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Quantitative Evaluation of Graduate Education Policy for Professional Degree in China: Based on PMC-Index model

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Abstracts:

China's professional degree graduate education has entered an era of high-quality development, where effective policy interventions are essential for achieving a stepwise enhancement in the quality of this education. This paper analyzes 78 professional degree graduate education policies issued by central government agencies and local governments in China from 1990 to 2021. Utilizing content analysis and text mining techniques, we extract and merge high-frequency terms, construct the PMC-Index model for China's professional degree graduate education policies, and quantitatively evaluate six specific policies. This evaluation reveals the characteristics, strengths, and weaknesses of the current policy formulation, aiming to provide a theoretical foundation for the subsequent improvement and refinement of professional degree graduate education. The goal is to establish a robust theoretical basis for enhancing future policies in this domain. The conclusions of this study are as follows: (1) The PMC indexes of the six professional degree graduate education policies are ranked in descending order as follows: P3 > P2 > P1 > P6 > P5 > P4. According to the established criteria for policy grade classification, four policies (P3, P2, P1, and P6) are categorized as excellent, while two policies (P5 and P4) are deemed acceptable. (2) The PMC indexes of the national-level policies (P1, P2, P3) exceed those of the local-level policies. Specifically, the PMC indexes of the national-level policies (P1, P2, P3) are higher than those of the local-level policies (P4, P5, P6). Factors such as policy inclination, content, and target audience are the primary reasons for the discrepancies in indexes between national and local-level policies. (3) National-level policies emphasize both macro-guidance and micro-implementation, demonstrating operational feasibility. In contrast, local-level policies exhibit uneven grading, with certain policies showing inconsistent use of policy tools, a lack of comprehensive coverage in policy content, and insufficient inclination towards policy objectives.

Keywords:

Professional degree; Graduate education; PMC-Index model; Policy evaluation

1. Introduction

Postgraduate education plays a crucial role in cultivating innovative talents, enhancing innovation capacity, and contributing to economic and social development, as well as promoting the modernization of the national governance system and governance capacity. Since the reform and opening up, China has experienced rapid

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social and economic development, resulting in a significant increase in the demand for high-level applied talents. Consequently, the categories and fields of professional degrees have been continuously adjusted and expanded, now covering the primary areas of China's social and economic development[1]. Graduate education for professional degrees carries the important mission of nurturing high-level applied talents in the new era, making it a significant research topic within the field of postgraduate education.

Currently, research on professional degree graduate education primarily focuses on cultivation modes, case teaching, policy analysis, education quality, practical teaching, and tutor working mechanisms. In the realm of policy research concerning professional degree graduate education, Hu Yiling developed a two-dimensional analytical framework of "policy tools - components of cultivation modes" from the perspective of policy tools, and conducted a quantitative analysis of the policy texts related to China's professional degree graduate cultivation modes[2]. Yang Xi et al. identified the 40 years of reform and opening up as a pivotal period and systematically analyzed the evolution, internal logic, and core driving forces of China's professional degree graduate education policy. They proposed valuable suggestions for further enhancing this policy [1]. Wang Li et al. argue that the policy faces challenges such as the need to realign its developmental positioning, strengthen structural reflections on its historical development, and address its outdated development model. They suggest that the professional degree graduate education policy should focus on optimizing top-level design, refining classification management, and encouraging social participation. Furthermore, the future policies should adopt a people-oriented approach while considering the diversity of the policy-making body and the evaluation mechanisms [3]. Throughout previous studies, scholars have generally employed methods such as text mining, word frequency statistics, and policy analysis to systematically examine professional degree graduate education policy from various perspectives. This area of research has yielded substantial insights and valuable policy recommendations, demonstrating significant academic merit. However, current research on the quantitative evaluation of the effectiveness of professional degree graduate education policies remains inadequate, necessitating further in-depth discussions.

The PMC-Index model is founded on the Omnia Mobilis hypothesis introduced by Ruiz Estrada and colleagues, which posits that all entities are in constant motion and interconnected. It emphasizes the importance of considering the influence of each related variable. In contrast to existing quantitative policy evaluation models, the PMC-Index model integrates text mining techniques to extract raw data and employs binary algorithms to balance the roles of various influencing factors. This approach enhances the scientific rigor and objectivity of the evaluation results[4]. Secondly, the PMC-Index model focuses on the study of the policy itself, effectively addressing the lack of emphasis on quantitative research of policy texts. Furthermore, the PMC-Index model not only facilitates the quantitative evaluation of individual policies but also allows for the analysis of consistency between different policies. It visually represents the advantages and shortcomings of these policies, thereby providing effective references for proposing policy improvement measures[6]. Currently, China's professional degree postgraduate education has entered an era of high-quality development, with effective policy interventions being crucial for achieving incremental improvements in the quality of this education. To address this, this paper analyzes 78 professional degree graduate education policies issued by China's central government agencies and local governments from 1990 to 2021. Utilizing content analysis and text mining techniques, we extract and consolidate high-frequency terms, construct the PMC-Index model for China's professional degree graduate education policies, and quantitatively evaluate six sample policies.

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This analysis aims to reveal the characteristics of current policy formulation, including its advantages and shortcomings, thereby providing a theoretical basis for the enhancement and refinement of future professional degree graduate education policies.

2. Model construction

The PMC index, as a policy measurement model, is designed to analyze the consistency level of a specific policy, visualize its strengths and weaknesses, and characterize the meanings and levels of these variables[7]. The construction of the PMC-Index model involves four key steps: 1) variable classification and parameter identification; 2) table of multiple-input-output; 3) calculation of PMC index; and 4) surface plot of PMC.

2.1. Data sources

At the onset of the reform and opening up, China's postgraduate training was in its nascent stages, with professional degree postgraduates still in a preliminary phase[1]. In 1984, China initiated pilot programs across various industries and fields, leading to the formal establishment of the first professional degree, namely the "Master of Business Administration," in 1990. Since that time, a series of policies concerning the education of professional degree graduates have been systematically introduced. This paper selects policy texts from 1990 to 2021, focusing exclusively on policies related to graduate education for professional degrees, all of which are sourced from publicly available data. The search strategy for these policy texts involved using the keywords 'postgraduate' and 'professional degree' to locate relevant policy documents on the official websites of the Chinese government, the Ministry of Education, and the legal database of Peking University. Additionally, relevant policy documents were identified through searches in the government documents sub-database of the China Knowledge Network, which was further supplemented by additional searches for pertinent policy documents. The screening of policy documents adheres to several principles: First, the policy text must directly reflect relevant content concerning professional degree graduate education. Second, the issuing authority of the policy should be a central government agency or a local government, primarily at the provincial level or in municipalities directly under the central government. Third, the policy text must encompass policies related to both general professional degree graduate education and those specific to particular types of professional degrees. Fourth, the types of policy documents considered should include those that reflect government policies, such as plans, opinions, notices, and programs, to ensure the authority of the selected policies. Following a systematic screening process, a total of 78 policy texts (as of July 31, 2021) closely related to professional degree graduate education were identified.

2.2. Variable classification and parameter identification

Variable classification and parameter identification are crucial steps in constructing the PMC-Index model. The selection of first-level variables in this model is informed by the research findings of Estrada[7], Zhang Yongan[8-10], Zhao Yang[11], Song Dacheng[12], and other scholars. Ten generalized indices have been established, encompassing the nature of policy, policy timeliness, and policy tools. During the selection process of secondary variables, the measurement items (secondary variables) of the seven primary variables—namely, policy nature, issuing organization, policy timeliness, policy tools, effectiveness level, policy evaluation, and policy disclosure—are derived from the attribute information of the policy sample. The measurements of

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the three primary variables—policy tendency, policy content, and policy object—cannot be obtained directly. Based on previous studies, it is also essential to consider the characteristics of the policy texts related to professional degree graduate education. Therefore, this paper employs text mining methods, importing 78 policy texts into a text mining database. Utilizing the word frequency analysis tool of ROSTCM6.0, we conducted a word segmentation process to extract high-frequency and key feature words, while eliminating irrelevant words that lack significant meaning. This process resulted in the formation of a social network knowledge mapping. Due to space constraints, only the first 60 words are presented to provide a reference basis for the selection of secondary variables (Table 1).

Table 1 Top 60 High Frequency Words in Professional Degree Graduate Education Policy Texts

NO.	Word	Frequency	NO.	Word	Frequency	NO.	Word	Frequency
1	postgraduate	2612	21	Establishment	392	41	Occupation	231
2	Degree	2199	22	System	391	42	Service	212
3	Cultivation	1844	23	Guidance	356	43	Cooperation	208
4	Education	1475	24	Enrollment	353	44	Model	206
5	Development	750	25	Improvement	351	45	Assessment	203
6	Quality	668	26	Academic	350	46	Combine	201
7	Construction	662	27	Course	337	47	Society	199
8	Unit	655	28	Conduction	301	48	Paper	196
9	Mentor	580	29	College	269	49	Research	193
10	Talent	568	30	Country	269	50	Intensity	190
11	Reinforcement	567	31	Level	264	51	Evaluation	189
12	Reform	504	32	Need	259	52	Doctor	188
13	Master	481	33	Improvement	255	53	Sound	183
14	Practice	474	34	Committee	252	54	Science	180
15	Mechanism	468	35	Positive	249	55	Organization	176
16	Innovation	463	36	Evaluation	247	56	Promotion	175
17	Management	463	37	Base	244	57	Standard	175
18	Competency	453	38	Research	243	58	Domain	175
19	Teaching	415	39	Propel	238	59	Plan	171
20	discipline	406	40	System	235	60	Encouragement	171

The distribution of high-frequency words in the policy text, along with the core structure and degree of radiation of the knowledge map, reflects, to a certain extent, the focus of China's professional degree graduate education policy. Based on relevant results and taking into full consideration the subjective and objective factors associated with professional degree graduate education, words that characterize emotional tendencies, such as 'strengthen' and 'encourage', are utilized as measurement items for policy tendency (secondary variables); words reflecting policy concerns, such as "enrollment" and "cultivation," serve as measurement items for policy tendency (secondary variables). Additionally, terms like "unit" and "tutor," which represent the roles of the target, are utilized as measures of policy content (secondary variables). In summary, the PMC-Index model of professional degree graduate education policy comprises 10 first-level variables and 41 second-level variables, as detailed in Table 2. The parameters of the secondary variables are defined in binary format (0 and 1) based on the following criteria: if the policy text includes content relevant to the secondary variable, the parameter is assigned a value of 1; otherwise, it is assigned a value of 0. This approach ensures

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that each secondary variable is equally significant and exerts an identical influence on the multi-input-output table [8].

Table 2 Variable setting of PMC-Index model of professional degree graduate education policy

Primary Variables		Secondary Variables		Evaluation Criterion
Code	**Name**	**Code**	**Name**	
X_1	Policy Nature	X_{1-1}	Opinion	Whether it is an opinion? Yes is 1, no is 0.
		X_{1-2}	Notification	Whether it is a notification? Yes is 1, no is 0.
		X_{1-3}	Reply	Whether it is a reply? Yes is 1, no is 0.
X_2	Policy Release Agency	X_{2-1}	State Council (PRC)	Whether the policy issuing agency is the State Council (PRC)? Yes is 1,no is 0.
		X_{2-2}	State Council Ministries, Commissions and Bureaus	Whether the policy issuing agency is the State Council Ministries, Commissions and Bureaus? Yes is 1,no is 0.
		X_{2-3}	Other State Council Agencies	Whether the policy issuing agency is other State Council agencies? Yes is 1,no is 0.
		X_{2-4}	Local Governments and Bureaus	Whether the policy issuing agency is local governments and bureaus? Yes is 1,no is 0.
		X_{2-5}	Other Local Government Agencies	Whether the policy issuing agency is other local government agencies? Yes is 1,no is 0.
X_3	Policy Timeliness	X_{3-1}	Long-term（＞ 5 years）	Whether it involves for more than 5 years? Yes is 1, no is 0.
		X_{3-2}	Medium-term（3-5 years）	Whether it involves for 3-5 years? Yes is 1, no is 0.
		X_{3-3}	Medium-term（1-3 years）	Whether it involves for 1-3 years? Yes is 1, no is 0.

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Primary Variables		Secondary Variables		Evaluation Criterion
Code	Name	Code	Name	
X_4	Policy Inclination	X_{4-1}	Supervision	Whether reflects the supervision? Yes, 1, no, 0.
		X_{4-2}	Guidance	Whether reflects the guidance? Yes, 1, no, 0.
		X_{4-3}	Enhancement	Whether it involves enhancement measures? Yes 1, no 0.
		X_{4-4}	Incentive	Whether it involves incentive measures? Yes 1, no 0.
		X_{4-5}	Advancement	Whether it involves advancement measures ? Yes 1, no 0.
X_5	Policy Tool	X_{5-1}	Command Tool	Whether it involves command tools? Yes 1, no 0.
		X_{5-2}	Motivational Tool	Whether it involves motivational tools? Yes 1, no 0.
		X_{5-3}	Advisory Tool	Whether it involves advisory tools? Yes 1, no 0.
		X_{5-4}	Capacity-building Tool	Whether it involves capacity-building tools? Yes 1, no 0.
		X_{5-5}	Systemic Change Tool	Whether it involves systemic change tools? Yes 1, no 0.
X_6	Policy content	X_{6-1}	Postgraduate Enrollment	Whether it involves postgraduate enrollment? Yes 1, no 0.
		X_{6-2}	Postgraduate Training	Whether it involves postgraduate training? Yes 1, no 0.
		X_{6-3}	Postgraduate Scholarship	Whether it involves postgraduate scholarship? Yes 1, no 0.
		X_{6-4}	Postgraduate Employment	Whether it involves postgraduate employment? Yes 1, no 0.
		X_{6-5}	Course Teaching Case Library	Whether it involves course teaching case library? Yes 1, no 0.
		X_{6-6}	Practice Base	Whether it involves practice base? Yes 1, no 0.

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Primary Variables		Secondary Variables		Evaluation Criterion
Code	Name	Code	Name	
X_7	Policy Level	X_{7-1}	Legislation	Whether it is a legislation? Yes is 1, no is 0.
		X_{7-2}	Administrative Regulation	Whether it is an administrative regulation? Yes is 1, no is 0.
		X_{7-3}	Departmental Regulation	Whether it is a departmental regulation? Yes is 1, no is 0.
		X_{7-4}	Local Normative Document	Whether it is a local normative document? Yes is 1, no is 0.
		X_{7-5}	Local Working Document	Whether it is a local working document? Yes is 1, no is 0.
X_8	Policy Objectives	X_{8-1}	Relevant Government Departments	Whether it involves relevant government departments? Yes 1, no 0.
		X_{8-2}	Training Unit	Whether it involves relevant training unit? Yes 1, no 0.
		X_{8-3}	Supervisor	Whether it involves supervisor? Yes 1, no 0.
		X_{8-4}	Student	Whether it involves student? Yes 1, no 0.
		X_{8-5}	(Industry) Enterprise	Whether it involves (industry) enterprise? Yes 1, no 0.
X_9	Policy Evaluation	X_{9-1}	Sufficient Basis	Whether the basis is sufficient, Yes for 1, No for 0.
		X_{9-2}	Clear Goals	Whether the goals set are clear, Yes for 1, No for 0.
		X_{9-3}	Scheme Science	Whether the implemented scheme is scientific, Yes for 1, No for 0.
		X_{9-4}	Reasonable Planning	Whether the proposed plan is reasonable, Yes for 1, No for 0.
X_{10}	Policy Publicity	—	—	

2.3. Table of multiple-input-output

A multi-input-output table serves as an alternative data analysis framework capable of storing substantial amounts of data. It comprises several primary variables that are unordered and independent of one another, alongside an unrestricted number of secondary variables that possess equal weights and lack prioritization. This paper establishes a multi-input-output table based on the parameter settings of the variables within the

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PMC-Index model of professional degree graduate education policy (refer to Table 3).

Table 3 Multi-input-output table

Primary Variables	Secondary Variables
X_1	X_{1-1} X_{1-2} X_{1-3}
X_2	X_{2-1} X_{2-2} X_{2-3} X_{2-4} X_{2-5}
X_3	X_{3-1} X_{3-2} X_{3-3}
X_4	X_{4-1} X_{4-2} X_{4-3} X_{4-4} X_{4-5}
X_5	X_{5-1} X_{5-2} X_{5-3} X_{5-4} X_{5-5}
X_6	X_{6-1} X_{6-2} X_{6-3} X_{6-4} X_{6-5} X_{6-6}
X_7	X_{7-1} X_{7-2} X_{7-3} X_{7-4} X_{7-5}
X_8	X_{8-1} X_{8-2} X_{8-3} X_{8-4} X_{8-5}
X_9	X_{9-1} X_{9-2} X_{9-3} X_{9-4}
X_{10}	—

2.4. Calculation of PMC index

The PMC index serves as a comprehensive indicator reflecting the overall effectiveness of policy formulation. The specific calculation steps are as follows: 1. Input the ten first-level variables and forty-one second-level variables related to the policy evaluation of professional degree graduate education into a multi-input-output Table. 2. Following Estrada's method of assigning values[7], assign values to the second-level variables using formulas (1) and (2). 3. Calculate the specific values for each first-level variable according to formula (3). 4. Similarly, calculate the specific values for each second-level variable using formula (3). 5. Finally, compute the PMC index for the policy under evaluation as per equation (4). A higher PMC index value indicates a superior grade.

$$X \sim N[0,1] \tag{1}$$

$$X = \{XR: [0 \sim 1]\} \tag{2}$$

$$X_i\left(\sum_{j=1}^{n} \frac{X_{ij}}{t(X_{ij})}\right) \tag{3}$$

Where, i is the main-varibale, i=1,2,3,…,m. j is the sub-varibale, j= 1,2,3,...,n.

$$PMC = \begin{bmatrix} X_1\sum_{j=1}^{3}\frac{X_{1j}}{3} + & X_2\sum_{j=1}^{4}\frac{X_{2j}}{4} + & X_3\sum_{j=1}^{3}\frac{X_{3j}}{3} + \\ X_4\sum_{j=1}^{5}\frac{X_{4j}}{5} + & X_5\sum_{j=1}^{5}\frac{X_{5j}}{5} + & X_6\sum_{j=1}^{6}\frac{X_{6j}}{6} + \\ X_7\sum_{j=1}^{5}\frac{X_{7j}}{5} + & X_8\sum_{j=1}^{5}\frac{X_{8j}}{5} + & X_9\sum_{j=1}^{4}\frac{X_{9j}}{4} + X_{10} \end{bmatrix} \tag{4}$$

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The settlement results of the PMC index facilitate an assessment of policy consistency levels, categorized into four grades based on Estrada's criteria for classifying policy evaluations: perfect, good, acceptable, and low (see Table 4).

Table 4 Evaluation criteria of the PMC-Index of a policy

PMC-Index	10~9	8.99~7	6.99~5	4.99~0
Evaluation	Perfect	Good	Acceptable	Low

2.5. Construction of the PMC-Surface

The PMC surface provides a three-dimensional and intuitive representation of the evaluation results pertaining to a professional degree graduate education policy, illustrated through images that facilitate the assessment of the policy's strengths and weaknesses. This paper examines ten primary variables, which have been refined to create a third-order PMC matrix, as X_{10} lacks subordinate variables. This process is delineated in Equation (5).

$$PMC\ Surface = \begin{bmatrix} X_1 & X_2 & X_3 \\ X_4 & X_5 & X_6 \\ X_7 & X_8 & X_9 \end{bmatrix} \quad (5)$$

3. Empirical study on policy evaluation

3.1. Research samples

The primary feature of the PMC-Index model is its comprehensive consideration of all potentially relevant variables. Consequently, the sample policies do not need to be selected based on separate categories of variables, such as policy instrument, issuing agency, and level of effectiveness [13]. In light of these considerations, and with a focus on the comparability of the policy text content, this paper selects six policies related to professional degree graduate education issued between 1990 and 2021 as sample policies for quantitative evaluation (see Table 5).

Table 5 6 Policies on Graduate Education for Professional Degrees introduced 1990-2021

Policy Code	Policy Name	Issuing Agency	Date issued
P_1	Several Opinions on Doing a Good Job in Training Full-time Master's Degree Graduate Students	Ministry of Education	03-19-2009
P_2	Opinions on Deepening the Reform of the Training Model for Professional Degree Graduate Students	Ministry of Education; Ministry of of Human Resources and Social Security	11-04-2013
P_3	Notice on the Issuance of the "Professional Degree Graduate Education Development Plan (2020-2025)".	Academic Degrees Committee of the State Council; Ministry of Education	09-25-2020
P_4	Suggestions on Further Promoting the Reform of Professional Degree Postgraduate Training Mode	Zhejiang Provincial Department of Education	07-01-2018

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P_5	Guiding Opinions on Accelerating the Development of Graduate Education for Professional Degree	Tianjin Municipal Education Commission	02-14-2019
P_6	Notice on Issuing the "Henan Province Degree and Postgraduate Education Improvement Action Plan (2021-2025)"	Henan Provincial Finance Department	06-10-2021

3.2. PMC-Index calculation

Based on the selection of primary and secondary variables, as well as the setting of variable parameters mentioned above, a multi-input-output table for six professional degree graduate education policies has been established (see Table 6).

Table 6 Multi-input-output tables of six professional degree graduate education policies

Main-variables	Sub-variables	P_1	P_2	P_4	P_8	P_9	P_{10}
X_1	X_{1-1}	1	1	0	1	1	0
	X_{1-2}	0	0	1	0	0	1
	X_{1-3}	0	0	0	0	0	0
X_2	X_{2-1}	0	0	0	0	0	0
	X_{2-2}	1	1	1	0	0	0
	X_{2-3}	1	1	1	0	0	0
	X_{2-4}	1	1	1	1	0	1
	X_{2-5}	1	1	1	1	1	1
X_3	X_{3-1}	1	1	0	1	0	0
	X_{3-2}	1	1	1	1	1	1
	X_{3-3}	1	1	1	1	1	1
X_4	X_{4-1}	0	1	1	0	1	1
	X_{4-2}	0	1	1	0	1	1
	X_{4-3}	1	1	1	1	1	1
	X_{4-4}	0	1	1	1	1	1
	X_{4-5}	1	1	1	0	1	1
X_5	X_{5-1}	1	0	1	0	1	0
	X_{5-2}	0	1	1	0	0	1
	X_{5-3}	0	1	1	1	1	1
	X_{5-4}	1	1	1	1	1	1
	X_{5-5}	1	1	1	0	1	1
X_6	X_{6-1}	1	1	1	0	1	1
	X_{6-2}	1	1	1	1	1	1
	X_{6-3}	1	1	1	0	1	0
	X_{6-4}	1	1	1	0	1	1
	X_{6-5}	1	1	1	1	1	1
	X_{6-6}	1	1	1	1	1	1

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Main-variables	Sub-variables	P_1	P_2	P_4	P_8	P_9	P_{10}
X_7	X_{7-1}	0	0	0	0	0	0
	X_{7-2}	0	0	0	0	0	0
	X_{7-3}	1	1	1	0	0	0
	X_{7-4}	1	1	1	1	1	1
	X_{7-5}	1	1	1	1	1	1
X_8	X_{8-1}	1	1	1	0	0	1
	X_{8-2}	1	1	1	1	1	1
	X_{8-3}	1	1	1	1	1	1
	X_{8-4}	1	0	1	0	1	0
	X_{8-5}	1	1	1	1	0	0
X_9	X_{9-1}	1	1	1	1	1	1
	X_{9-2}	1	1	1	1	1	1
	X_{9-3}	1	1	1	1	1	1
	X_{9-4}	1	1	1	1	1	1
X_{10}	—	1	1	1	1	1	1

According to formula (4), the PMC index values for policies P_1, P_2, P_3, P_4, P_5, and P_6 were calculated. Based on the policy level classification standard, these six sample policies were graded, as shown in Table 7.

Table 7 PMC-Index of six professional degree graduate education policies

Main-variables	P_1	P_2	P_3	P_4	P_5	P_6	Average
X_1	0.33	0.33	0.33	0.33	0.33	0.33	0.33
X_2	0.80	0.80	0.80	0.40	0.20	0.40	0.57
X_3	1.00	1.00	0.66	1.00	0.66	0.66	0.83
X_4	0.40	1.00	1.00	0.40	1.00	1.00	0.80
X_5	0.60	0.80	1.00	0.40	0.80	0.80	0.73
X_6	1.00	1.00	1.00	0.50	1.00	0.83	0.89
X_7	0.60	0.60	0.60	0.40	0.40	0.40	0.50
X_8	1.00	0.80	1.00	0.60	0.60	0.60	0.77
X_9	1.00	1.00	1.00	1.00	1.00	1.00	1.00
X_{10}	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PMC-Index	7.73	8.33	8.39	6.03	6.99	7.03	7.42
level	Good	Good	Good	Acceptable	Acceptable	Good	—

3.3. PMC-Surface drawing

According to Formula (5), the PMC surfaces for P_1, P_2, P_3, P_4, P_5, and P_6 are illustrated in Figure 1.

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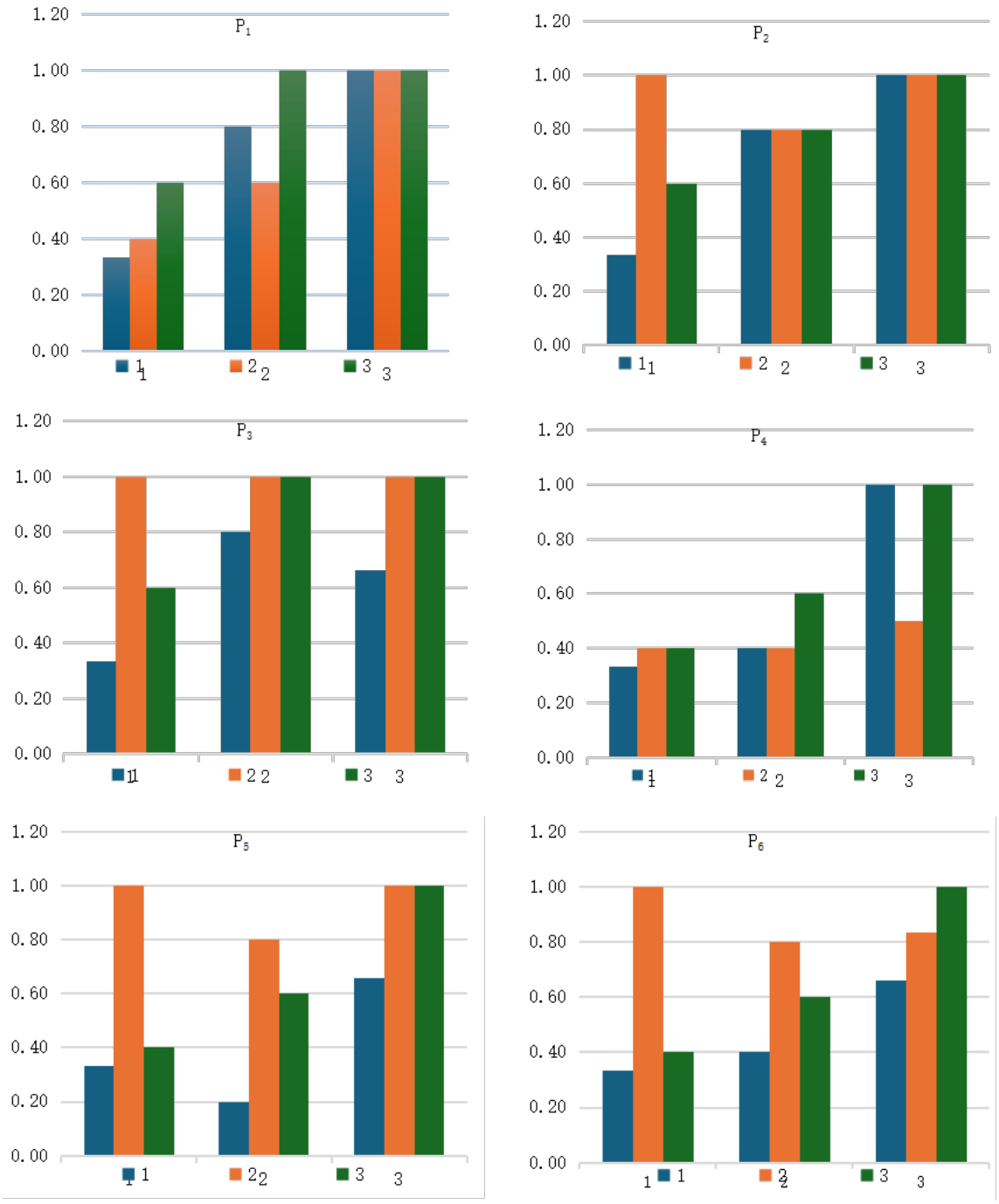


Figure 1 PMC-Surface Diagram of Postgraduate Education Policy for 6 Professional Degrees

3.4. Quantitative policy analysis

3.4.1. Overall evaluation of the policy

The results indicate that the PMC index for the six professional degree graduate education policies is ranked from highest to lowest as follows: $P_3 > P_2 > P_1 > P_6 > P_5 > P_4$. Based on the policy grading criteria, four policies (P_3, P_2, P_1, P_6) are classified as 'good,' while two policies (P_5, P_4) are classified as 'acceptable.'

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Furthermore, the PMC indices of the national-level policies (P_1, P_2, P_3) exceed those of the local-level policies (P_4, P_5, P_6). A comprehensive analysis reveals that, in addition to the influence of objective variables such as the policy-issuing organization and the level of effectiveness, the variables of policy tendency, policy content, and policy object are the primary reasons for the differences in indices between national-level and local-level policies. State-level policies consider various dimensions, including supervision, guidance, and encouragement. The policy content encompasses multiple aspects such as graduate student enrollment, training, and employment. It emphasizes the development of course teaching cases and practical training bases. Additionally, the policy targets relevant government departments, training units, tutors, students, and (industrial) enterprises. Overall, national policies regarding professional degree graduate education emphasize both macro-level guidance and micro-level implementation and operability. In comparison to national-level policies, local-level policies exhibit inconsistencies in quality. Some of these policies demonstrate uneven application of policy tools, a lack of comprehensiveness in their content coverage, and insufficient inclination towards policy effectiveness.

3.4.2. Policy hierarchy evaluation

3.4.2.1. National policy

P_1, P_2, and P_3 are national policies issued by central government agencies that are closely related to professional degree graduate education. The PMC index of P_3 is 8.39, ranking first with a policy grade rating of 'excellent,' which is close to the perfect range of 10 to 9. The PMC indices for P_1 and P_2 are 7.73 and 8.33, respectively, and their policy ratings are assessed as 'good.' P_3, titled 'The Program for the Development of Professional Degree Graduate Education (2020-2025),' was jointly issued by the Academic Degrees Committee of the State Council and the Ministry of Education on September 25, 2020.

As illustrated in Figure 2, the P_3 policy exhibits higher or equal levels of various variables, including policy tendency, policy tools, policy content, policy objects, and policy evaluation, compared to the P_1 and P_2 policies. This indicates that the formulation of the program has thoroughly considered the comprehensive development of professional degree postgraduate education. It encompasses a broad range of stakeholders, including government entities, educational institutions, and industrial enterprises, addressing multiple facets such as postgraduate student enrollment, cultivation, employment, teaching cases, and practice bases. Furthermore, the program employs an array of policy tools, such as mandates, incentives, encouragement, capacity building, and systemic changes. Ultimately, it has established the development program for professional degree graduate education (2020-2025) based on solid foundations, with clear objectives, scientifically designed programs, and reasonable planning. The effective implementation of this program is expected to significantly enhance the high-quality development of professional degree graduate education in China. In contrast, the P_1 and P_2 policies exhibit potential for optimization and improvement, particularly concerning the variables of policy tendency and policy instruments.P_1 policy neglects several critical functions, such as monitoring, guiding, and encouraging, and relies predominantly on command tools, capacity-building tools, and systemic change tools. It lacks the incorporation of incentive and exhortation tools. Introduced in 2009, this policy coincided with a significant increase in the number of professional degree categories in the country, which saw the addition of 19 new professional degrees. Since 2009, China's professional degree graduate education has entered a new phase characterized by steady improvements in quality[1]. The extensive utilization of com-

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mand tools, capacity-building tools, and system change tools indicates that the state places significant emphasis on the advancement of professional degree graduate education. Between 2009 and 2016, there was a rapid expansion in the fields and categories of professional degrees in China, accompanied by a substantial increase in the number of individuals trained. During this period, China's professional degree education evolved in response to contemporary needs, implementing reforms focused on program settings, categories, training processes, and assessment and evaluation methods for professional degrees[1]. The P_2 policy emerged during this transformative period. In 2013, the Ministry of Education and the Ministry of Human Resources and Social Security issued an opinion on the in-depth promotion of the reform of the cultivation mode for professional degree graduate students. This opinion holds significant guiding value; although it has not attained the highest effectiveness in the two variables of policy instruments and policy objectives, the overall design of the policy is of excellent quality, ranking just below the P_3 policy.

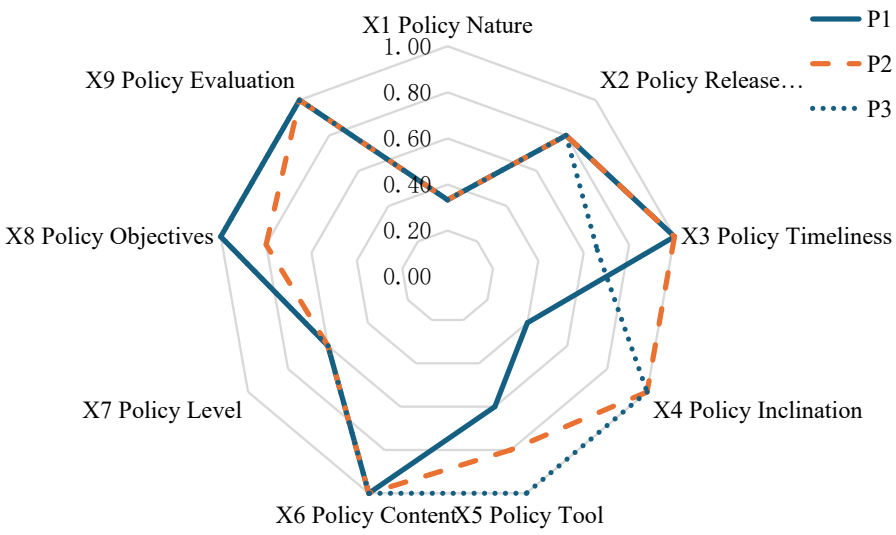


Figure 2 Debra chart of professional degree studies education policy P1, P2, P3

3.4.2.2. Local policy

P_4, P_5, and P_6 are local normative documents issued by the governmental departments of Zhejiang Province, Tianjin Municipality, and Henan Province, respectively. These documents are closely related to the graduate education of professional degrees, with policy release dates in 2018, 2019, and 2021, in that order. Among these, the P_6 policy achieved a PMC index of 7.03, reaching a good level and ranking first. This was followed by the P_5 policy, which had a PMC index of 6.99, categorized as acceptable and close to the good range (8.99 to 7). Lastly, the P_4 policy was also rated as acceptable. Overall, as illustrated in Figure 3, local policies are more inclined to propose suggestions or opinions pertaining to professional degree graduate education at the meso- and micro-levels, while exhibiting a deficiency in policy leadership at the macro-level. A further analysis indicates that, regarding policy targets, local policies prioritize the roles of training units and tutors, often overlooking the essential functions of government macro-adjustment, student self-training, and the

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collaborative efforts of multiple stakeholders, including industry enterprises.Since 2016, the development of professional degrees in China has transitioned from incremental to connotative development. The state places significant emphasis on enhancing the quality of professional degree graduate education and training. It is only through the mobilization of strengths and resources from various stakeholders that local governments can establish a new framework characterized by upward and downward linkages and multilayered promotion. From an individual policy perspective, the P_5 and P_6 policies have achieved or are nearing an excellent standard in global design. However, these policies fall short in terms of stakeholder involvement; the P_5 policy lacks effective incentive tools, while the P_6 policy is deficient in command tools and graduate student awards and grants related to policy content. An optimal combination of policy tools can address these deficiencies, complementing strengths and weaknesses while avoiding the pitfalls associated with the exclusive use of a single tool[14]. The integration of capacity-building tools, which typically require extended investment periods and yield gradual results, with incentive tools that stimulate policy implementation and can produce immediate benefits, can collectively enhance the overall effectiveness of the policy[2].The PMC index of the P_4 policy ranks the lowest, primarily due to the following reasons: First, the policy neglects the functions of supervision, guidance, and promotion. Second, the policy tools are limited to exhortation and capacity-building tools, and the lack of diversity in the combination of these tools adversely affects the policy's implementation effectiveness. Third, the policy content focuses solely on the cultivation of postgraduate students, teaching cases, and practice bases, thereby overlooking the intrinsic connections among the three components of "enrollment, training, and employment" as well as the external dynamics related to postgraduate awards during the cultivation process. Consequently, while the P_4 policy falls within an acceptable range, there remains significant room for improvement.

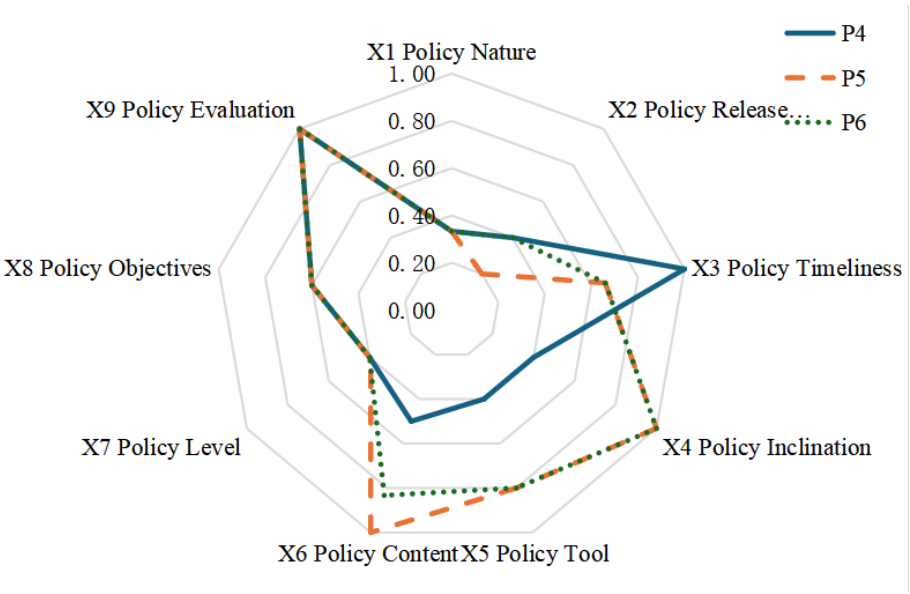


Figure3 Debra chart of professional degree studies education policy P_4, P_5, P_6

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4. Conclusions and Implications

Based on an analysis of 78 professional degree graduate education policies issued by central and local government agencies in China from 1990 to 2021, this paper employs content analysis and text mining techniques to extract and merge high-frequency terms. It constructs the PMC-Index model for China's professional degree graduate education policies and quantitatively evaluates six specific policies related to professional degree graduate education.

Research conclusions: (1) The PMC index of the six professional degree graduate education policies is ranked from high to low as $P_3 > P_2 > P_1 > P_6 > P_5 > P_4$. According to the policy level classification standard, four policies (P_3, P_2, P_1, P_6) are rated as 'good,' while two policies (P_5, P_4) are rated as 'acceptable.' (2) The PMC indices of national-level policies (P_1, P_2, P_3) are all higher than those of local-level policies (P_4, P_5, P_6). The variables of policy tendency, policy content, and policy object are the primary reasons for the differences in the indices between national-level and local-level policies. (3) National-level policies emphasize both macro-guidance and micro-implementation, ensuring operability. In contrast, local-level policies are rated unevenly; some exhibit inconsistent use of policy tools, lack comprehensive policy coverage, and demonstrate insufficient policy inclination. Based on this, the paper recommends the following:

First, a focus on policy orientation. It is essential to expand the toolbox for selecting policy tendencies in China's professional degree graduate education. This involves further strengthening the monitoring and guiding functions of policies, making reasonable and effective use of governmental behavior to 'make the best use of the situation.' This approach aims to recognize the significant role that policy tendency selection plays in guiding the gradual enhancement of the quality of professional degree graduate education, with the ultimate goal of 'creating momentum.'

Second, regarding policy content, many local government policies on professional degree graduate education primarily emphasize graduate training, teaching cases, and practical bases, while overlooking the continuity and systematic nature of policy development. Therefore, it is recommended that government departments focus on the comprehensive planning of professional degree graduate education. This should include emphasizing the intrinsic connections among the three stages of graduate students' "enrollment-cultivation-employment," as well as the extrinsic motivations such as awards and subsidies during the cultivation phase. By prioritizing these aspects, while also addressing certain elements in the short term, the policy system for professional degree graduate education in China can be further optimized.

Third, regarding the aspect of policy objects, the one-sidedness, isolation, and superficiality of these objects may result in a lack of wholeness, systematicity, and profundity in the evaluation of policy performance. Therefore, it is recommended that local governments, while emphasizing the functional roles of cultivation units and instructors, also pay special attention to policy objects such as governments, students, and (industrial) enterprises. By fully mobilizing the strengths and resources of various stakeholders, a new pattern of vertical and horizontal linkages and multi-layered promotion can be established.

Fourthly, regarding policy tools, it is essential to integrate command tools, incentive tools, exhortation tools, capacity-building tools, and systemic change tools. Additionally, it is important to address any gaps in these tools, particularly in the areas of command and incentive tools. The combination of policy tools

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should be optimized; for instance, capacity-building tools can be effectively paired with incentive tools. This approach takes into account both the authority and incentives provided by policies, thereby maximizing the short-term impacts of these policies while promoting long-term sustainable development[16].

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