	[0.288,0.46]	[0.451,1]	[0,0]	[0.405,0.607]	[0.501,1]	[0.435,1]	[0.369,0.575]
F15	[0.4,0.6]	[0.439,1]	[0.408,1]	[0.365,0.562]	[0.47,1]	[0.399,1]	[0.597,1]	[0.381,0.582]	[0.431,1]	[0.414,1]	[0.431,1]	[0.29,0.473]	[0.518,1]	[0.415,0.618]	[0,0]	[0.516,1]	[0.483,1]	[0.454,1]
F16	[0.29,0.473]	[0.3,0.483]	[0.271,0.445]	[0.271,0.445]	[0.356,1]	[0.26,0.433]	[0.438,1]	[0.274,0.436]	[0.3,0.483]	[0.278,0.459]	[0.347,1]	[0.21,0.353]	[0.329,0.52]	[0.299,0.488]	[0.291,0.451]	[0,0]	[0.326,0.523]	[0.329,0.52]
F17	[0.32,0.503]	[0.381,1]	[0.319,0.509]	[0.319,0.509]	[0.382,1]	[0.354,1]	[0.503,1]	[0.338,0.542]	[0.328,0.51]	[0.389,1]	[0.389,1]	[0.26,0.433]	[0.406,1]	[0.335,0.531]	[0.381,0.587]	[0.437,1]	[0,0]	[0.363,0.564]
F18	[0.337,0.526]	[0.38,1]	[0.356,1]	[0.309,0.48]	[0.438,1]	[0.373,1]	[0.522,1]	[0.381,1]	[0.381,1]	[0.407,1]	[0.381,1]	[0.289,0.463]	[0.444,1]	[0.335,0.521]	[0.422,1]	[0.509,1]	[0.429,1]	[0,0]

According to formula (2), normalize the matrix R' to get the normalized matrix N. Further, calculate the comprehensive impact matrix T according to formula (4). Indicates both direct and indirect influence relationship between various elements, as shown in Table 6.

Table 6. Comprehensive impact matrix T.

Factor	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18
F1	[0.013,0.107]	[0.039,0.2]	[0.034,0.191]	[0.031,0.129]	[0.041,0.211]	[0.036,0.198]	[0.052,0.225]	[0.036,0.154]	[0.039,0.2]	[0.043,0.206]	[0.039,0.219]	[0.029,0.116]	[0.045,0.214]	[0.04,0.183]	[0.044,0.2]	[0.052,0.217]	[0.045,0.208]	[0.042,0.19]
F2	[0.033,0.119]	[0.013,0.135]	[0.033,0.175]	[0.031,0.115]	[0.041,0.19]	[0.031,0.156]	[0.05,0.201]	[0.035,0.138]	[0.038,0.181]	[0.038,0.185]	[0.037,0.195]	[0.026,0.104]	[0.039,0.141]	[0.038,0.149]	[0.041,0.178]	[0.048,0.195]	[0.044,0.186]	[0.04,0.159]
F3	[0.037,0.159]	[0.043,0.204]	[0.013,0.152]	[0.034,0.153]	[0.044,0.213]	[0.038,0.202]	[0.054,0.229]	[0.042,0.175]	[0.042,0.203]	[0.045,0.209]	[0.042,0.221]	[0.032,0.143]	[0.043,0.159]	[0.043,0.185]	[0.047,0.203]	[0.053,0.221]	[0.048,0.211]	[0.045,0.196]
F4	[0.034,0.132]	[0.04,0.195]	[0.034,0.19]	[0.012,0.097]	[0.043,0.205]	[0.036,0.193]	[0.054,0.217]	[0.038,0.149]	[0.041,0.195]	[0.043,0.2]	[0.038,0.212]	[0.029,0.114]	[0.042,0.153]	[0.041,0.177]	[0.044,0.195]	[0.052,0.21]	[0.048,0.201]	[0.043,0.188]
F5	[0.031,0.117]	[0.037,0.181]	[0.03,0.155]	[0.03,0.114]	[0.015,0.145]	[0.035,0.177]	[0.051,0.201]	[0.034,0.135]	[0.033,0.162]	[0.042,0.185]	[0.036,0.195]	[0.026,0.104]	[0.039,0.141]	[0.037,0.164]	[0.041,0.178]	[0.049,0.195]	[0.042,0.187]	[0.04,0.174]
F6	[0.034,0.124]	[0.037,0.166]	[0.035,0.179]	[0.031,0.118]	[0.044,0.194]	[0.013,0.137]	[0.052,0.208]	[0.037,0.142]	[0.042,0.184]	[0.04,0.174]	[0.039,0.2]	[0.028,0.108]	[0.04,0.145]	[0.041,0.168]	[0.043,0.185]	[0.05,0.2]	[0.046,0.191]	[0.044,0.178]
F7	[0.021,0.07]	[0.023,0.096]	[0.02,0.092]	[0.02,0.067]	[0.026,0.109]	[0.021,0.094]	[0.013,0.09]	[0.024,0.083]	[0.024,0.098]	[0.026,0.102]	[0.023,0.107]	[0.018,0.059]	[0.024,0.076]	[0.024,0.087]	[0.029,0.102]	[0.033,0.114]	[0.028,0.104]	[0.025,0.096]
F8	[0.032,0.12]	[0.037,0.185]	[0.033,0.179]	[0.031,0.117]	[0.039,0.194]	[0.034,0.183]	[0.052,0.208]	[0.013,0.111]	[0.037,0.184]	[0.039,0.191]	[0.037,0.2]	[0.026,0.107]	[0.04,0.145]	[0.037,0.15]	[0.039,0.166]	[0.047,0.199]	[0.042,0.191]	[0.039,0.162]
F9	[0.032,0.116]	[0.037,0.175]	[0.031,0.15]	[0.031,0.112]	[0.035,0.167]	[0.035,0.174]	[0.049,0.197]	[0.035,0.135]	[0.013,0.128]	[0.04,0.181]	[0.036,0.191]	[0.026,0.1]	[0.038,0.14]	[0.036,0.141]	[0.04,0.175]	[0.047,0.191]	[0.04,0.166]	[0.037,0.17]
F10	[0.032,0.113]	[0.032,0.151]	[0.032,0.165]	[0.029,0.109]	[0.039,0.181]	[0.03,0.147]	[0.048,0.192]	[0.034,0.128]	[0.037,0.17]	[0.013,0.128]	[0.034,0.185]	[0.024,0.096]	[0.037,0.136]	[0.034,0.14]	[0.035,0.152]	[0.043,0.185]	[0.04,0.176]	[0.037,0.148]
F11	[0.032,0.127]	[0.037,0.191]	[0.032,0.185]	[0.029,0.12]	[0.039,0.2]	[0.034,0.191]	[0.051,0.213]	[0.035,0.145]	[0.038,0.191]	[0.039,0.195]	[0.013,0.16]	[0.025,0.109]	[0.041,0.15]	[0.037,0.174]	[0.04,0.191]	[0.049,0.204]	[0.044,0.196]	[0.04,0.185]
F12	[0.042,0.141]	[0.044,0.2]	[0.041,0.195]	[0.037,0.132]	[0.047,0.21]	[0.042,0.197]	[0.058,0.225]	[0.043,0.17]	[0.045,0.2]	[0.046,0.205]	[0.044,0.217]	[0.012,0.09]	[0.047,0.158]	[0.046,0.181]	[0.046,0.198]	[0.056,0.216]	[0.052,0.206]	[0.048,0.193]
F13	[0.026,0.092]	[0.03,0.127]	[0.024,0.118]	[0.024,0.088]	[0.031,0.138]	[0.026,0.123]	[0.041,0.166]	[0.031,0.131]	[0.029,0.126]	[0.031,0.132]	[0.031,0.161]	[0.022,0.079]	[0.009,0.067]	[0.029,0.113]	[0.034,0.148]	[0.038,0.144]	[0.033,0.134]	[0.031,0.123]
F14	[0.03,0.118]	[0.035,0.183]	[0.032,0.175]	[0.029,0.115]	[0.037,0.193]	[0.033,0.181]	[0.048,0.203]	[0.033,0.139]	[0.034,0.183]	[0.037,0.19]	[0.034,0.196]	[0.025,0.106]	[0.037,0.144]	[0.013,0.119]	[0.036,0.165]	[0.045,0.197]	[0.039,0.191]	[0.034,0.156]
F15	[0.035,0.125]	[0.038,0.187]	[0.034,0.181]	[0.032,0.119]	[0.041,0.197]	[0.035,0.185]	[0.053,0.209]	[0.035,0.142]	[0.038,0.185]	[0.039,0.193]	[0.038,0.201]	[0.026,0.107]	[0.042,0.146]	[0.037,0.152]	[0.015,0.139]	[0.047,0.201]	[0.043,0.194]	[0.04,0.179]
F16	[0.026,0.089]	[0.026,0.121]	[0.024,0.113]	[0.024,0.085]	[0.031,0.153]	[0.024,0.118]	[0.039,0.16]	[0.025,0.099]	[0.026,0.119]	[0.027,0.124]	[0.029,0.157]	[0.02,0.074]	[0.028,0.091]	[0.026,0.11]	[0.028,0.118]	[0.014,0.108]	[0.03,0.127]	[0.03,0.118]
F17	[0.029,0.109]	[0.033,0.167]	[0.028,0.141]	[0.027,0.104]	[0.034,0.176]	[0.031,0.165]	[0.045,0.188]	[0.03,0.123]	[0.031,0.145]	[0.034,0.172]	[0.033,0.181]	[0.023,0.092]	[0.034,0.135]	[0.031,0.131]	[0.034,0.149]	[0.041,0.183]	[0.013,0.127]	[0.033,0.141]
F18	[0.03,0.123]	[0.034,0.189]	[0.031,0.183]	[0.029,0.117]	[0.038,0.197]	[0.032,0.186]	[0.047,0.21]	[0.034,0.161]	[0.034,0.188]	[0.036,0.194]	[0.034,0.202]	[0.026,0.107]	[0.036,0.147]	[0.031,0.148]	[0.037,0.188]	[0.045,0.202]	[0.039,0.195]	[0.013,0.135]

Calculate the centrality and cause degree for all impacting factors according to formulas (6)-(10). According to the results, they are divided into cause factors and result factors, as shown in Table 7. Finally, create a cause-result graph of influencing factors (as shown in Fig. 3)

Table 7. Centrality degree and cause degree.

Factor	R_i	E_i	Z_i	Rank	Y_i	Attribute
F1	[0.428,0.893]	[0.511,0.976]	1.405	9	0.083	Causal factor
F2	[0.465,0.965]	[0.488,0.958]	1.438	10	0.008	Causal factor
F3	[0.423,0.959]	[0.533,0.978]	1.447	8	0.065	Causal factor
F4	[0.405,0.882]	[0.517,0.972]	1.389	16	0.101	Causal factor
F5	[0.492,0.973]	[0.483,0.959]	1.454	2	-0.012	Result factor
F6	[0.438,0.963]	[0.509,0.963]	1.437	11	0.035	Causal factor
F7	[0.585,0.981]	[0.348,0.822]	1.368	15	-0.198	Result factor
F8	[0.454,0.929]	[0.487,0.963]	1.417	12	0.033	Causal factor
F9	[0.469,0.965]	[0.478,0.953]	1.433	5	-0.001	Result factor
F10	[0.489,0.97]	[0.463,0.947]	1.435	13	-0.025	Result factor
F11	[0.466,0.977]	[0.487,0.968]	1.450	14	0.006	Causal factor
F12	[0.362,0.853]	[0.557,0.975]	1.374	3	0.158	Causal factor
F13	[0.49,0.932]	[0.41,0.906]	1.369	18	-0.053	Result factor
F14	[0.469,0.945]	[0.463,0.961]	1.419	17	0.005	Causal factor
F15	[0.497,0.964]	[0.494,0.965]	1.461	1	-0.001	Result factor
F16	[0.563,0.977]	[0.383,0.892]	1.408	4	-0.133	Result factor
F17	[0.519,0.971]	[0.436,0.942]	1.434	6	-0.056	Result factor
F18	[0.49,0.958]	[0.46,0.966]	1.437	7	-0.011	Result factor

Table 7 provides information on the primary causal factors that contribute to the objectives of clean production and quality management. These factors include Employee Quality Skill Level (F1), Quality Work Experience (F2), Working Attitude (F3), Basic Equipment (F4), Data Acquisition (F6), BOM Accuracy (F8), Quality Process Standards (F11), Quality Inspection Guidelines (F12), and Quality Training (F14). It is important to prioritize the investigation of these determinants as they have the potential to significantly influence other factors related to cleaner production. The factors of Total Productive Maintenance (F5), Equipment Upgrade (F7), Material Specification (F9), Material Traceability (F10), Quality Culture (F13), Production Environment Quality (F15), Independent Software Development (F16), Mobile Internet Application (F17), and Technical Transformation (F18). These factors are strongly influenced by other variables, and thus, by regulating these resultant factors, the objective of cleaner production can be realized.

The diagram (Fig. 3) is created using the quadrant determination technique, which allows for the depiction of the relationship between quality management elements and clean production. In this technique, the centrality degree is represented as the horizontal coordinate, while the cause degree is represented as the vertical coordinate. The coordinate intersection is determined by the median of centrality degrees and cause degree of the 18 factors, which has a value of (1.433, 0.02). Through this aforementioned process, the impact of each factor is visually elucidated.

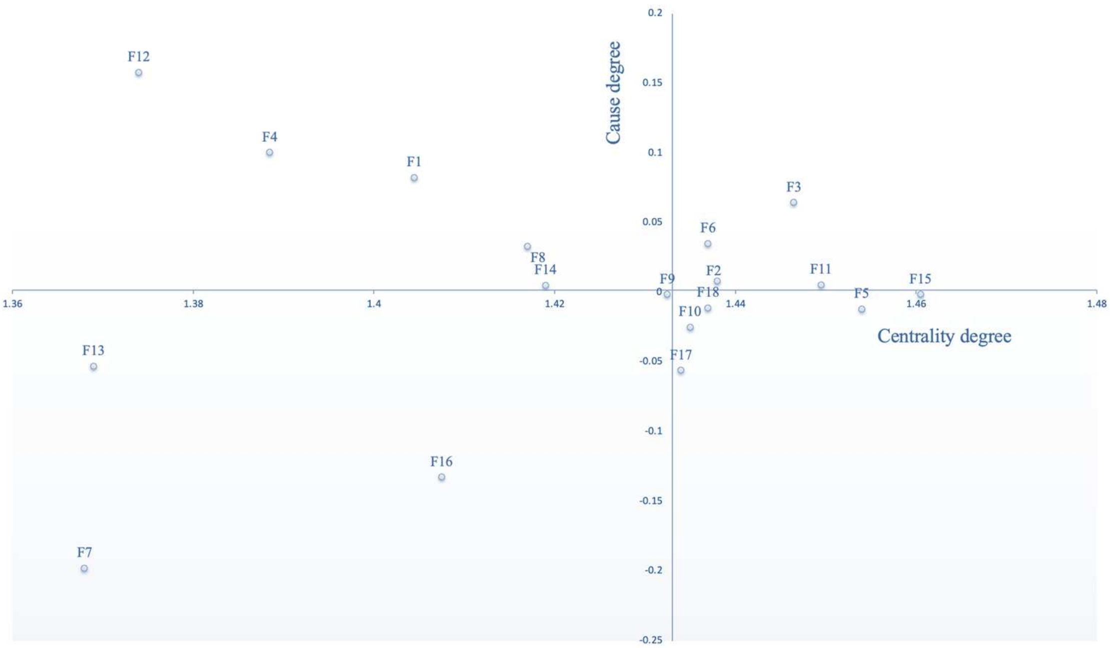

Fig. 3. The cause-result diagram of interactive influencing factors.

4.2.2 Results of AISM

The defuzzified comprehensive influence matrix is obtained through formula (8). the adjacency matrix B is calculated according to formulas (11) (12), as shown in Table 8.

Table 8. Adjacency matrix *B*.

Factor	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18
F1	0	1	1	0	1	0	1	0	1	1	1	0	1	0	1	1	1	0
F2	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0
F3	0	1	0	0	1	1	1	0	1	1	1	0	0	0	1	1	1	1
F4	0	0	0	0	1	1	1	0	0	1	1	0	0	0	1	1	1	0
F5	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
F6	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	1	0	0
F7	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
F8	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0
F9	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0
F10	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0
F11	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	1	1	0
F12	0	1	0	0	1	1	1	0	1	1	1	0	0	1	1	1	1	1
F13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
F14	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
F15	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	1	0
F16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
F17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F18	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0

Using the Boolean operation rule, the reachability matrix K is calculated as shown in Table 9.

Table 9. Reachability matrix *K*.

Factor	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18
F1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
F2	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
F3	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
F4	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
F5	0	0	0	0	1	0	1	0	1	0	1	0	1	0	1	1	1	1
F6	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
F7	0	0	0	0	1	0	1	0	1	0	1	0	1	0	1	1	1	1
F8	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
F9	0	0	0	0	1	0	1	0	1	0	1	0	1	0	1	1	1	1
F10	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
F11	0	0	0	0	1	0	1	0	1	0	1	0	1	0	1	1	1	1
F12	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
F13	0	0	0	0	1	0	1	0	1	0	1	0	1	0	1	1	1	1
F14	0	0	0	0	1	0	1	0	1	0	1	0	1	1	1	1	1	1
F15	0	0	0	0	1	0	1	0	1	0	1	0	1	0	1	1	1	1
F16	0	0	0	0	1	0	1	0	1	0	1	0	1	0	1	1	1	1
F17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
F18	0	0	0	0	1	0	1	0	1	0	1	0	1	0	1	1	1	1

According to Equation (13) and the reachability matrix *K*, the levels are divided according to two rules: result priority and level priority. The results are shown in Table 10.

Table 10. Final hierarchy results.

	UP Cascade Extraction		DOWN Cascade Extraction
L1	F17	L1	F17
L2	F5 F7 F9 F11 F13 F15 F16 F18	L2	F5 F7 F9 F11 F13 F15 F16 F18
L3	F14	L3	F14
L4	F2 F4 F6 F8 F10 F12	L4	F2 F4 F6 F8 F10 F12
L5	F3	L5	F3
L6	F1	L6	F1

Following the findings of multilevel analysis, the levels extracted by the two rules are consistent, and a hierarchical diagram of the influencing factors is drawn, as shown in Fig. 4.

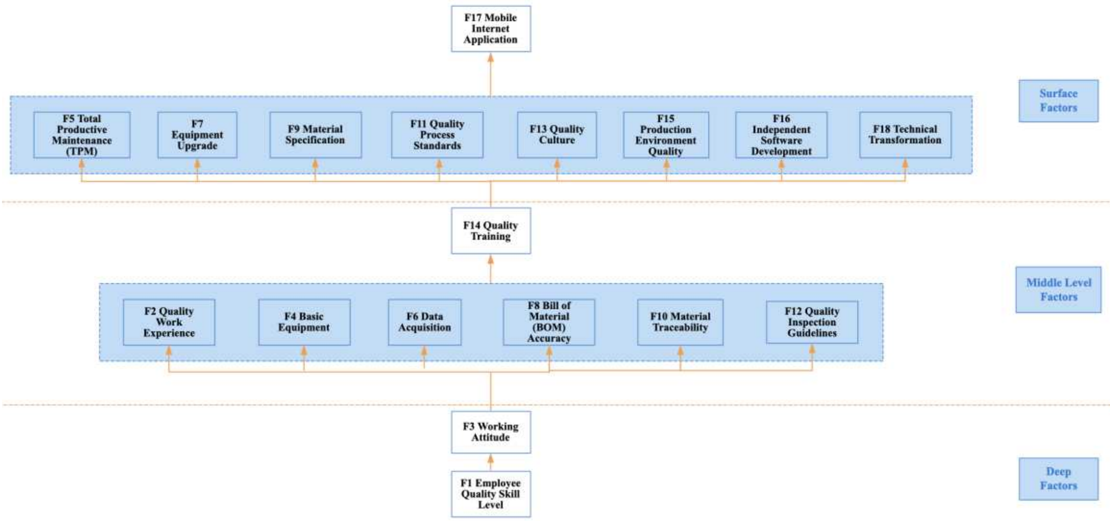

Fig. 4. Multilevel structural model.

5. Discussion and implications

This section provides a comprehensive examination of the factors derived from Part 4, and presents a thorough analysis of the significance and importance of these pivotal analysis indicators in the research. Concurrently, the theoretical and practical significance of this study is expounded upon.

5.1 Discussion

This research demonstrates the implementation of the integrated GT-IVHFS-DEMATEL-AISM technology to identify and examine the reciprocal influencing factors of quality and cleaner production in the manufacturing process, focusing on individual elements. Moreover, it aims to construct a framework model that uncovers the mechanism of interaction. This investigation employs quality management instruments and grounded theory to unveil 18 aspects that influence quality and cleaner production in the manufacturing procedure. The classification of the identified influencing factors into causal groups was carried out using IVHFS-DEMATEL. Subsequently, the influencing factors were stratified using AISM, and a framework model (Fig. 4) was developed.

The developed framework model can be divided into three levels: surface factors, middle factors, and deep factors. The surface factors represent the endpoint of result orientation and are subject to the influence of other factors. On the other hand, the deep factors act as the starting point of cause orientation and have an impact on the upper-level factors. In this analysis, Employee Quality Skill Level (F1) and Working Attitude (F3) are deep factors, which are also causal factors in DEMATEL analysis and drive middle factors.

The middle factors serve as the pivot, carrying the influence from lower-level factors to the top. In the centrality value of each influencing factor (Table 7, Figure 3), Production Environment Quality (F15) and Total Productive Maintenance (F5) rank first and second, which shows that Production Environment Quality and Total Productive Maintenance play a significant role in influencing factors. occupy a central position in the system. Combined with the positions of the two in Figure 4, it shows that Production Environment Quality and Total Productive Maintenance play a connecting role in the influencing factor system. Among them, Production Environment Quality (F15) includes environmental condition control, resource management, energy, and equipment (Table 3), which matches the cleaner production plan to reduce material consumption and improve resource efficiency (Borges et al., 2023). Total Productive Maintenance (F5) includes health status monitoring, health status prediction, and preventive maintenance (Table 3), mainly focusing on equipment maintenance and production status. Implementing TPM can improve production efficiency and is consistent with the goal of cleaner production (Van Berkel et al., 1997). In addition, the Chinese government also proposed in the "Cleaner Production Promotion Work" that one of the goals of cleaner production is to improve the efficiency of energy resource utilization. Therefore, Production Environment Quality (F15) and Total Productive Maintenance (F5) are the more important factors affecting cleaner production in quality management.

The surface factors are driven by underlying factors and are the result factors in DEMATEL analysis. Among them, the concentration of Mobile Internet Applications (F17) lies in Pareto optimality, which directly affects the advancement of quality management and clean production tasks. This corresponds to technological changes in clean production practices. At the same time, the importance of improving technology was emphasized (Oliveira et al., 2019). In addition, as China's traditional manufacturing industry strives for innovation and modernization in the Industry 4.0 era (Liu et al., 2023), the application of mobile internet technology for equipment upgrades has improved the technical capabilities and performance of clean production by more accurately detecting and distinguishing potential quality faults (Qiao et al., 2023).

5.2 Implications

Cleaner production and quality management represent crucial tools for organizations seeking to acquire competitive advantages and foster sustainable development. The existing body of literature predominantly concentrates on the efficacy of combining cleaner production with quality management in enhancing organizational performance, while giving comparatively insufficient consideration to the interplay between the two systems. This study aims to elucidate the integration mechanism of these two systems from an elemental standpoint, addressing the existing research void. Through the utilization of the GT-IVHFS-DEMATEL-AISM approach, this study offers significant insights into the correlation between cleaner production and quality management theory. The methodology put forth identifies 18 quality factors associated with cleaner production, examining the interrelationships in terms of correlation and direct impact to construct a comprehensive framework model. Serving as a valuable addition to the realms of quality management and cleaner production theory, this research underscores the pivotal role of quality factors in cleaner production endeavors. By prioritizing quality-related initiatives, organizations can effectively navigate towards achieving cleaner production objectives and driving sustainable development.

This study possesses compelling practical implications for practitioners within the manufacturing sector. Firstly, the research contributes by identifying the quality factors that facilitate the implementation of cleaner production to realize the objectives of cleanliness and quality. Secondly, it elucidates the precedence and causal relationships among these quality factors to assist in establishing the hierarchy, thus enabling the methodical integration of quality management in cleaner production. The factor of Production Environment Quality (F15) exhibits the strongest correlation out of all the pivotal factors, while Employee Quality Skill Level (F1) emerges as the most influential; Consequently, it is imperative to accord priority to these two crucial factors when devising plans for cleaner production and quality management execution. Moreover, the key factors identified are categorized into groups based on causal outcomes, underscoring the need for decision-makers and policymakers to place greater emphasis on causal determinants.

6. Conclusion

Cleaner and higher-quality production in the manufacturing sector is impacted by numerous variables. Given the intricate nature of industrial processes, it becomes imperative to conduct a thorough analysis and optimization of the production factors. In this particular investigation, a combination of quality tools and proceduralized grounded theory was employed, leading to the identification of 18 interactive influencing factors. The interplay between these factors was then assessed using the IVHFS-DEMATEL-AISM methodology, resulting in the creation of a hierarchical relationship model. This model offers a comprehensive depiction of the chain of relationships among the various factors studied. As such, it serves as a valuable point of reference for both managers and policy-makers. Taking into account the principles of cleaner production and quality production can contribute to the attainment of a mutually beneficial scenario, where sustainable production and environmental protection are achieved simultaneously.

Given the important implications of this research, it has certain limitations that can prove to be fruitful directions for future research. Although the results of this study are valuable, there are still some limitations, which provide direction for future research. Although representative experts have been selected for this study to analyze the interactions between factors, the number of experts is still limited. Therefore, the conclusions drawn may not be universally applicable to various industries because different industries may have differences in production processes, quality characteristics, environmental regulations, and other aspects. These differences will all affect the achievement of clean production goals. Future work should focus on researching quality management and clean production in different industrial sectors. In addition, future research should also consider the economic and cultural influences of different countries/regions, and establish more targeted interactive influencing factor models to balance the goals of clean production and quality production.

Although there are some limitations, there are still many opportunities to study how to use this tool to understand how various standards and calibration framework measures interact with each other, and to help fully prepare for more effective and efficient improvement of sustainability.

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Appendix A.

Table 11. Hesitant fuzzy preference decision matrix R.

Factors	F1	F2	F3	F4
F1	0	[0.4-0.6][0.4-0.6][0.6-0.8][0.2-0.3][0.4-0.6][0.1-0.2][0.3-0.5][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.4-0.6][0.6-0.8][0.3-0.5][0.1-0.2][0.4-0.6][0.2-0.3][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.4-0.6][0.6-0.8][0.3-0.5][0.4-0.6][0.4-0.6][0.2-0.3][0.3-0.5][0.3-0.5][0.3-
F2	[0.4-0.6][0.2-0.4][0.2-0.3][0.4-0.5][0.4-0.6][0.8-1][0.3-0.5][0.6-0.8][0.6-0.8][0.6-	0	[0.4-0.6][0.3-0.5][0.3-0.5][0.4-0.5][0.1-0.2][0.8-1][0.2-0.3][0.6-0.8][0.6-0.8][0.6-	[0.4-0.6][0.3-0.5][0.3-0.5][0.4-0.5][0.4-0.6][0.8-1][0.2-0.3][0.6-0.8][0.6-0.8][0.6-
F3	[0.4-0.6][0.2-0.4][0.2-0.3][0.3-0.5][0.8-1][0.4-0.6][0.5-0.7][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.3-0.5][0.3-0.5][0.2-0.3][0.8-1][0.1-0.2][0.5-0.7][0.1-0.2][0.1-0.2][0.1-	0	[0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.8-1][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-
F4	[0.4-0.6][0.2-0.4][0.2-0.3][0.3-0.5][0.4-0.6][0.4-0.6][0.5-0.7][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.3-0.5][0.3-0.5][0.2-0.3][0.4-0.6][0.1-0.2][0.5-0.7][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.1-0.2][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	0
F5	[0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.8-1][0.4-0.6][0.3-0.5][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.4-0.6][0.6-0.8][0.2-0.3][0.8-1][0.1-0.2][0.3-0.5][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.4-0.6][0.6-0.8][0.3-0.5][0.4-0.6][0.4-0.6][0.2-0.3][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.4-0.6][0.6-0.8][0.3-0.5][0.8-1][0.4-0.6][0.2-0.3][0.2-0.3][0.2-0.3][0.2-
F6	[0.4-0.6][0.2-0.4][0.2-0.3][0.3-0.5][0.4-0.6][0.8-1][0.5-0.7][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.3-0.5][0.3-0.5][0.2-0.3][0.4-0.6][0.4-0.6][0.5-0.7][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.1-0.2][0.8-1][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.4-0.6][0.8-1][0.3-0.5][0.3-0.5][0.3-0.5][0.3-
F7	[0.8-1][0.2-0.4][0.3-0.5][0.6-0.8][0.8-1][0.8-1][0.5-0.7][0.6-0.8][0.6-0.8][0.6-0.8]	[0.8-1][0.3-0.5][0.6-0.8][0.4-0.6][0.8-1][0.4-0.6][0.5-0.7][0.3-0.5][0.3-0.5][0.3-	[0.8-1][0.3-0.5][0.6-0.8][0.6-0.8][0.4-0.6][0.8-1][0.3-0.5][0.6-0.8][0.6-0.8][0.6-	[0.8-1][0.3-0.5][0.6-0.8][0.6-0.8][0.8-1][0.8-1][0.3-0.5][0.6-0.8][0.6-0.8][0.6-0.8]
F8	[0.4-0.6][0.5-0.6][0.3-0.5][0.4-0.5][0.4-0.6][0.4-0.6][0.5-0.7][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.7-0.9][0.6-0.8][0.3-0.5][0.4-0.6][0.1-0.2][0.5-0.7][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.7-0.9][0.6-0.8][0.4-0.5][0.1-0.2][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.7-0.9][0.6-0.8][0.4-0.5][0.4-0.6][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-
F9	[0.4-0.6][0.2-0.4][0.3-0.5][0.6-0.8][0.8-1][0.4-0.6][0.3-0.5][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.3-0.5][0.6-0.8][0.4-0.6][0.8-1][0.1-0.2][0.3-0.5][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.3-0.5][0.6-0.8][0.6-0.8][0.4-0.6][0.4-0.6][0.2-0.3][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.3-0.5][0.6-0.8][0.6-0.8][0.8-1][0.4-0.6][0.2-0.3][0.2-0.3][0.2-0.3][0.2-
F10	[0.4-0.6][0.2-0.4][0.2-0.3][0.6-0.8][0.4-0.6][0.8-1][0.8-1][0.3-0.5][0.3-0.5][0.3-0.5]	[0.4-0.6][0.3-0.5][0.3-0.5][0.4-0.6][0.4-0.6][0.4-0.6][0.8-1][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.3-0.5][0.3-0.5][0.6-0.8][0.1-0.2][0.8-1][0.6-0.8][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.3-0.5][0.3-0.5][0.6-0.8][0.4-0.6][0.8-1][0.6-0.8][0.3-0.5][0.3-0.5][0.3-
F11	[0.8-1][0.2-0.4][0.2-0.3][0.3-0.5][0.4-0.6][0.4-0.6][0.5-0.7][0.3-0.5][0.3-0.5][0.3-	[0.8-1][0.3-0.5][0.3-0.5][0.2-0.3][0.4-0.6][0.1-0.2][0.5-0.7][0.1-0.2][0.1-0.2][0.1-	[0.8-1][0.3-0.5][0.3-0.5][0.3-0.5][0.1-0.2][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.8-1][0.3-0.5][0.3-0.5][0.3-0.5][0.4-0.6][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-
F12	[0.4-0.6][0.1-0.2][0.2-0.3][0.3-0.5][0.4-0.6][0.4-0.6][0.5-0.7][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.2-0.4][0.3-0.5][0.2-0.3][0.4-0.6][0.1-0.2][0.5-0.7][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.2-0.4][0.3-0.5][0.3-0.5][0.1-0.2][0.4-0.6][0.3-0.5][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.2-0.4][0.3-0.5][0.3-0.5][0.4-0.6][0.4-0.6][0.3-0.5][0.2-0.3][0.2-0.3][0.2-
F13	[0.4-0.6][0.1-0.2][0.3-0.5][0.6-0.8][0.8-1][0.8-1][0.5-0.7][0.3-0.5][0.3-0.5][0.3-0.5]	[0.4-0.6][0.2-0.4][0.6-0.8][0.4-0.6][0.8-1][0.4-0.6][0.5-0.7][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.2-0.4][0.6-0.8][0.6-0.8][0.4-0.6][0.8-1][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.2-0.4][0.6-0.8][0.6-0.8][0.8-1][0.8-1][0.3-0.5][0.3-0.5][0.3-0.5][0.3-0.5]
F14	[0.4-0.6][0.2-0.4][0.3-0.5][0.8-1][0.4-0.6][0.4-0.6][0.5-0.7][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.3-0.5][0.6-0.8][0.7-0.9][0.4-0.6][0.1-0.2][0.5-0.7][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.3-0.5][0.6-0.8][0.8-1][0.1-0.2][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.3-0.5][0.6-0.8][0.8-1][0.4-0.6][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-
F15	[0.4-0.6][0.5-0.6][0.2-0.3][0.8-1][0.4-0.6][0.4-0.6][0.8-1][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.7-0.9][0.3-0.5][0.7-0.9][0.4-0.6][0.1-0.2][0.8-1][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.7-0.9][0.3-0.5][0.8-1][0.1-0.2][0.4-0.6][0.6-0.8][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.7-0.9][0.3-0.5][0.8-1][0.4-0.6][0.4-0.6][0.6-0.8][0.2-0.3][0.2-0.3][0.2-
F16	[0.4-0.6][0.3-0.5][0.3-0.5][0.8-1][0.8-1][0.8-1][0.8-1][0.3-0.5][0.3-0.5][0.3-0.5]	[0.4-0.6][0.4-0.6][0.6-0.8][0.7-0.9][0.8-1][0.4-0.6][0.8-1][0.1-0.2][0.1-0.2][0.1-0.2]	[0.4-0.6][0.4-0.6][0.6-0.8][0.8-1][0.4-0.6][0.8-1][0.6-0.8][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.4-0.6][0.6-0.8][0.8-1][0.8-1][0.8-1][0.6-0.8][0.3-0.5][0.3-0.5][0.3-0.5]
F17	[0.4-0.6][0.2-0.4][0.6-0.8][0.8-1][0.8-1][0.4-0.6][0.5-0.7][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.3-0.5][0.8-1][0.7-0.9][0.8-1][0.1-0.2][0.5-0.7][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.3-0.5][0.8-1][0.8-1][0.4-0.6][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.3-0.5][0.8-1][0.8-1][0.8-1][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-0.5]
F18	[0.4-0.6][0.1-0.2][0.3-0.5][0.8-1][0.4-0.6][0.4-0.6][0.5-0.7][0.6-0.8][0.6-0.8][0.6-	[0.4-0.6][0.2-0.4][0.6-0.8][0.7-0.9][0.4-0.6][0.1-0.2][0.5-0.7][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.2-0.4][0.6-0.8][0.8-1][0.1-0.2][0.4-0.6][0.3-0.5][0.6-0.8][0.6-0.8][0.6-	[0.4-0.6][0.2-0.4][0.6-0.8][0.8-1][0.4-0.6][0.4-0.6][0.3-0.5][0.6-0.8][0.6-0.8][0.6-

F11	F10	F9	F8	F7	F6	F5
[0.1-0.2][0.4-0.6][0.6-0.8][0.3-0.5][0.4-0.6][0.4-0.6][0.2-0.3][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.4-0.6][0.6-0.8][0.1-0.2][0.4-0.6][0.1-0.2][0.1-0.2][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.4-0.6][0.3-0.5][0.1-0.2][0.1-0.2][0.4-0.6][0.3-0.5][0.6-0.8][0.6-0.8][0.6-	[0.4-0.6][0.1-0.2][0.3-0.5][0.2-0.3][0.4-0.6][0.4-0.6][0.2-0.3][0.3-0.5][0.3-0.5][0.3-	[0.1-0.2][0.4-0.6][0.3-0.5][0.1-0.2][0.1-0.2][0.1-0.2][0.2-0.3][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.4-0.6][0.6-0.8][0.3-0.5][0.4-0.6][0.1-0.2][0.2-0.3][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.1-0.2][0.4-0.6][0.3-0.5][0.6-0.8][0.6-0.8][0.6-
[0.1-0.2][0.3-0.5][0.3-0.5][0.4-0.5][0.4-0.6][0.8-1][0.2-0.3][0.6-0.8][0.6-0.8][0.6-	[0.4-0.6][0.3-0.5][0.3-0.5][0.2-0.3][0.4-0.6][0.4-0.6][0.1-0.2][0.6-0.8][0.6-0.8][0.6-	[0.4-0.6][0.3-0.5][0.2-0.3][0.2-0.3][0.1-0.2][0.8-1][0.3-0.5][0.8-1][0.8-1][0.8-1]	[0.4-0.6][0.1-0.2][0.2-0.3][0.3-0.5][0.4-0.6][0.8-1][0.2-0.3][0.6-0.8][0.6-0.8][0.6-	[0.1-0.2][0.3-0.5][0.2-0.3][0.2-0.3][0.1-0.2][0.4-0.6][0.2-0.3][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.3-0.5][0.3-0.5][0.4-0.5][0.4-0.6][0.4-0.6][0.2-0.3][0.6-0.8][0.6-0.8][0.6-	[0.4-0.6][0.2-0.4][0.2-0.3][0.4-0.5][0.1-0.2][0.8-1][0.3-0.5][0.8-1][0.8-1][0.8-1]
[0.1-0.2][0.3-0.5][0.3-0.5][0.3-0.5][0.8-1][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.3-0.5][0.3-0.5][0.1-0.2][0.8-1][0.1-0.2][0.1-0.2][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.3-0.5][0.2-0.3][0.1-0.2][0.4-0.6][0.4-0.6][0.5-0.7][0.6-0.8][0.6-0.8][0.6-	[0.4-0.6][0.1-0.2][0.2-0.3][0.2-0.3][0.8-1][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.1-0.2][0.3-0.5][0.2-0.3][0.1-0.2][0.4-0.6][0.1-0.2][0.3-0.5][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.8-1][0.1-0.2][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.2-0.4][0.2-0.3][0.3-0.5][0.4-0.6][0.4-0.6][0.5-0.7][0.6-0.8][0.6-0.8][0.6-
[0.1-0.2][0.3-0.5][0.3-0.5][0.3-0.5][0.4-0.6][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.3-0.5][0.3-0.5][0.1-0.2][0.4-0.6][0.1-0.2][0.1-0.2][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.3-0.5][0.2-0.3][0.1-0.2][0.1-0.2][0.4-0.6][0.5-0.7][0.6-0.8][0.6-0.8][0.6-	[0.4-0.6][0.1-0.2][0.2-0.3][0.2-0.3][0.4-0.6][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.1-0.2][0.3-0.5][0.2-0.3][0.1-0.2][0.1-0.2][0.1-0.2][0.3-0.5][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.4-0.6][0.1-0.2][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.2-0.4][0.2-0.3][0.3-0.5][0.1-0.2][0.4-0.6][0.5-0.7][0.6-0.8][0.6-0.8][0.6-
[0.1-0.2][0.4-0.6][0.6-0.8][0.3-0.5][0.8-1][0.4-0.6][0.2-0.3][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.4-0.6][0.6-0.8][0.1-0.2][0.8-1][0.1-0.2][0.1-0.2][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.4-0.6][0.3-0.5][0.1-0.2][0.4-0.6][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.1-0.2][0.3-0.5][0.2-0.3][0.8-1][0.4-0.6][0.2-0.3][0.2-0.3][0.2-0.3][0.2-	[0.1-0.2][0.4-0.6][0.3-0.5][0.1-0.2][0.4-0.6][0.1-0.2][0.2-0.3][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.4-0.6][0.6-0.8][0.3-0.5][0.8-1][0.1-0.2][0.2-0.3][0.2-0.3][0.2-0.3][0.2-	0
[0.1-0.2][0.3-0.5][0.3-0.5][0.3-0.5][0.4-0.6][0.8-1][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.3-0.5][0.3-0.5][0.1-0.2][0.4-0.6][0.4-0.6][0.1-0.2][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.3-0.5][0.2-0.3][0.1-0.2][0.1-0.2][0.8-1][0.5-0.7][0.6-0.8][0.6-0.8][0.6-	[0.4-0.6][0.1-0.2][0.2-0.3][0.2-0.3][0.4-0.6][0.8-1][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.1-0.2][0.3-0.5][0.2-0.3][0.1-0.2][0.1-0.2][0.4-0.6][0.3-0.5][0.1-0.2][0.1-0.2][0.1-	0	[0.4-0.6][0.2-0.4][0.2-0.3][0.3-0.5][0.1-0.2][0.8-1][0.5-0.7][0.6-0.8][0.6-0.8][0.6-
[0.4-0.6][0.3-0.5][0.6-0.8][0.6-0.8][0.8-1][0.8-1][0.3-0.5][0.6-0.8][0.6-0.8][0.6-0.8]	[0.8-1][0.3-0.5][0.6-0.8][0.3-0.5][0.8-1][0.4-0.6][0.1-0.2][0.6-0.8][0.6-0.8][0.6-	[0.8-1][0.3-0.5][0.3-0.5][0.3-0.5][0.4-0.6][0.8-1][0.5-0.7][0.8-1][0.8-1][0.8-1]	[0.8-1][0.1-0.2][0.3-0.5][0.4-0.6][0.8-1][0.8-1][0.3-0.5][0.6-0.8][0.6-0.8][0.6-0.8]	0	[0.8-1][0.3-0.5][0.6-0.8][0.6-0.8][0.8-1][0.4-0.6][0.3-0.5][0.6-0.8][0.6-0.8][0.6-	[0.8-1][0.2-0.4][0.3-0.5][0.6-0.8][0.4-0.6][0.8-1][0.5-0.7][0.8-1][0.8-1][0.8-1]
[0.1-0.2][0.7-0.9][0.6-0.8][0.4-0.5][0.4-0.6][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.7-0.9][0.6-0.8][0.2-0.3][0.4-0.6][0.1-0.2][0.1-0.2][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.7-0.9][0.3-0.5][0.2-0.3][0.1-0.2][0.4-0.6][0.5-0.7][0.6-0.8][0.6-0.8][0.6-	0	[0.1-0.2][0.7-0.9][0.3-0.5][0.2-0.3][0.1-0.2][0.1-0.2][0.3-0.5][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.7-0.9][0.6-0.8][0.4-0.5][0.4-0.6][0.1-0.2][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.5-0.6][0.3-0.5][0.4-0.5][0.1-0.2][0.4-0.6][0.5-0.7][0.6-0.8][0.6-0.8][0.6-
[0.1-0.2][0.3-0.5][0.6-0.8][0.6-0.8][0.8-1][0.4-0.6][0.2-0.3][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.3-0.5][0.6-0.8][0.3-0.5][0.8-1][0.1-0.2][0.1-0.2][0.2-0.3][0.2-0.3][0.2-	0	[0.4-0.6][0.1-0.2][0.3-0.5][0.4-0.6][0.8-1][0.4-0.6][0.2-0.3][0.2-0.3][0.2-0.3][0.2-	[0.1-0.2][0.3-0.5][0.3-0.5][0.3-0.5][0.4-0.6][0.1-0.2][0.2-0.3][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.3-0.5][0.6-0.8][0.6-0.8][0.8-1][0.1-0.2][0.2-0.3][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.2-0.4][0.3-0.5][0.6-0.8][0.4-0.6][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-
[0.1-0.2][0.3-0.5][0.3-0.5][0.6-0.8][0.4-0.6][0.8-1][0.6-0.8][0.3-0.5][0.3-0.5][0.3-	0	[0.4-0.6][0.3-0.5][0.2-0.3][0.3-0.5][0.1-0.2][0.8-1][0.8-1][0.6-0.8][0.6-0.8][0.6-0.8]	[0.4-0.6][0.1-0.2][0.2-0.3][0.4-0.6][0.4-0.6][0.8-1][0.6-0.8][0.3-0.5][0.3-0.5][0.3-	[0.1-0.2][0.3-0.5][0.2-0.3][0.3-0.5][0.1-0.2][0.4-0.6][0.6-0.8][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.3-0.5][0.3-0.5][0.6-0.8][0.4-0.6][0.4-0.6][0.6-0.8][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.2-0.4][0.2-0.3][0.6-0.8][0.1-0.2][0.8-1][0.8-1][0.6-0.8][0.6-0.8][0.6-0.8]
0	[0.8-1][0.3-0.5][0.3-0.5][0.1-0.2][0.4-0.6][0.1-0.2][0.1-0.2][0.3-0.5][0.3-0.5][0.3-	[0.8-1][0.3-0.5][0.2-0.3][0.1-0.2][0.1-0.2][0.4-0.6][0.5-0.7][0.6-0.8][0.6-0.8][0.6-	[0.8-1][0.1-0.2][0.2-0.3][0.2-0.3][0.4-0.6][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.3-0.5][0.2-0.3][0.1-0.2][0.1-0.2][0.1-0.2][0.3-0.5][0.1-0.2][0.1-0.2][0.1-	[0.8-1][0.3-0.5][0.3-0.5][0.3-0.5][0.4-0.6][0.1-0.2][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.8-1][0.2-0.4][0.2-0.3][0.3-0.5][0.1-0.2][0.4-0.6][0.5-0.7][0.6-0.8][0.6-0.8][0.6-
[0.1-0.2][0.2-0.4][0.3-0.5][0.3-0.5][0.4-0.6][0.4-0.6][0.3-0.5][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.2-0.4][0.3-0.5][0.1-0.2][0.4-0.6][0.1-0.2][0.1-0.2][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.2-0.4][0.2-0.3][0.1-0.2][0.1-0.2][0.4-0.6][0.5-0.7][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.1-0.2][0.2-0.3][0.2-0.3][0.4-0.6][0.4-0.6][0.3-0.5][0.2-0.3][0.2-0.3][0.2-	[0.1-0.2][0.2-0.4][0.2-0.3][0.1-0.2][0.1-0.2][0.1-0.2][0.3-0.5][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.2-0.4][0.3-0.5][0.3-0.5][0.4-0.6][0.1-0.2][0.3-0.5][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.1-0.2][0.2-0.3][0.3-0.5][0.1-0.2][0.4-0.6][0.5-0.7][0.3-0.5][0.3-0.5][0.3-
[0.1-0.2][0.2-0.4][0.6-0.8][0.6-0.8][0.8-1][0.8-1][0.3-0.5][0.3-0.5][0.3-0.5][0.3-0.5]	[0.4-0.6][0.2-0.4][0.6-0.8][0.3-0.5][0.8-1][0.4-0.6][0.1-0.2][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.2-0.4][0.3-0.5][0.3-0.5][0.4-0.6][0.8-1][0.5-0.7][0.6-0.8][0.6-0.8][0.6-	[0.4-0.6][0.1-0.2][0.3-0.5][0.4-0.6][0.8-1][0.8-1][0.3-0.5][0.3-0.5][0.3-0.5][0.3-0.5]	[0.1-0.2][0.2-0.4][0.3-0.5][0.3-0.5][0.4-0.6][0.4-0.6][0.3-0.5][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.2-0.4][0.6-0.8][0.6-0.8][0.8-1][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.1-0.2][0.3-0.5][0.6-0.8][0.4-0.6][0.8-1][0.5-0.7][0.6-0.8][0.6-0.8][0.6-
[0.1-0.2][0.3-0.5][0.6-0.8][0.8-1][0.4-0.6][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.3-0.5][0.6-0.8][0.5-0.6][0.4-0.6][0.1-0.2][0.1-0.2][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.3-0.5][0.3-0.5][0.5-0.6][0.1-0.2][0.4-0.6][0.5-0.7][0.6-0.8][0.6-0.8][0.6-	[0.4-0.6][0.1-0.2][0.3-0.5][0.7-0.9][0.4-0.6][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.1-0.2][0.3-0.5][0.3-0.5][0.5-0.6][0.1-0.2][0.1-0.2][0.3-0.5][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.3-0.5][0.6-0.8][0.8-1][0.4-0.6][0.1-0.2][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.2-0.4][0.3-0.5][0.8-1][0.1-0.2][0.4-0.6][0.5-0.7][0.6-0.8][0.6-0.8][0.6-
[0.1-0.2][0.7-0.9][0.3-0.5][0.8-1][0.4-0.6][0.4-0.6][0.6-0.8][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.7-0.9][0.3-0.5][0.5-0.6][0.4-0.6][0.1-0.2][0.3-0.5][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.7-0.9][0.2-0.3][0.5-0.6][0.1-0.2][0.4-0.6][0.8-1][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.3-0.5][0.2-0.3][0.7-0.9][0.4-0.6][0.4-0.6][0.6-0.8][0.2-0.3][0.2-0.3][0.2-	[0.1-0.2][0.7-0.9][0.2-0.3][0.5-0.6][0.1-0.2][0.1-0.2][0.6-0.8][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.7-0.9][0.3-0.5][0.8-1][0.4-0.6][0.1-0.2][0.6-0.8][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.5-0.6][0.2-0.3][0.8-1][0.1-0.2][0.4-0.6][0.8-1][0.3-0.5][0.3-0.5][0.3-
[0.1-0.2][0.4-0.6][0.6-0.8][0.8-1][0.8-1][0.8-1][0.6-0.8][0.3-0.5][0.3-0.5][0.3-0.5]	[0.4-0.6][0.4-0.6][0.6-0.8][0.5-0.6][0.8-1][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.4-0.6][0.3-0.5][0.5-0.6][0.4-0.6][0.8-1][0.8-1][0.6-0.8][0.6-0.8][0.6-0.8]	[0.4-0.6][0.1-0.2][0.3-0.5][0.7-0.9][0.8-1][0.8-1][0.6-0.8][0.3-0.5][0.3-0.5][0.3-0.5]	[0.1-0.2][0.4-0.6][0.3-0.5][0.5-0.6][0.4-0.6][0.4-0.6][0.6-0.8][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.4-0.6][0.6-0.8][0.8-1][0.8-1][0.4-0.6][0.6-0.8][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.3-0.5][0.3-0.5][0.8-1][0.4-0.6][0.8-1][0.8-1][0.6-0.8][0.6-0.8][0.6-0.8]
[0.1-0.2][0.3-0.5][0.8-1][0.8-1][0.8-1][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-0.5]	[0.4-0.6][0.3-0.5][0.8-1][0.5-0.6][0.8-1][0.1-0.2][0.1-0.2][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.3-0.5][0.6-0.8][0.5-0.6][0.4-0.6][0.4-0.6][0.5-0.7][0.6-0.8][0.6-0.8][0.6-	[0.4-0.6][0.1-0.2][0.6-0.8][0.7-0.9][0.8-1][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.1-0.2][0.3-0.5][0.6-0.8][0.5-0.6][0.4-0.6][0.1-0.2][0.3-0.5][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.3-0.5][0.8-1][0.8-1][0.8-1][0.1-0.2][0.3-0.5][0.3-0.5][0.3-0.5][0.3-0.5]	[0.4-0.6][0.2-0.4][0.6-0.8][0.8-1][0.4-0.6][0.4-0.6][0.5-0.7][0.6-0.8][0.6-0.8][0.6-
[0.1-0.2][0.2-0.4][0.6-0.8][0.8-1][0.4-0.6][0.4-0.6][0.3-0.5][0.6-0.8][0.6-0.8][0.6-	[0.4-0.6][0.2-0.4][0.6-0.8][0.5-0.6][0.4-0.6][0.1-0.2][0.1-0.2][0.6-0.8][0.6-0.8][0.6-	[0.4-0.6][0.2-0.4][0.3-0.5][0.5-0.6][0.1-0.2][0.4-0.6][0.5-0.7][0.8-1][0.8-1][0.8-1]	[0.4-0.6][0.1-0.2][0.3-0.5][0.7-0.9][0.4-0.6][0.4-0.6][0.3-0.5][0.6-0.8][0.6-0.8][0.6-	[0.1-0.2][0.2-0.4][0.3-0.5][0.5-0.6][0.1-0.2][0.1-0.2][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.2-0.4][0.6-0.8][0.8-1][0.4-0.6][0.1-0.2][0.3-0.5][0.6-0.8][0.6-0.8][0.6-	[0.4-0.6][0.1-0.2][0.3-0.5][0.8-1][0.1-0.2][0.4-0.6][0.5-0.7][0.8-1][0.8-1][0.8-1]

F18	F17	F16	F15	F14	F13	F12
[0.4-0.6][0.6-0.8][0.3-0.5][0.1-0.2][0.4-0.6][0.4-0.6][0.2-0.3][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.4-0.6][0.1-0.2][0.1-0.2][0.1-0.2][0.4-0.6][0.2-0.3][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.3-0.5][0.3-0.5][0.1-0.2][0.1-0.2][0.1-0.2][0.1-0.2][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.1-0.2][0.6-0.8][0.1-0.2][0.4-0.6][0.4-0.6][0.1-0.2][0.6-0.8][0.6-0.8][0.6-	[0.4-0.6][0.4-0.6][0.3-0.5][0.1-0.2][0.4-0.6][0.4-0.6][0.2-0.3][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.6-0.8][0.3-0.5][0.1-0.2][0.1-0.2][0.1-0.2][0.2-0.3][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.6-0.8][0.6-0.8][0.3-0.5][0.4-0.6][0.4-0.6][0.2-0.3][0.6-0.8][0.6-0.8][0.6-
[0.4-0.6][0.4-0.5][0.2-0.3][0.1-0.2][0.4-0.6][0.8-1][0.2-0.3][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.3-0.5][0.1-0.2][0.1-0.2][0.1-0.2][0.8-1][0.2-0.3][0.6-0.8][0.6-0.8][0.6-	[0.4-0.6][0.2-0.4][0.2-0.3][0.1-0.2][0.1-0.2][0.4-0.6][0.1-0.2][0.6-0.8][0.6-0.8][0.6-	[0.4-0.6][0.1-0.2][0.3-0.5][0.1-0.2][0.4-0.6][0.8-1][0.1-0.2][0.8-1][0.8-1][0.8-1]	[0.4-0.6][0.3-0.5][0.2-0.3][0.1-0.2][0.4-0.6][0.8-1][0.2-0.3][0.6-0.8][0.6-0.8][0.6-	[0.4-0.6][0.4-0.5][0.2-0.3][0.2-0.3][0.1-0.2][0.4-0.6][0.2-0.3][0.6-0.8][0.6-0.8][0.6-	[0.4-0.6][0.4-0.5][0.3-0.5][0.4-0.5][0.4-0.6][0.8-1][0.2-0.3][0.8-1][0.8-1][0.8-1]
[0.4-0.6][0.4-0.5][0.2-0.3][0.1-0.2][0.8-1][0.4-0.6][0.3-0.5][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.3-0.5][0.1-0.2][0.1-0.2][0.4-0.6][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.2-0.4][0.2-0.3][0.1-0.2][0.4-0.6][0.1-0.2][0.1-0.2][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.1-0.2][0.3-0.5][0.1-0.2][0.8-1][0.4-0.6][0.1-0.2][0.6-0.8][0.6-0.8][0.6-	[0.4-0.6][0.3-0.5][0.2-0.3][0.1-0.2][0.8-1][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.4-0.5][0.2-0.3][0.1-0.2][0.4-0.6][0.1-0.2][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.4-0.5][0.3-0.5][0.3-0.5][0.8-1][0.4-0.6][0.3-0.5][0.6-0.8][0.6-0.8][0.6-
[0.4-0.6][0.4-0.5][0.2-0.3][0.1-0.2][0.4-0.6][0.4-0.6][0.3-0.5][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.3-0.5][0.1-0.2][0.1-0.2][0.1-0.2][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.2-0.4][0.2-0.3][0.1-0.2][0.1-0.2][0.1-0.2][0.1-0.2][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.1-0.2][0.3-0.5][0.1-0.2][0.4-0.6][0.4-0.6][0.1-0.2][0.6-0.8][0.6-0.8][0.6-	[0.4-0.6][0.3-0.5][0.2-0.3][0.1-0.2][0.4-0.6][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.4-0.5][0.2-0.3][0.1-0.2][0.1-0.2][0.1-0.2][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.4-0.5][0.3-0.5][0.3-0.5][0.4-0.6][0.4-0.6][0.3-0.5][0.6-0.8][0.6-0.8][0.6-
[0.4-0.6][0.6-0.8][0.3-0.5][0.1-0.2][0.8-1][0.4-0.6][0.2-0.3][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.4-0.6][0.1-0.2][0.1-0.2][0.4-0.6][0.4-0.6][0.2-0.3][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.3-0.5][0.3-0.5][0.1-0.2][0.4-0.6][0.1-0.2][0.1-0.2][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.1-0.2][0.6-0.8][0.1-0.2][0.8-1][0.4-0.6][0.1-0.2][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.4-0.6][0.3-0.5][0.1-0.2][0.8-1][0.4-0.6][0.2-0.3][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.6-0.8][0.3-0.5][0.1-0.2][0.4-0.6][0.1-0.2][0.2-0.3][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.6-0.8][0.6-0.8][0.3-0.5][0.8-1][0.4-0.6][0.2-0.3][0.3-0.5][0.3-0.5][0.3-
[0.4-0.6][0.4-0.5][0.2-0.3][0.1-0.2][0.4-0.6][0.8-1][0.3-0.5][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.3-0.5][0.1-0.2][0.1-0.2][0.1-0.2][0.8-1][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.2-0.4][0.2-0.3][0.1-0.2][0.1-0.2][0.4-0.6][0.1-0.2][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.1-0.2][0.3-0.5][0.1-0.2][0.4-0.6][0.8-1][0.1-0.2][0.6-0.8][0.6-0.8][0.6-	[0.4-0.6][0.3-0.5][0.2-0.3][0.1-0.2][0.4-0.6][0.8-1][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.4-0.5][0.2-0.3][0.1-0.2][0.1-0.2][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.4-0.5][0.3-0.5][0.3-0.5][0.4-0.6][0.8-1][0.3-0.5][0.6-0.8][0.6-0.8][0.6-
[0.8-1][0.4-0.5][0.3-0.5][0.1-0.2][0.8-1][0.8-1][0.3-0.5][0.3-0.5][0.3-0.5][0.3-0.5]	[0.8-1][0.3-0.5][0.1-0.2][0.1-0.2][0.4-0.6][0.8-1][0.3-0.5][0.6-0.8][0.6-0.8][0.6-	[0.8-1][0.2-0.4][0.3-0.5][0.1-0.2][0.4-0.6][0.4-0.6][0.1-0.2][0.6-0.8][0.6-0.8][0.6-	[0.8-1][0.1-0.2][0.6-0.8][0.1-0.2][0.8-1][0.8-1][0.1-0.2][0.8-1][0.8-1][0.8-1]	[0.8-1][0.3-0.5][0.3-0.5][0.1-0.2][0.8-1][0.8-1][0.3-0.5][0.6-0.8][0.6-0.8][0.6-0.8]	[0.8-1][0.4-0.5][0.3-0.5][0.3-0.5][0.4-0.6][0.4-0.6][0.3-0.5][0.6-0.8][0.6-0.8][0.6-	[0.8-1][0.4-0.5][0.6-0.8][0.6-0.8][0.8-1][0.8-1][0.3-0.5][0.8-1][0.8-1][0.8-1]
[0.4-0.6][0.8-1][0.3-0.5][0.1-0.2][0.4-0.6][0.4-0.6][0.3-0.5][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.7-0.9][0.1-0.2][0.1-0.2][0.1-0.2][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.5-0.6][0.3-0.5][0.1-0.2][0.1-0.2][0.1-0.2][0.1-0.2][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.3-0.5][0.6-0.8][0.1-0.2][0.4-0.6][0.4-0.6][0.1-0.2][0.6-0.8][0.6-0.8][0.6-	[0.4-0.6][0.7-0.9][0.3-0.5][0.1-0.2][0.4-0.6][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.8-1][0.3-0.5][0.2-0.3][0.1-0.2][0.1-0.2][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.8-1][0.6-0.8][0.4-0.5][0.4-0.6][0.4-0.6][0.3-0.5][0.6-0.8][0.6-0.8][0.6-
[0.4-0.6][0.4-0.5][0.3-0.5][0.1-0.2][0.8-1][0.4-0.6][0.2-0.3][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.3-0.5][0.1-0.2][0.1-0.2][0.4-0.6][0.4-0.6][0.2-0.3][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.2-0.4][0.3-0.5][0.1-0.2][0.4-0.6][0.1-0.2][0.1-0.2][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.1-0.2][0.6-0.8][0.1-0.2][0.8-1][0.4-0.6][0.1-0.2][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.3-0.5][0.3-0.5][0.1-0.2][0.8-1][0.4-0.6][0.2-0.3][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.4-0.5][0.3-0.5][0.3-0.5][0.4-0.6][0.1-0.2][0.2-0.3][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.4-0.5][0.6-0.8][0.6-0.8][0.8-1][0.4-0.6][0.2-0.3][0.3-0.5][0.3-0.5][0.3-
[0.4-0.6][0.4-0.5][0.2-0.3][0.1-0.2][0.4-0.6][0.8-1][0.6-0.8][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.3-0.5][0.1-0.2][0.1-0.2][0.1-0.2][0.8-1][0.6-0.8][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.2-0.4][0.2-0.3][0.1-0.2][0.1-0.2][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.1-0.2][0.3-0.5][0.1-0.2][0.4-0.6][0.8-1][0.3-0.5][0.6-0.8][0.6-0.8][0.6-	[0.4-0.6][0.3-0.5][0.2-0.3][0.1-0.2][0.4-0.6][0.8-1][0.6-0.8][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.4-0.5][0.2-0.3][0.3-0.5][0.1-0.2][0.4-0.6][0.6-0.8][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.4-0.5][0.3-0.5][0.6-0.8][0.4-0.6][0.8-1][0.6-0.8][0.6-0.8][0.6-0.8][0.6-
[0.8-1][0.4-0.5][0.2-0.3][0.1-0.2][0.4-0.6][0.4-0.6][0.3-0.5][0.1-0.2][0.1-0.2][0.1-	[0.8-1][0.3-0.5][0.1-0.2][0.1-0.2][0.1-0.2][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.8-1][0.2-0.4][0.2-0.3][0.1-0.2][0.1-0.2][0.1-0.2][0.1-0.2][0.3-0.5][0.3-0.5][0.3-	[0.8-1][0.1-0.2][0.3-0.5][0.1-0.2][0.4-0.6][0.4-0.6][0.1-0.2][0.6-0.8][0.6-0.8][0.6-	[0.8-1][0.3-0.5][0.2-0.3][0.1-0.2][0.4-0.6][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.8-1][0.4-0.5][0.2-0.3][0.1-0.2][0.1-0.2][0.1-0.2][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.8-1][0.4-0.5][0.3-0.5][0.3-0.5][0.4-0.6][0.4-0.6][0.3-0.5][0.6-0.8][0.6-0.8][0.6-
[0.4-0.6][0.3-0.5][0.2-0.3][0.1-0.2][0.4-0.6][0.4-0.6][0.3-0.5][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.2-0.4][0.1-0.2][0.1-0.2][0.1-0.2][0.4-0.6][0.3-0.5][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.1-0.2][0.2-0.3][0.1-0.2][0.1-0.2][0.1-0.2][0.1-0.2][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.1-0.2][0.3-0.5][0.1-0.2][0.4-0.6][0.4-0.6][0.1-0.2][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.2-0.4][0.2-0.3][0.1-0.2][0.4-0.6][0.4-0.6][0.3-0.5][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.3-0.5][0.2-0.3][0.1-0.2][0.1-0.2][0.1-0.2][0.3-0.5][0.2-0.3][0.2-0.3][0.2-	0
[0.4-0.6][0.3-0.5][0.3-0.5][0.1-0.2][0.8-1][0.8-1][0.3-0.5][0.1-0.2][0.1-0.2][0.1-0.2]	[0.4-0.6][0.2-0.4][0.1-0.2][0.1-0.2][0.4-0.6][0.8-1][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.1-0.2][0.3-0.5][0.1-0.2][0.4-0.6][0.4-0.6][0.1-0.2][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.1-0.2][0.6-0.8][0.1-0.2][0.8-1][0.8-1][0.1-0.2][0.6-0.8][0.6-0.8][0.6-0.8]	[0.4-0.6][0.2-0.4][0.3-0.5][0.1-0.2][0.8-1][0.8-1][0.3-0.5][0.3-0.5][0.3-0.5][0.3-0.5]	0	[0.4-0.6][0.3-0.5][0.6-0.8][0.6-0.8][0.8-1][0.8-1][0.3-0.5][0.6-0.8][0.6-0.8][0.6-0.8]
[0.4-0.6][0.4-0.5][0.3-0.5][0.3-0.5][0.4-0.6][0.4-0.6][0.3-0.5][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.3-0.5][0.1-0.2][0.3-0.5][0.1-0.2][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.2-0.4][0.3-0.5][0.3-0.5][0.1-0.2][0.1-0.2][0.1-0.2][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.1-0.2][0.6-0.8][0.3-0.5][0.4-0.6][0.4-0.6][0.1-0.2][0.6-0.8][0.6-0.8][0.6-	0	[0.4-0.6][0.4-0.5][0.3-0.5][0.5-0.6][0.1-0.2][0.1-0.2][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.4-0.5][0.6-0.8][0.8-1][0.4-0.6][0.4-0.6][0.3-0.5][0.6-0.8][0.6-0.8][0.6-
[0.4-0.6][0.8-1][0.2-0.3][0.3-0.5][0.4-0.6][0.4-0.6][0.6-0.8][0.1-0.2][0.1-0.2][0.1-	[0.4-0.6][0.7-0.9][0.1-0.2][0.3-0.5][0.1-0.2][0.4-0.6][0.6-0.8][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.5-0.6][0.2-0.3][0.3-0.5][0.1-0.2][0.1-0.2][0.3-0.5][0.2-0.3][0.2-0.3][0.2-	0	[0.4-0.6][0.7-0.9][0.2-0.3][0.3-0.5][0.4-0.6][0.4-0.6][0.6-0.8][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.8-1][0.2-0.3][0.5-0.6][0.1-0.2][0.1-0.2][0.6-0.8][0.2-0.3][0.2-0.3][0.2-	[0.4-0.6][0.8-1][0.3-0.5][0.8-1][0.4-0.6][0.4-0.6][0.6-0.8][0.3-0.5][0.3-0.5][0.3-
[0.4-0.6][0.6-0.8][0.3-0.5][0.3-0.5][0.8-1][0.8-1][0.6-0.8][0.1-0.2][0.1-0.2][0.1-0.2]	[0.4-0.6][0.4-0.6][0.1-0.2][0.3-0.5][0.4-0.6][0.8-1][0.6-0.8][0.3-0.5][0.3-0.5][0.3-	0	[0.4-0.6][0.1-0.2][0.6-0.8][0.3-0.5][0.8-1][0.8-1][0.3-0.5][0.6-0.8][0.6-0.8][0.6-0.8]	[0.4-0.6][0.4-0.6][0.3-0.5][0.3-0.5][0.8-1][0.8-1][0.6-0.8][0.3-0.5][0.3-0.5][0.3-0.5]	[0.4-0.6][0.6-0.8][0.3-0.5][0.5-0.6][0.4-0.6][0.4-0.6][0.6-0.8][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.6-0.8][0.6-0.8][0.8-1][0.8-1][0.8-1][0.6-0.8][0.6-0.8][0.6-0.8][0.6-0.8]
[0.4-0.6][0.4-0.5][0.6-0.8][0.3-0.5][0.8-1][0.4-0.6][0.3-0.5][0.1-0.2][0.1-0.2][0.1-	0	[0.4-0.6][0.2-0.4][0.6-0.8][0.3-0.5][0.4-0.6][0.1-0.2][0.1-0.2][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.1-0.2][0.8-1][0.3-0.5][0.8-1][0.4-0.6][0.1-0.2][0.6-0.8][0.6-0.8][0.6-	[0.4-0.6][0.3-0.5][0.6-0.8][0.3-0.5][0.8-1][0.4-0.6][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.4-0.5][0.6-0.8][0.5-0.6][0.4-0.6][0.1-0.2][0.3-0.5][0.3-0.5][0.3-0.5][0.3-	[0.4-0.6][0.4-0.5][0.8-1][0.8-1][0.8-1][0.4-0.6][0.3-0.5][0.6-0.8][0.6-0.8][0.6-0.8]
0	[0.4-0.6][0.2-0.4][0.1-0.2][0.3-0.5][0.1-0.2][0.4-0.6][0.3-0.5][0.6-0.8][0.6-0.8][0.6-	[0.4-0.6][0.1-0.2][0.3-0.5][0.3-0.5][0.1-0.2][0.1-0.2][0.1-0.2][0.6-0.8][0.6-0.8][0.6-	[0.4-0.6][0.1-0.2][0.6-0.8][0.3-0.5][0.4-0.6][0.4-0.6][0.1-0.2][0.8-1][0.8-1][0.8-1]	[0.4-0.6][0.2-0.4][0.3-0.5][0.3-0.5][0.4-0.6][0.4-0.6][0.3-0.5][0.6-0.8][0.6-0.8][0.6-	[0.4-0.6][0.3-0.5][0.3-0.5][0.5-0.6][0.1-0.2][0.1-0.2][0.3-0.5][0.6-0.8][0.6-0.8][0.6-	[0.4-0.6][0.3-0.5][0.6-0.8][0.8-1][0.4-0.6][0.4-0.6][0.3-0.5][0.8-1][0.8-1][0.8-1]

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