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Research on Comprehensive Evaluation of the Entrepreneur Quality based on Grey Relational Analysis

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Abstract: With the accelerated process of economic globalization, enterprises are facing increasingly fierce competition in the international and domestic. A country's comprehensive national strength is inextricably linked to the economic strength of enterprises. The quality of entrepreneurs play an increasingly important role in social change, economic development and people's lives. Entrepreneurs quality of pros and cons, directly affect the enterprise's development and benefits. In this study, the entrepreneurs' evaluation information in evaluation process is uncertainty and incompleteness. It presents an example based on the multi-level comprehensive evaluation model of grey theory is given. The model can avoid the general evaluation method in order to defects of various gray degree evaluation information use, make the evaluation result is objective and reasonable which provides a scientific and practical quantitative analysis method for analysis and objective evaluation of entrepreneur quality system.

Key words: Grey relational analysis, entrepreneur quality, evaluation index system, weight

INTRODUCTION

The connotation of entrepreneur quality widely, so far there is no unified definition, so there is no established a complete entrepreneur quality evaluation index system. Katz and Reynolds pointed out that, when the self employment birth took place and a new company, self employment quantity and number of new company can become entrepreneur quality measurement indicators (Shane, 1996). Research on self employment in the ownership and control power as entrepreneur quality evaluation, new research into the number of company business organization as the evaluation indexes of entrepreneur quality main, ownership and organization creation becomes the main content of entrepreneur quality evaluation but innovation, value creation and growth. Index, not subject to the same attention to evaluate the quality of entrepreneurs. Some entrepreneurs quality evaluation lead to conflicting conclusions. Ratio of new company and new business only in their establishment year are considered as the quality of entrepreneurs, if this year no one failed in business, in second years, the new entrepreneurship ratio will not record a year.

Entrepreneurial action, second years of entrepreneurial spirit than in the first years of sharp decline, so the conclusion and practical contradiction. Although, this example is extreme but it suggests that changes in the quality of entrepreneurs ratio is the evaluation index of entrepreneur quality monitor.

Gregory B. Murphy etc., think of the performance measurement accurate, appropriate is the key of entrepreneur quality but the quality of entrepreneurs in the study, evaluation of the organization's performance is not unified measurement approach, they apply the principal component analysis method to select 9 key indicators sieve from 171 performance indicators (Xu, 2013; Hua and Jiabo, 2011; Xu and Han, 2008), at home to create an entrepreneur quality qualitative index quantitative precedent but he put the internal measurement of entrepreneur quality of the limitations in the range of excellent entrepreneur. Preliminary results of evaluation index of entrepreneur quality with different emphasis, every index has its limitations, can not only reflect the quality of entrepreneurs panorama. This study selects the evaluation index of entrepreneur quality, establish a scientific and complete entrepreneur quality evaluation index system, level and then use the grey correlation degree of sequential evaluation method to comprehensive evaluation of entrepreneur quality (Shane, 1996).

Here, we need to introduce grey correlation analysis and overview of the quality of entrepreneurs.

Grey correlation analysis: With the process of economic globalization, the comprehensive evaluation has penetrated into every field of society and appeared in the evaluation system of bank credit, a listing Corporation operating performance, enterprise vitality, Tourist Hotel

business performance, teacher quality. Most of these evaluation system based on analytic hierarchy process and fuzzy theory. But the evaluation information uncertainty and incomplete tend to make the evaluation results and the actual deviation. The grey system theory in the nineteen eighties, someone founded, for the current general methods of defects in various gray degree evaluation information utilization, focuses on the analytic hierarchy process and fuzzy theory to solve the “small sample”, “poor information” problems of uncertainty (Sarasvathy, 2004; William and Shane, 1995; Covin and Slevin, 1991). This study used the grey system the theory of “little data modeling” to build a comprehensive evaluation model and gave the evaluation of entrepreneur quality to an application.

Quality of entrepreneurs overview: The sum of the characteristics of entrepreneur formed entrepreneur quality. The level, quality, not only to themselves but also important influence on enterprise, have on society. First of all, the quality of entrepreneurs is effectively realize function of the entrepreneur which has become the basis of enterprise functions; secondly, the quality of entrepreneurs is an important basis for development of the entrepreneurs, entrepreneur's quality is higher, the more its own can develop faster and higher.

DESIGN OF THE EVALUATION INDEX SYSTEM OF ENTREPRENEUR QUALITY

According to the results of domestic and foreign research and practice, the author thinks, in the new situation of economic development, as an outstanding entrepreneurs must have a strong sense of professionalism, responsibility, honesty and dedication; also must have rich knowledge of modern market economy, both to understand the modern technology and to understand the modern leadership knowledge and, at the various production elements of scientific combination, to achieve its goal through summary, the author think that entrepreneurs should possess the following 7 qualities:

- **Political quality:** The political quality is the primary quality of entrepreneurs, it is to make the entrepreneur to protecting the interests of the nation, the national policy, the enhancement enterprise development potential security, is also a manifestation of shaping the entrepreneur character, honesty and self-discipline spirit, including political culture, political consciousness, enterprising, grasp the right, use right, the policy level, promote able men, the sense of social responsibility

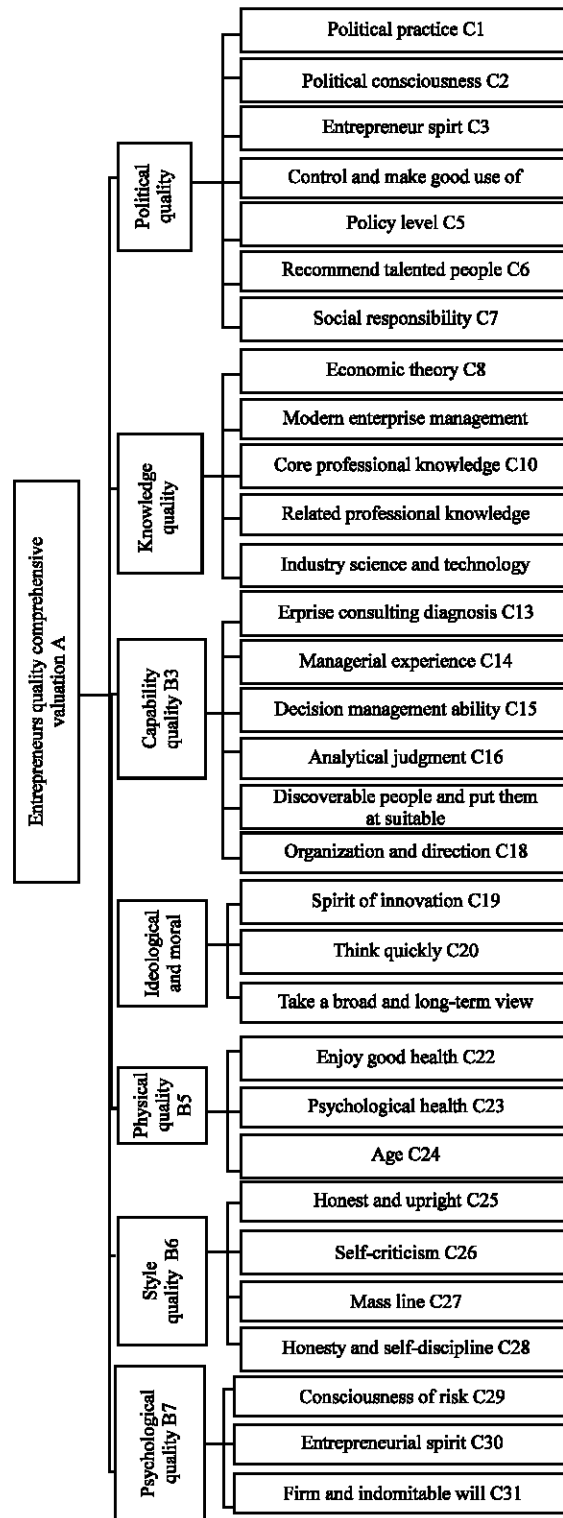


Fig. 1: Entrepreneurs quality index system

- **Knowledge:** Have a rich business management knowledge and practical experience and strong

professional skills, at the same time, also have a certain knowledge of foreign languages and computer network, the basic knowledge and skills, including economic theory, theory of modern enterprise management, nuclear technology of dynamic heart professional knowledge, professional knowledge, ability and quality in the industry

- **Capacity:** It is unable to succeed in the competitive environment of the enterprises in the complex without the corresponding ability as the guarantee condition. Capacity here mainly refers to: Business consulting diagnosis, management experience, management ability, analysis and judgment, Zhirensanren and organizing and commanding ability (Dess *et al.*, 2003)
- **Ideological and moral quality:** The enterprise can successfully play a decisive role. Chinese and foreign entrepreneurs countless examples have proved, entrepreneur ethics in business on the road to success is not to be underestimated. Morality is the fundamental for the entrepreneur, if there is no good moral cultivation is to gain a foothold and development in the world. Because of this, Chinese and foreign outstanding entrepreneurs and theorists have put the moral see very important. Market economy is the core of the moral integrity and moral quality in a very important part of that integrity, it is can become entrepreneurs to settle down in the country. The misbehavior, acts of misconduct, an outstanding moral character (Jiang, 2005). As the spirit of innovation, the thought is agile, look far ahead from a high plane are an excellent entrepreneur should have quality
- **Physical quality:** Health is a important condition for a successful entrepreneur ability, physical quality is the quality of entrepreneurs to ensure sustainable development. Entrepreneurs in the business center, on account of considering more issue, the intensity of work, it is difficult to complete the heavy work without a healthy body (Kazanjian *et al.*, 2002). Therefore, entrepreneurs must be reasonable arrangements for work, study and life time, work and rest, relaxation and actively participate in physical exercise, hard volition, give full play to the role of team, rely on group strength to do a good job. Reflect the physical quality indexes include: health and age, mental health
- **Quality of style:** Entrepreneurs must be realistic, practical, down-to-earth style of work, to emphasize practical results, not empty talk, seek truth from

facts; to have serious, down-to-earth style of doing things, in the complex management issues, to making available, everything has an echo; to treat people with sincerity, work in just ways; office things to justice, not swayed by personal considerations, the mainly includes the upright style, self criticism, the mass line, honesty and self-discipline

- **Psychological quality:** Facing the fierce competition and vary from minute to minute market environment, especially has entered the era of World Trade Organization to China, the system of various measures, are still inadequate, entrepreneurs must be optimistic and confident, confidence in the society, to the country, to the enterprise, on their own, with good self-control, self-regulation and the ability of self ability to motivate, only in this way, can the frustration, withstand various tests and fight, victory is not arrogance, defeat is not hungry; entrepreneurs must be broad-minded, should absorb different opinions, to accommodate various types of talent shortage and tolerate the and disadvantages, do people; entrepreneurs should often self-reflection, make the ability of continuous improvement and perfection, enterprises and individuals to sacrifice short-term benefits, to maximize the long-term interests of enterprises and realize self value, including risk consciousness, enterprising spirit, firm and indomitable will (Zahra *et al.*, 1999)

ROLE OF ENTREPRENEUR QUALITY EVALUATION METHOD

First of all, the entrepreneur quality quantitative evaluation method is a beneficial supplement to evaluate the qualities of entrepreneurs. Because of many uncertainties exist, using quantitative method to completely replace the qualitative evaluation is not reality is not accurate, however, quantitative evaluation has its own advantages: It can be intuitively, clearly show an evaluation results, although the results are not necessarily as final evaluation standard but it obviously has important reference value. Secondly, a positive role in cultivating the quantitative evaluation method of entrepreneur quality of entrepreneurs. Evaluation of entrepreneur quality using quantitative methods, it inevitably involves the entrepreneur quality index division, through quantitative assessment of these indicators, this study can find the deficiencies and advantages of entrepreneur, entrepreneur culture to guide the direction and method.

MULTI-LEVEL GREY SYSTEM EVALUATION MODEL

The basic idea of using grey relational analysis to evaluate the quality of entrepreneurs is: To the quality of entrepreneurs (ideal entrepreneur) the index value as the reference sequence X_0 entities X_{0k} , each index was evaluation of entrepreneur as compared with the sequence X_i to the entity X_{ik} , the relational r_i . The bigger the degree of connection that is evaluation of entrepreneur and the quality of the strongest entrepreneurs more and more similar, its quality is high; conversely, the quality is weak. Therefore, the correlation sequence, is the evaluation of the strength of the order of entrepreneur quality. The evaluation procedure is as follows:

- **Select the reference sequence:** Assume: i is No i evaluation of enterprise's serial number, $i = 1, 2, \dots, m$; k for the No. k evaluation serial number, $k = 1, 2, \dots, n$; V_{ik} for No. i 's evaluation unit No. k index value evaluation. Each index of the optimum value of V_{0k} reference series V_0 entity and so:

$$V_0 = (v_{01}, v_{02}, \dots, v_{0n})$$

In the equation:

$$v_{0k} = \text{opt}(v_{ik}), i = 1, 2, \dots, m; k = 1, 2, \dots, n$$

On a m evaluation system of entrepreneur, n evaluation indexes, the following matrix:

$$V = (V_{ik})_{m \times n} = \begin{bmatrix} V_{11} & V_{12} & \dots & V_{1n} \\ V_{21} & V_{22} & \dots & V_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ V_{m1} & V_{m2} & \dots & V_{mn} \end{bmatrix}$$

- **Index value standardization:** In order to make the comparison between the indexes, the indexes were standardized, standardized equation is as follows:

$$X_{ik} = \frac{V_{ik} - \min_i V_{ik}}{\max_i V_{ik} - \min_i V_{ik}}$$

After normalization, to:

$$X = (X_{ik})_{m \times n} = \begin{bmatrix} X_{11} & X_{12} & \dots & X_{1n} \\ X_{21} & X_{22} & \dots & X_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ X_{m1} & X_{m2} & \dots & X_{mn} \\ X_{01} & X_{02} & \dots & X_{0n} \end{bmatrix}$$

- **Calculate the correlation coefficient:** correlation coefficient matrix is.

For a data reference line x_0 , comparative sequence is x_i , use the following relation representation was compared correlation degree of object and reference object:

$$\xi_i(k) = \frac{\min_i \min_k |x_0(k) - x_i(k)| + \zeta \max_i \max_k |x_0(k) - x_i(k)|}{|x_0(k) - x_i(k)| + \zeta \max_i \max_k |x_0(k) - x_i(k)|}$$

Type:

$$i = 1, 2, \dots, m; k = 1, 2, \dots, n, \zeta \in [0, 1]$$

If note:

$$\Delta \min = \min_i \min_k |x_0(k) - x_i(k)|$$

the minimum difference of two grades:

$$\Delta \max = \max_i \max_k |x_0(k) - x_i(k)|$$

the maximum difference of two grades

Then $\Delta \min$ and $\Delta \max$ respectively Minimum and maximum absolute difference for each time x_0 and x_i . Then:

$$\xi_i(k) = \frac{\Delta \min + \zeta \Delta \max}{|x_0(k) - x_i(k)| + \zeta \Delta \max}$$

Thus get the following correlation coefficient matrix:

$$E = (\xi_{ik})_{m \times n} = \begin{bmatrix} \xi_{11} & \xi_{12} & \dots & \xi_{1n} \\ \xi_{21} & \xi_{22} & \dots & \xi_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \xi_{m1} & \xi_{m2} & \dots & \xi_{mn} \end{bmatrix}$$

Type: ξ_{ik} is the i evaluation unit (entrepreneur) k index and The correlation coefficient of the k best index

- **Calculation of correlation degree of single level:** Considering the importance of each indicator is not the same, so the correlation calculation method to take the correlation coefficients are multiplied by the weights. According to the priority weights of experts get each index of a layer with respect to the upper level objective for:

$$W = (w_1, w_2, \dots, w_n)$$

Type:

$$\sum_{k=1}^t w_k = 1$$

indicates the number of indexes in the layer. The calculation equation of correlation degree is:

$$R = (r_i)_{1 \times m} = (r_1, r_2, \dots, r_m) = WE^T$$

- Final correlation calculation of multi-layer evaluation system:** The multi-level evaluation system composed of L layer, the final calculation method of correlation: The correlation index coefficient K were synthesized, respectively they belong on a layer of the correlation degree of each index in the K-1 layer; and then a layer of the degree of association as the original value, continue to synthesize correlation degree of each index, the K-2 layer and so on, until the top index correlation degree.
- Sort of entrepreneur quality size:** Based on the correlation of $r_i (i = 1, 2, L, m)$, sorted, the correlation sequence is entrepreneur quality rank

EXAMPLE CALCULATION

Here, the 4 entrepreneurs (V_1, V_2, V_3, V_4, V_5) as an example, to illustrate its application:

- Establishment of evaluation index system of entrepreneur quality:** Entrepreneur quality evaluation index system as shown in Table 1, the system consists of three layers : the first layer: Index, target layer, entrepreneur quality comprehensive evaluation, second layers: The factors, including political quality, knowledge quality, ability quality, thought quality, physical quality, style, quality, psychological quality; third, a total of 31 index
- Calculation of single correlation:** Five entrepreneurs (V_1, V_2, V_3, V_4, V_5) of each index data of $v_{ik} (i = 1, 2, 3, 4, 5; k = 1, 2, 3, L, 31)$ and the optimal values of v_{0k} are listed in Table 1

From Table 1 can be drawn from the reference sequence:

$$V_0 = (8, 8, 8, 8, 6, 7, 8, 5, 8, 8, 8, 7, 8, 8, 7, 8, 7, 8, 7, 8, 7, 8, 7, 8, 8, 8, 7, 8, 7, 8, 7, 8)$$

In Table 1 the index value after standard treatment, get the correlation coefficient of each index and the optimal ζ_{ik} value of the reference sequence ($i = 1, 2, 3, 4, 5, 6, 7; k = 1, 2, 3, L, 31$) are listed in Table 2.

Table 1: Entrepreneurs quality index value and satisfaction value

Entrepreneurs index	V_1	V_2	V_3	V_4	V_5	Standard data array
C_1	8	6	5	5	4	8
C_2	7	8	6	4	5	8
C_3	8	4	8	6	7	8
C_4	6	7	3	8	3	8
C_5	5	6	5	5	5	6
C_6	7	4	4	4	7	7
C_7	5	8	6	7	5	8
C_8	4	4	5	5	5	5
C_9	5	6	7	8	7	8
C_{10}	6	8	5	6	5	8
C_{11}	8	5	8	7	8	8
C_{12}	7	7	6	5	6	7
C_{13}	5	6	6	7	8	8
C_{14}	8	8	7	5	7	8
C_{15}	7	5	6	6	6	7
C_{16}	8	5	7	6	6	8
C_{17}	7	6	6	5	7	7
C_{18}	5	7	5	8	8	8
C_{19}	7	7	6	6	6	7
C_{20}	6	8	8	5	7	8
C_{21}	7	7	5	8	8	8
C_{22}	8	8	7	5	7	8
C_{23}	7	6	6	7	6	7
C_{24}	6	7	8	8	7	8
C_{25}	6	7	6	6	7	7
C_{26}	5	6	7	5	8	8
C_{27}	7	5	7	7	5	7
C_{28}	8	8	8	8	6	8
C_{29}	8	7	8	7	6	8
C_{30}	7	7	7	5	7	7
C_{31}	6	6	5	8	6	8

Table 2: Correlation coefficient table of the entrepreneurs quality

Entrepreneurs correlation coefficient	V_1	V_2	V_3	V_4	V_5
ζ_{i1}	0.583	0.7	0.778	0.778	0.875
ζ_{i2}	0.636	0.583	0.7	0.875	0.778
ζ_{i3}	0.583	0.875	0.583	0.7	0.636
ζ_{i4}	0.7	0.636	1	0.583	1
ζ_{i5}	0.778	0.7	0.778	0.778	0.778
ζ_{i6}	0.636	0.875	0.875	0.875	0.636
ζ_{i7}	0.778	0.583	0.7	0.636	0.778
ζ_{i8}	0.6	0.6	1	1	1
ζ_{i9}	0.333	0.429	0.6	1	0.6
ζ_{i10}	0.429	1	0.333	0.429	0.333
ζ_{i11}	1	0.333	1	0.6	1
ζ_{i12}	1	1	0.6	0.429	0.6
ζ_{i13}	0.333	0.429	0.429	0.6	1
ζ_{i14}	1	1	0.6	0.333	0.6
ζ_{i15}	1	0.429	0.6	0.6	0.6
ζ_{i16}	1	0.333	0.6	0.429	0.429
ζ_{i17}	1	0.6	0.6	0.429	1
ζ_{i18}	0.333	0.6	0.333	1	1
ζ_{i19}	1	1	0.6	0.6	0.6
ζ_{i20}	0.429	1	1	0.333	0.6
ζ_{i21}	0.6	0.6	0.333	1	1
ζ_{i22}	1	1	0.6	0.333	0.6
ζ_{i23}	1	0.6	0.6	1	0.6
ζ_{i24}	0.429	0.6	1	1	0.6
ζ_{i25}	0.6	1	0.6	0.6	1
ζ_{i26}	0.333	0.429	0.6	0.333	1
ζ_{i27}	1	0.429	1	1	0.429
ζ_{i28}	1	1	1	1	0.429
ζ_{i29}	1	0.6	1	0.6	0.429
ζ_{i30}	1	1	1	0.429	1
ζ_{i31}	0.429	0.429	0.333	1	0.429

- **Multi-layer structure correlation synthesis:** By using expert survey method obtains the following weight:

$$W_{AB} = (0.12, 0.14, 0.15, 0.16, 0.13, 0.15, 0.15)$$

$$W_{B1C} = (0.10, 0.20, 0.10, 0.20, 0.10, 0.20, 0.10)$$

$$W_{B2C} = (0.10, 0.30, 0.30, 0.15, 0.15)$$

$$W_{B3C} = (0.10, 0.10, 0.20, 0.20, 0.20, 0.20)$$

$$W_{B4C} = (0.33, 0.33, 0.33)$$

$$W_{B5C} = (0.40, 0.40, 0.20)$$

$$W_{B6C} = (0.30, 0.30, 0.10, 0.30)$$

$$W_{B7C} = (0.33, 0.33, 0.33)$$

Using the equation $R = WE^T$, You can get all the B index layer correlation:

$$R_{B1} = W_{B1C}E_{B1C}^T = 0.667, 0.705, 0.799, 0.756, 0.790$$

$$R_{B2} = W_{B2C}E_{B2C}^T = 0.589, 0.689, 0.620, 0.683, 0.620$$

$$R_{B3} = W_{B3C}E_{B3C}^T = 0.800, 0.535, 0.530, 0.585, 0.766$$

$$R_{B4} = W_{B4C}E_{B4C}^T = 0.676, 0.867, 0.644, 0.644, 0.733$$

$$R_{B5} = W_{B5C}E_{B5C}^T = 0.886, 0.760, 0.680, 0.733, 0.600$$

$$R_{B6} = W_{B6C}E_{B6C}^T = 0.680, 0.771, 0.760, 0.680, 0.771$$

$$R_{B7} = W_{B7C}E_{B7C}^T = 0.810, 0.676, 0.778, 0.676, 0.619$$

In the equation $E_{B1C}, E_{B2C}, E_{B3C}, E_{B4C}, E_{B5C}, E_{B6C}, E_{B7C}$, Matrix, respectively for the corresponding data in Table 2, Correlation can be further obtained the top index A:

$$R_A = (r_{1A}, r_{2A}, r_{3A}, r_{4A}, r_{5A}) = W_{AB}[R_{B1}, R_{B2}, R_{B3}, R_{B4}, R_{B5}, R_{B6}, R_{B7}] = (0.727, 0.716, 0.684, 0.676, 0.700)$$

- **Quality of entrepreneurs sort:** According to R_{A_i} the correlation obtained the rank of each entrepreneur quality:

$$V_1 > V_2 > V_3 > V_4$$

CONCLUSION

Entrepreneur quality system is actually a system of information incomplete, inaccurate, this study applies the grey comprehensive evaluation method, the comprehensive evaluation of entrepreneur quality. In the information incomplete, uncertain conditions, expand information source. Improve the credibility of analysis and evaluation, subjective factors make people is only confined to a very small range. In the calculation of correlation, using weighted average method instead of the arithmetic mean method, to consider the importance of each index difference which overcomes the defects in the quality of entrepreneurs in the process of evaluation of subjective factor too much influence, thus accurately evaluate. The application of this method is convenient and feasible, scientific, objectivity to the entrepreneur quality evaluation. This method provides a computation method for the enterprise human resources development in the recruitment, promotion, promotion, salary grade calculation.

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