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EVALUATION OF ASPECTS OF COGNITIVE SKILLS USING THE PIPRECIA METHOD

Abstract

Human resources, as a sector of great importance for the successful operation of an organization, is always a current topic that needs to be researched and studied. The application of multi-criteria decision-making methods in assessing the importance of factors that have an impact on the selection of candidates in various sectors is one of the ways to improve and make a more authoritative and precise decision. In this paper, a multi-criteria approach based on the Pivot Pairwise Relative Criteria Importance Assessment - PIPRECIA method was applied. A detailed review of the literature defined a list of aspects and corresponding factors that were evaluated by four sectors from each sector by three decision makers, more precisely by the twelfth decision maker. The obtained results are relevant and authoritative, and thus the usefulness and applicability of the proposed approach, in evaluating the mentioned aspects of cognitive skills and their importance, have been unequivocally confirmed. The main goal of this paper is to indicate the usefulness of the application of multi-criteria decision-making methods (MCDM) in the implementation of this type of analysis.

Key words: PIPRECIA, MCDM, human resources, management, communication skills

JEL classification: C44, M12

ЕВАЛУАЦИЈА АПСЕКАТА КОГНИТИВНИХ ВЕШТИНА ПРИМЕНОМ ПИПРЕЦИА МЕТОДЕ

Апстракт

Људски ресурси као сектор од великог значаја за успешно пословање организације, увек су актуелна тема коју је потребно истраживати и проучавати. Примена метода вишекритеријумског одлучивања у оцени значајности фактора који имају утицаја на избор кандидата у различитим

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секторима представља један од начина да се унапреде, и донесе меродавнија и прецизнија одлука. У овом раду је примењен вишекритеријумски приступ заснован на примени *Pivot Pairwise Relative Criteria Importance Assessment – PIPRECIA* метода. Детаљним прегледом литературе дефинисана је листа аспеката и одговарајућих фактора који су оцењени од стране четири сектора из сваког сектора по три доносиоца одлука тачније дванаеста доносиоца одлука. Добијени резултати су релевантни и меродавни, а самим тим недвосмислено је потврђена корисност и применљивост предложеног приступа, при евалуацији наведених аспеката когнитивних вештина као и њихов значај. Основни циљ овог рада је да укаже на корисност примене вишекритеријумских метода одлучивања (MCDM) у имплементацији ове врсте анализе.

Кључне речи: PIPRECIA, VKO, људски ресурси, менаџмент, комуникационе вештине

Introduction

Human resource management is important to create a stimulating environment for acquiring knowledge and personal development (Mirčetić et al., 2022; Grmuša, 2021; Popović et al., 2021; Karabašević et al., 2018; Karabašević et al., 2016a; 2016b; Karabašević et al., 2015).

Due to increased competitive pressure, employers in all sectors recognize and demonstrate a strong need for non-technical skills, including problem-solving skills, teamwork skills, communication skills, time management and cultural adaptability (Bailey, 2014). Interpersonal and communication skills, particularly listening skills, are particularly prominent in the recruitment and promotion of employees across industries, suggesting that these skills are highly valued by employers (Gillard, 2009).

Because cognitive skills are actually critical to product performance in today's workplace, current and future business leaders are emphasizing the importance of developing cognitive skills. They are defined as a combination of skills, attitudes, behavior, personal qualities, and opinions that individuals use in order to be successful in various situations in work and life. Recent research suggests that cognitive skill development focuses on the following five skill sets: self-confidence, self-control, communication, social skills, and higher-order thinking (which includes problem-solving, critical thinking, and decision-making) (Lippman, 2015). Different researchers and scholars have created their lists of cognitive skills according to different contexts. However, what is valid for all cognitive skills is a common outcome - helping in the development of personal growth, learning, and success in employment. (Gibb, 2014). Author Remedios, stated that there are two categories of cognitive skills: skills that an individual "must have" and skills that are "good to have" (Remedios, 2012).

In their research, authors Lim et al. identified a set of cognitive skills that employers value highly (Lim et al., 2016):

- a) analytical skills,
- b) decision-making skills,
- c) oral and written communication skills,

- d) problem-solving skills,
- e) teamwork skills,
- f) ability to collect information i
- g) ability to work under pressure.

Among all these skills, oral and written communication skills are the highest rated skills that employers have identified as necessary for any new hire to be successful. Desirable skills related to oral communication are listening attentively and presenting well in interviews or a well-prepared presentation or speech. Written communication skills are including the ability to create clear and useful reports, memos and business correspondence. Based on the definitions of cognitive skills, we understand that they are of key importance for business and the selection of human resources. Their research must be done continuously because there are changes in the market and there is a generational gap between the generations that are already working and those that are yet to come. We must explore their needs and somehow influence their cognitive skills.

In this sense, multi-criteria decision-making methods (MCDM methods) can be useful and helpful. The application of MCDM methods helps decision makers in objective and systematic evaluation of alternatives based on multiple criteria (Petrović et al. 2019). MCDM methodology provides a simple way to observe and evaluate a wide range of possible alternative solutions (different aspects of smart tourism types) in relation to several defined factors (Ćirić et al., 2020). The authors recognized the usefulness of MCDM methods and applied them in solving different types of problems in the field of tourism (Lin, 2020; Lin et al., 2020; Yang et al., 2020).

For the purposes of this work will be applied, a relatively new MCDM method called the Pivot Pairwise Relative Criteria Importance Assessment (PIPRECIA) proposed by Stanujkić et al., (2017). This method is primarily intended for defining the importance (weight) of evaluation criteria, but it can be equally successfully applied for solving MCDM problems, that is, for evaluating alternatives and choosing the best criteria for decision-making (Stanujkić et al., 2021). So far, the authors have used the PIPRECIA method to facilitate decision-making in various fields, such as: the hotel industry and tourism (Popović et al., 2019; Karabašević et al., 2019; Popović et al., 2021), information technology (Stević et al., 2018; Stanujkić et al., 2021), evaluation of customer satisfaction (Stanujkić et al., 2019), quality assessment of e-learning materials (Jauković-Jocić et al., 2020), staff selection (Ulutas et al. , 2020), employee motivation (Đukić, 2022), aviation industry (Bakir et al., 2020; Stanujkić et al., 2021), solving problems when choosing a transport company (Ulutas et al., 2021; Biswas, 2020; Vesković et al., 2020; Memis et al., 2020), and others. In this paper, with the help of the PIPRECIA method, the aspects and factors that are significant in the selection of human resources will be defined.

Method

The PIPRECIA method (Stanujkić et al., 2017) is very suitable for defining the meaning of criteria, especially in the conditions of group decision-making. The idea for the development of the PIPRECIA method originated from the Step-Wise Weight Assessment Ratio Analysis - SWARA method (Kersulienė et al., 2020), or, more

precisely, from the perceived lack of the SWARA method related to the need to pre-sort criteria according to expected importance. This initial step of the SWARA method automatically disqualifies it as a technique suitable for use in group decision-making conditions. The authors of the PIPRECIA method have made some adjustments, so it does not require prior sorting of criteria and allows the definition of importance simply and understandably.

PIPRECIA method can be illustrated by the following series of steps:

Step 1 . Selection of the evaluation criteria where presorting is not mandatory.

Step 2 . Determination of the relative importance that begins from the second criterion as

$$\text{follows: } s_j: s_j = \begin{cases} >1 & \text{when } C_j \succ C_{j-1} \\ 1 & \text{when } C_j = C_{j-1} \\ <1 & \text{when } C_j \prec C_{j-1} \end{cases} \quad (1)$$

Step 3 . Definition of the coefficient in the following way: k_j

$$k_j = \begin{cases} 1 & j=1 \\ 2-s_j & j>1 \end{cases} \quad (2)$$

Step 4 . Detection of the recalculated value as follows: q_j

$$q_j = \begin{cases} 1 & j=1 \\ \frac{q_{j-1}}{k_j} & j>1 \end{cases} \quad (3)$$

Step 5 . Determination of the relative weights of the estimated criteria by using the following Eq.:

$$w_j = \frac{q_j}{\sum_{k=1}^n q_k} \quad (4)$$

where w_j represents the relative weight of the criterion. j .

Step 6 . In the case of a larger number of decision-makers, the mean value is taken out of the account using the formula:

$$w_j = \frac{\sum w_j}{n} \quad (5)$$

When w_j^* is the average value of w_j of decision-makers, n is the number of decision-makers.

Research results and discussion

As already stated, the aim of the paper is to define the importance of aspects and factors that indicate the ranking of cognitive skills by executive managers and the very application of the method that indicates the most important factors. In this sense, Table 1 presents a list of aspects and factors relevant to cognitive skills.

Table 1. Overview of cognitive skills categorized by the executive managers

Aspects		Factors	
C1	Communication Skills	C ₁₁	Public speaking
		C ₁₂	Listening
		C ₁₃	Business writing
		C ₁₄	Articulate
		C ₁₅	Body language
		C ₁₆	Business innovation
		C ₁₇	Email etiquette
		C ₁₈	Presentation skills
		C ₁₉	Language skills
C ₂	Teamwork & Leadership Qualities	C ₂₁	Cooperative
		C ₂₂	Supportive
		C ₂₃	Helpful
		C ₂₄	Coordination
		C ₂₅	Working well with people
C3	Positive Attitude	C ₃₁	Genuine
		C ₃₂	Commitment
		C ₃₃	Honest
		C ₃₄	Sincerely
		C ₃₅	Hardworking
		C ₃₆	Following rules
C4	Integrity & Work Ethics	C ₄₁	Dependable
		C ₄₂	Reliable
		C ₄₃	Accountable
		C ₄₄	Self-disciplined
C ₅	Fast problem solving	C ₅₁	Meditation
		C ₅₂	Dialogue
		C ₅₃	Negotiation
		C ₅₄	Without provocations and causing conflicts
C6	Interpersonal Skills	C ₆₁	Patience
		C ₆₂	Friendly
		C ₆₃	Empathetic
		C ₆₄	People skills
C ₇	Stress & Time Management	C ₇₁	Punctual
		C ₇₂	Work-life balance
		C ₇₃	Relaxed
		C ₇₄	Meeting deadlines
		C ₇₅	Never late

C ₈	Flexibility & Responsibility	C ₈₁	Adaptability
		C ₈₂	Agility
		C ₈₃	Quick learner
		C ₈₄	Willing to change
		C ₈₅	Open to ideas and views
		C ₈₆	Dependable
		C ₈₇	Reliable
		C ₈₈	Accountable
C ₉	Professionalism & Courtesy	C ₉₁	Polite
		C ₉₂	Mannerisms
		C ₉₃	Well-groomed
		C ₉₄	Image projection
		C ₉₅	Workplace & social etiquette
		C ₉₆	Regards,
		C ₉₇	Humility
		C ₉₈	Well behaved

Source: Deepa S. (2014). Executive perceptions of top ten soft skills at work: Developing these through SAIF. Indian Institute of Management Kozhikode

In order to obtain the most reliable results, three decision-makers from four different sectors were included in the decision-making process. The first sector J - information and communication and includes the domain of publishing activities, telecommunications activities, information service activities as well as a wide range of other activities, but only those from which the decision-makers were, as with other sectors, are listed. The second sector M includes professional, scientific and innovative activities, which include scientific research and development, advertising and other professional, scientific and technical activities, and market research. The fourth sector of P education, is higher education, art education, and auxiliary educational activities. First, the importance of basic aspects of cognitive skills will be determined by applying formulas (1)-(6). Table 2 shows the obtained results.

Table 2. The relative importance of indicators group

Sector J	w _j *	Sector M	w _j *	Sector N	w _j *	Sector P	w _j *
C _{1j}	0.108	C _{1m}	0.066	C _{1n}	0.082	C _{1p}	0.113
C _{2j}	0.119	C _{2m}	0.083	C _{2n}	0.079	C _{2p}	0.094
C _{3j}	0.109	C _{3m}	0.119	C _{3n}	0.083	C _{3p}	0.093
C _{4j}	0.101	C _{4m}	0.099	C _{4n}	0.078	C _{4p}	0.085
C _{5j}	0.100	C _{5m}	0.132	C _{5n}	0.112	C _{5p}	0.116
C _{6j}	0.090	C _{6m}	0.142	C _{6n}	0.127	C _{6p}	0.122
C _{7j}	0.112	C _{7m}	0.140	C _{7n}	0.135	C _{7p}	0.146
C _{8j}	0.133	C _{8m}	0.122	C _{8n}	0.151	C _{8p}	0.123
C _{9j}	0.129	C _{9m}	0.093	C _{9n}	0.151	C _{9p}	0.109

Source: Author's research

In order to minimize the subjectivity of decision-makers and determine the most relevant results, the mean value of the received weights was calculated using the formula (5).

According to the first decision-makers from sector J - information and communication, the most important aspect of cognitive skills is C_{8j} - Flexibility & Responsibility, while decision-makers from sector M - professional, scientific, innovative and technical activities believe that the most important aspect of cognitive skills is C_{6m} - Interpersonal Skills. The third sector N - administrative and auxiliary service activities decision makers consider the most important aspects of cognitive skills to be C_{8n} - Flexibility & Responsibility and C_{9n} - Professionalism & Courtesy. Decision-makers from the fourth sector P - education, believe that the most important aspect is cognitive skills C_{7p} - Stress & Time Management.

Based on table 1, we could notice that each of the aspects includes several factors, ie the next stage of the analysis will be the relative importance of the respective factors determined in tables 3 - 11.

Table 3. *Weights of the factors of communication skills*

Sector J	w_j^*	Sector M	w_j^*	Sector N	w_j^*	Sector P	w_j^*
C_{11j}	0.139	C_{11m}	0.131	C_{11n}	0.107	C_{11p}	0.106
C_{12j}	0.134	C_{12m}	0.143	C_{12n}	0.126	C_{12p}	0.133
C_{13j}	0.122	C_{13m}	0.132	C_{13n}	0.128	C_{13p}	0.143
C_{14j}	0.098	C_{14m}	0.097	C_{14n}	0.117	C_{14p}	0.127
C_{15j}	0.106	C_{15m}	0.074	C_{15n}	0.093	C_{15p}	0.109
C_{16j}	0.104	C_{16m}	0.102	C_{16n}	0.090	C_{16p}	0.083
C_{17j}	0.101	C_{17m}	0.109	C_{17n}	0.098	C_{17p}	0.083
C_{18j}	0.098	C_{18m}	0.122	C_{18n}	0.126	C_{18p}	0.107
C_{19j}	0.098	C_{19m}	0.109	C_{19n}	0.116	C_{19p}	0.109

Source: Author's research

According to the first sector J, the most important factor is C_{11j} - Public speaking because it is a sector dealing with information and communications. According to the decision-makers from the second sector M, the most important factor is C_{12m} - Listening because it is a sector of innovation and technical deltas where it is of great importance to conveying information in the right way. According to the decision-makers from sector N and sector P, the most important factor is C_{13n} - Business writing, because these are sectors dealing with administrative and educational activities.

Table 4. *Weights of the factors of teamwork & leadership qualities*

Sector J	w_j^*	Sector M	w_j^*	Sector N	w_j^*	Sector P	w_j^*
C_{21j}	0.182	C_{21m}	0.172	C_{21n}	0.204	C_{21p}	0.178
C_{22j}	0.199	C_{22m}	0.194	C_{22n}	0.176	C_{22p}	0.178

C _{23j}	0.199	C _{23m}	0.198	C _{23n}	0.200	C _{23p}	0.193
C _{24j}	0.200	C _{24m}	0.197	C _{24n}	0.211	C _{24p}	0.200
C _{25j}	0.219	C _{25m}	0.239	C _{25n}	0.208	C _{25p}	0.251

Source: Author’s research

In this case, in all sectors we have complete agreement with the decision makers from the aspect of teamwork & leadership qualities when it comes to factor C₂₅ - Working well with people that it is the most significant, because after all we are talking about sectors where good communication with people comes first.

Table 5. Weights of the factors of positive attitude

Sector J	w _j *	Sector M	w _j *	Sector N	w _j *	Sector P	w _j *
C _{31j}	0.188	C _{31m}	0.135	C _{31n}	0.192	C _{31p}	0.142
C _{32j}	0.154	C _{32m}	0.147	C _{32n}	0.169	C _{32p}	0.147
C _{33j}	0.165	C _{33m}	0.152	C _{33n}	0.151	C _{33p}	0.150
C _{34j}	0.138	C _{34m}	0.143	C _{34n}	0.138	C _{34p}	0.161
C _{35j}	0.163	C _{35m}	0.191	C _{35n}	0.163	C _{35p}	0.197
C _{36j}	0.192	C _{36m}	0.231	C _{36n}	0.188	C _{36p}	0.202

Source: Author’s research

According to the first J, the second M and the fourth O sector, the most important factor is C₃₆ – Following rules because these are the sectors that are engaged in such type of activity for which it is of great importance for good business to follow and respect certain rules. According to decision-makers from the third sector N, the most important factor is C_{31n} – Genuine.

Table 6. Weights of the factors integrity & work ethics

Sector J	w _j *	Sector M	w _j *	Sector N	w _j *	Sector P	w _j *
C _{41j}	0.273	C _{41m}	0.223	C _{41n}	0.205	C _{41p}	0.212
C _{42j}	0.257	C _{42m}	0.239	C _{42n}	0.251	C _{42p}	0.241
C _{43j}	0.253	C _{43m}	0.262	C _{43n}	0.264	C _{43p}	0.264
C _{44j}	0.217	C _{44m}	0.276	C _{44n}	0.280	C _{44p}	0.283

Source: Author’s research

According to the first sector J, the most important factor is C_{41j} - Dependable. According to decision makers from other sectors, the most important factor is C₄₄ - Self-disciplined.

Table 7. Weights of the factors of fast problem solving

Sector J	w_j^*	Sector M	w_j^*	Sector N	w_j^*	Sector P	w_j^*
C_{51j}	0.232	C_{51m}	0.238	C_{51n}	0.209	C_{51p}	0.176
C_{52j}	0.253	C_{52m}	0.213	C_{52n}	0.237	C_{52p}	0.241
C_{53j}	0.250	C_{53m}	0.256	C_{53n}	0.272	C_{53p}	0.272
C_{54j}	0.264	C_{54m}	0.293	C_{54n}	0.311	C_{54p}	0.311

Source: Author's research

In this case, decision makers from different sectors made the same decision that the most significant factor is C_{54j} - Without provocations and causing conflicts .

Table 8. Weights of the factors of interpersonal skills

Sector J	w_j^*	Sector M	w_j^*	Sector N	w_j^*	Sector P	w_j^*
C_{61j}	0.243	C_{61m}	0.242	C_{61n}	0.288	C_{61p}	0.255
C_{62j}	0.251	C_{62m}	0.254	C_{62n}	0.275	C_{62p}	0.238
C_{63j}	0.237	C_{63m}	0.231	C_{63n}	0.229	C_{63p}	0.254
C_{64j}	0.269	C_{64m}	0.273	C_{64n}	0.208	C_{64p}	0.283

Source: Author's research

In this case, according to the first sector J, the second M and the fourth P sector, the most important factor is C_{64} - People skills, while for the decision-makers from the third sector N the most important factor is C_{61} - Patience.

Table 9. Weights of the factors of stress & time management

Sector J	w_j^*	Sector M	w_j^*	Sector N	w_j^*	Sector P	w_j^*
C_{71j}	0.184	C_{71m}	0.205	C_{71n}	0.212	C_{71p}	0.204
C_{72j}	0.169	C_{72m}	0.189	C_{72n}	0.188	C_{72p}	0.208
C_{73j}	0.167	C_{73m}	0.166	C_{73n}	0.180	C_{73p}	0.209
C_{74j}	0.205	C_{74m}	0.192	C_{74n}	0.186	C_{74p}	0.188
C_{75j}	0.275	C_{75m}	0.247	C_{75n}	0.233	C_{75p}	0.191

Source: Author's research

According to the decision-makers from the first J, second M and third N sectors, the most important factor is C_{75} - never late, while for the decision-makers of the P sector, the most important factor is C_{73} - relaxed.

Table 10. Weights of the factors of flexibility & responsibility

Sector J	w_j^*	Sector M	w_j^*	Sector N	w_j^*	Sector P	w_j^*
C _{81j}	0.097	C _{81m}	0.091	C _{81n}	0.142	C _{81p}	0.130
C _{82j}	0.105	C _{82m}	0.105	C _{82n}	0.115	C _{82p}	0.118
C _{83j}	0.128	C _{83m}	0.111	C _{83n}	0.110	C _{83p}	0.110
C _{84j}	0.115	C _{84m}	0.137	C _{84n}	0.113	C _{84p}	0.123
C _{85j}	0.140	C _{85m}	0.137	C _{85n}	0.142	C _{85p}	0.161
C _{86j}	0.153	C _{86m}	0.149	C _{86n}	0.107	C _{86p}	0.119
C _{87j}	0.138	C _{87m}	0.143	C _{87n}	0.118	C _{87p}	0.116
C _{88j}	0.131	C _{88m}	0.126	C _{88n}	0.154	C _{88p}	0.123

Source: Author's research

According to decision-makers from the first J and second M sectors, the factor that has the greatest importance is C₈₆ - Dependable. According to the decision makers from sector N, the factor that is of greatest importance is C₈₈ - Accountable. The most important factor according to decision-makers from the O sector is C₈₅ - Open to ideas and views.

Table 11. Weights of the factors of professionalism & courtesy

Sector J	w_j^*	Sector M	w_j^*	Sector N	w_j^*	Sector P	w_j^*
C _{91j}	0.088	C _{91m}	0.109	C _{91n}	0.114	C _{91p}	0.118
C _{92j}	0.104	C _{92m}	0.086	C _{92n}	0.104	C _{92p}	0.103
C _{93j}	0.118	C _{93m}	0.109	C _{93n}	0.109	C _{93p}	0.105
C _{94j}	0.127	C _{94m}	0.135	C _{94n}	0.086	C _{94p}	0.112
C _{95j}	0.173	C _{95m}	0.158	C _{95n}	0.105	C _{95p}	0.157
C _{96j}	0.145	C _{96m}	0.151	C _{96n}	0.140	C _{96p}	0.150
C _{97j}	0.120	C _{97m}	0.127	C _{97n}	0.148	C _{97p}	0.119
C _{98j}	0.124	C _{98m}	0.126	C _{98n}	0.193	C _{98p}	0.137

Source: Author's research

According to the decision-makers from the first J, second M sector, as well as the fourth P sector, the factor that has the greatest importance, is C₉₅ - Workplace & social etiquette. According to the decision makers from sector N, the most important factor is C₉₈ - Well behaved.

Conclusion

Although many scientists have conducted their research to understand the importance of cognitive skills in an individual's performance, it is incorrect to assume that everything related to cognitive skills is stated and concluded. In modern business, the rules of work are changing dramatically, and employees are measured not only by their knowledge or expertise but also by their emotional intelligence, as well as by cognitive skills or personal

competencies. Today's organizations face several challenges. This development has an impact on employees as well as managers. That's why managers need to be aware of the differences and similarities between the generational cohorts currently in the workplace. These differences and similarities have several effects on organizations as well as managers.

For the development of the human resources sector, a good selection of personnel as well as the necessary cognitive skills for various fields of activity, it is necessary to determine the factors that have the greatest impact. Therefore, in this paper, the PIPRECIA method was applied in the conditions of group decision-making.

Based on the literature review, nine key aspects of cognitive skills have been identified that include an appropriate number of factors to be assessed. The final results show that the key factors of aspects of cognitive skills are C_{8j} - Flexibility & Responsibility, C_{6m} - Interpersonal Skills, C_{9n} - Professionalism & Courtesy, Stress & Time Management. We must mention that a large number of decision-makers from different industries were involved here. As well as the fact that some results for the outcomes had the same most significant factor. The consequence of that is that all sectors deal with service activities basically and accordingly factors like C_{54} - Without provocations and causing conflicts is significant because every organization strives to have a harmonious team and to have good communication. Or when we talk about the aspect of *integrity & work ethics* the factor that has the greatest importance according to sector J is C_{41j} - Dependable. According to decision makers from other sectors, the most important factor is C_{44} - Self-disciplined. The reason for this result is that the J sector deals with information and reliability is a cognitive skill that is essential for someone who deals with this type of work. While in other sectors, Self-disciplined is important because such activities are in which such an aspect of cognitive skills is of crucial importance for personnel selection.

The obtained results would be more authoritative if more decision-makers were involved in the decision-making process, as well as if the evaluation process itself was related to a certain type of organization or a specific type of work. Nevertheless, the proposed methodology has confirmed its usefulness and applicability in decision-making in this area. The recommendation for future work includes the evaluation and ranking of certain factors that influence the selection of personnel in a certain activity, specifically on the list of previously defined aspects as well as factors using the PIPRECIA method.

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