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RESEARCH ARTICLE

Adapting entrepreneurial orientation for business performance of medium-sized business in South-West Nigeria

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Abstract: Entrepreneurial orientation as a concept has gained the attention of scholars over the last decade. It also became interesting to find out its relationship with business performance in South-West Nigeria. This study set out to find out any measure of influence that entrepreneurship as well as entrepreneurial orientation may assert on the performance of medium size businesses, with South-West Nigeria as the sample location. The results showed that pro-activeness (β = 0.145), competitive aggressiveness (β = 0.231), risk-taking (β = 0.087), and autonomy (β = 0.119) all had positive regression coefficients while innovativeness (β = -0.028) had a negative regression coefficient.

Keywords: entrepreneurial orientation, business performance, medium-sized business, family business

1 Introduction

The Nigerian economy is largely dominated by medium-sized businesses and so it is safe to posit that they form the nucleus of running businesses in the country [1–3]. Globally, Ismaila (2012) [4] similarly submitted that most of the enterprises in developed and developing countries are small and medium enterprises (SMEs) in structure. In other words, entrepreneurship as a concept could be argued to have taken a central place as a means of livelihood for middle-class business owners, largely due to increasing attention being devoted to its study by researchers [5]. Interestingly, Rauch et al. (2009) [6] observed that an aspect of entrepreneurship that appeared to have gained wide acceptability and had been centrally domiciled in the discipline in terms of theorizing and empirical study is entrepreneurial orientation. According to Kellermans and Eddleston (2006) [7], entrepreneurship involves recognising and using opportunities, as well as taking risks and accepting changes. In a broad sense, entrepreneurship refers to autonomy, innovation, risk-taking, proactivity, and competitiveness in business processes [8]. It is understood that entrepreneurship and entrepreneurial orientation are two separate concepts. Dess et al. (1997) [9] made a clear distinction by stating that entrepreneurship answers the question of what is being done, while entrepreneurial orientation answers the question of how the process is undertaken.

2 Literature review

The study reviewed relevant literature on key concepts including entrepreneurship, entrepreneurial orientation, and small and medium-scale enterprises.

2.1 Entrepreneurship

It explains an opportunity-seeking action, ultimately tending towards profit-making from such venture(s). The earliest definition as coined by Smith (1776) [10] related entrepreneurship to a deliberate act of risk-taking, amidst uncertainty. Indeed, Cantillion (1755) [11] identified a unique aspect of non-insurable risk borne by an entrepreneur. The process necessarily entails a measure of competence, creative skills, ingenuity, and innovation with a view to creating a competitive advantage. Accordingly, Amiri and Marimaei (2012) [12] and Schumpeter (1934) [13] all posit that the process of effecting change by converting opportunities while bearing the risk of competition, coupled with innovative skills aptly describes entrepreneurship. Essentially, the process is carried out with the aid of manpower and other resources in order to meet the needs of the target market in terms of new products or improved methods of production as well as services. Scholars such as Jennings (1994) [14] and Alarape (2015) [15] painted an entrepreneur as a catalyst who transforms resources including land, capital, and manpower

into a "productive organism". These resources which could not individually translate into end-product(s) or service(s) rely on the efforts of a coordinator to achieve optimal resource allocation with the expectation that the catalyst would eventually reap profit for his efforts. Often, the process leading to a productive organism could be discrete or instantaneous, and it could as well be gradual in some other instances, depending on the peculiarities of the entrepreneur and the resources at stake. Notwithstanding the varying perspectives from contemporary scholars with regard to entrepreneurship in terms of opportunities, change process or cataclysm, risk-taking, or coordinating efforts, this study accords due recognition to entrepreneurship for its important role in the developmental process of medium-sized businesses in Nigeria. By extension, its contributions to the growth of the national economy are equally recognized.

2.2 Entrepreneurial orientation

Literarily, orientation explains a process of training, assimilation or exposure such as imbibing a person with a culture in a specific direction, emplacement or bearing. Entrepreneurial orientation (EO), therefore, could be explained in terms of personal acquisition or conviction in pursuit of a business opportunity, bearing full consciousness of attendant risks as well as possible losses or profits as it ultimately turns out. The concept describes a situation whereby an executive institutes new processes, and practices in decision-making in a bid to explore perceived opportunities for the expansion of the business organization. Scholars hold a unanimous view that vital elements in EO include risk-taking, pro-activeness, innovation, autonomy, and a yearning for competitive aggressiveness [16, 17]. Indeed, Soomro and Shah (2022) [18], in a study conducted in Pakistan zeroed EO on three major assumptions including pro-activeness, risk-taking, and innovation, and established a positive relationship between EO and business performance. These qualities enable an entrepreneur or a group of entrepreneurs to initiate a business idea, taking into cognizance the inherent benefits of competitive advantage, having measured the extent of uncertainty in pursuance of creativity as well as experimentation. It presupposes that an entrepreneurially spirited person possesses the capability to scan the business environment for emerging opportunities and take innovative steps towards achieving competitive advantage with a desire for profit. In view of the foregoing, EO construct, with respect to medium-sized businesses would tend in the direction of financial yardsticks. The paramount factors, therefore, would include growth in sales and its attendant return on investment such that the entrepreneur is further encouraged to expand the business, taking due cognizance of consequential risks [6].

2.3 Business performance

There is a consensus among researchers that assurance with regard to the going concern of a business entity is contingent upon its performance. In this context, Bohlander et al. (2001) [19] coined the expression "what gets measured and rewarded gets attention". Performance describes the extent of effectiveness and efficiency in terms of accomplishing pre-determined goals and objectives at the least cost possible. An organization is at liberty to adopt an array of yardsticks for measuring performance including meeting timelines, and surpassing targets, but devoid of sidelining quality, innovation or ingenuity, leading to a competitive edge or admirable team spirit [20, 21]. Human resource practitioners hold divergent views about the measurement of business performance. While Torrington, Hall, and Taylor (2008) [22] lean on improved individual behavior as a proxy for performance, scholars such as Sajuyigbe et al. (2013) [23] expressed the view that performance transcends merely altered behavior to include paradigm shift in terms of commitment, dedication and work-finesse towards the business organisation. Therefore, performance within the context of medium-sized organisations could simply be considered tantamount to either increase in sales or an improvement in the method of production such that the business has experienced an expansion by way of stock as well as branches. Accordingly, productivity and profitability are strong indicators of performance in medium-sized businesses. While it remains a truism that several research findings had established a positive correlation between EO and the overall performance of the firm, it is equally important to state that in a few instances, certain factors could negatively affect performance. For instance, in a study conducted by Rezaei and Ortt (2018) [24] on 279 high-tech SMEs in Delft, The Netherlands, a negative correlation was reported between risk-taking and business performance.

2.4 Medium-sized business

There exists enough literature on the important role played by medium-sized businesses in the development of host economies across the globe. According to Ihua and Siyanbola (2012) [25], Monday et al. (2015) [26] no less than 90% of the total enterprises in developing countries are small and medium scale (SMEs) in nature, with a significant contribution of over 55% to the gross domestic product (GDP). Much attention is currently being paid to this sector

with a view to diversifying the economy. Accordingly, there is a paradigm shift from the huge capital intensity and investment with long-term maturity to SMEs in order to empower this sector for national economic growth. A rather simple classification provided by the Small and Medium Industrial Equity Investment Scheme (SMIEIS) of the Bankers Committee and the Central Bank of Nigeria (2001) [27] explains a medium-sized business as one with a total asset base of over N50 million, but not more the N200 million excluding the cost of land and working capital and labor size of between 100 and 300 workers [28]. The conception, design, resources, management, and total configuration of the SMEs are the sole prerogatives of the owner, or rather, the entrepreneur. In their contributions, Ojukwu (2006) [29], Apulu and Emmanuel (2011) [30] as well as Irefin, Abdul-Azeez and Tijani (2012) [31] all affirmed that the contributions of medium-sized businesses were not limited to job creation, but extended to economic growth and development in Nigeria.

3 Methodology

The study concentrated on Lagos, Ogun, and Oyo States out of the 6 constituents States in South West Nigeria with a total of thirty-three thousand, eight hundred and sixty-one (33,861) employees of registered medium-sized businesses in the study area [32].

Primary data, using a structured questionnaire was adopted, seeking respondents to answer specific questions on the entrepreneurial orientation of medium-sized family businesses as well as the performance of the businesses. With the aid of purposive sampling, a total of 384 respondents comprising both management and operational employees were selected for the study. Multiple regression techniques were used to analyze the results. The distribution of medium-sized businesses in South-West Nigeria, its population, and total employees is shown in Table 1.

Table 1 Distribution of medium-sized businesses in South-West Nigeria by population and total employment

S/N	States	Total Number of Medium-sized Businesses	Total Number of Employees
1	Ekiti	023	1805
2	Lagos	257	15826
3	Ogun	040	1702
4	Ondo	044	2235
5	Osun	51	2599
6	Oyo	176	9695
Total		591	33,861

Source: SMEDAN, 2013

4 Findings

The study found that five out of the widely referenced variables commonly used to explain entrepreneurial orientation played a significant role in determining the extent of the relationship between these variables on one hand, and the performance of medium-sized businesses on the other. These variables include pro-activeness, competitive aggressiveness, autonomy, innovativeness, and risk-taking. The distribution explaining the percentage of the relationship between entrepreneurial orientation and medium-sized businesses is shown in Table 2.

With respect to pro-activeness, Table 2 reveals that 47.1% of the respondents strongly agreed that their firm often leads the market competition by initiating actions while 3.4% strongly disagreed. The mean score was 4.21 ± 0.95. This implies that family businesses are highly proactive and prompt to initiate ideas with the aim of getting leverage or competitive advantage in the marketplace or leading change in the organization. This agrees with Vij and Bedi (2012) [33] submission that medium-sized businesses continuously monitor the market space with an organisational pursuit of favorable business opportunities. However, Kreiser et al. (2010) [34] argued that medium-sized businesses in "uncertainty-accepting" societies will be more willing to engage and exploit business opportunities than businesses in "uncertainty-avoiding" cultures.

Moreover, Table 2 shows the results for competitive aggressiveness that the majority (74%; SA - 39.6, A – 34.4) of the respondents agreed that the firm adopts a very competitive posture, aiming at overtaking competitors with an agreement index of 4.00 ± 0.93. This implies that medium-sized businesses have a fairly strong propensity to compete with rivals. Consequently, in tune with the position of Wiklund (1999) [35] that competitive advantage significantly determines business financial success, the motivation for competitive aggressiveness among medium-sized businesses could be justified since the businesses were created to make a profit.

Table 2 Descriptive analysis showing the entrepreneurial orientation of medium-sized businesses

Entrepreneurial Orientation	SA (%)	A (%)	U (%)	D (%)	SD (%)	Mean±SD
Pro-activeness						
Firm leadership and initiation of competition.	47.1	35.9	12.0	1.6	3.4	4.21±0.95
Leading competition through novel ideas.	31.5	48.4	12.8	1.3	6.0	3.98±1.01
Introduction of new products/services, technologies, etc.	35.9	48.4	10.7	3.9	1.0	4.14±0.83
Competitive Aggressiveness						
High aggression to competition	29.4	39.6	18.0	12.2	0.8	3.85±1.02
Adoption of competitive posture to overtake competitors.	39.6	34.4	15.9	6.8	3.4	4.00±0.93
Use of multiple strategies to achieve objectives	33.9	40.9	13.3	8.6	3.4	3.93±1.05
Risk taking						
Firm-level support for high-risk projects	33.3	43.0	15.6	7.0	1.0	4.00±0.93
Adoption of bold attitude to maximize and exploit potential opportunities	21.1	49.0	21.4	5.7	2.9	3.79±0.93
Increased propensity for high-risk projects	23.4	47.7	21.4	5.5	2.1	3.84±0.91
Innovativeness						
Research and development	50.8	33.3	12.8	1.3	1.8	4.29±0.87
Introduction of new products	21.9	62.0	6.8	8.9	0.5	3.95±0.82
Introduction of changes to existing products	28.1	58.6	7.8	5.2	0.3	4.09±0.76
Exploration of new processes and novel solutions	20.8	57.0	10.9	9.6	1.6	3.85±0.90
Autonomy						
Managerial motivation before action	34.1	45.6	13.0	4.4	2.9	4.03±0.95
Employees freely take initiatives	26.8	51.0	8.9	10.9	2.3	3.89±0.99
Individual or team reliance on senior managers to guide their work	24.5	46.4	21.1	5.7	2.3	3.84±0.93
Approval is necessary in decision making	33.1	43.2	13.0	7.0	3.6	3.95±1.03
Individual creativity and novelty	40.6	39.6	11.5	6.3	2.1	4.10±0.97

Notes: SA: Strongly Agree; A: Agree; U: Undecided; D: Disagree; SD: Strongly Disagree.

In addition, the effect of globalisation has put emerging businesses under intense pressure from competitors across the globe, making it imperative for medium-sized businesses to shore up their games or stand the risk of low business performance or even lose their competitive strength in the constantly evolving market [35,36].

Furthermore, Table 2 revealed that 76.3% (SA – 33.3%; A – 43.0%) of the respondents agreed that medium-sized businesses favors high-risk projects with chances of high returns on an agreement index of 3.00±0.93. This shows that medium-sized businesses invest less in uncertainties as an entrepreneurial inclination. Presumably, medium-sized businesses in their entrepreneurial spirit could invest in failure-prone projects or innovations, but most of them avoid or minimize risk as much as possible. Morris (2008) [37] believe that rather than put organisational resources into extreme and uncontrolled risk, most medium-sized businesses aim at taking moderate and calculated risks.

In the same vein, Table 2 indicated that the majority (84.1%; SA – 50.8%, A – 33.3%) of the respondents agreed that medium-sized businesses place a strong emphasis on research and development (R&D, tech leadership, and innovation while 12% disagreed. The agreement index was 4.29±0.87. The finding corroborates the findings of Antorites and Vanvuuren (2005) that innovation and exploitation of market opportunities, generally lead to profit-making. As necessity is the mother of invention, innovation is the heartbeat of every enterprise. The moment a firm stops to innovate, it risks extinction.

Finally, Table 2 further reveals that 80.2 percent (SA – 40.6%; A – 45.6%) agreed that medium-sized businesses encourage people to think and behave in creative and novel ways with an agreement index of 4.10±0.97. The implication is that medium-sized businesses allow employees to be self-expressive and make informed decisions based on their own rationale. The promotion of entrepreneurial characteristics in medium-sized businesses is best achieved by infusing autonomy organisational diamante for organisational or firm-based entrepreneurship [38]. Medium-sized businesses are sometimes characterized by a measure of delegation due to size [39] which ultimately enhances entrepreneurial tendencies and some level of autonomy among workers [40].

4.1 Effect of entrepreneurial orientation on business performance of medium-sized businesses

Regression analysis was carried out to determine the effect of each dimension of entrepreneurial orientation (pro-activeness, competitive aggressiveness, innovativeness, autonomy and risk taking) on business performance. The regression analysis is presented in Table 3.

Table 3 shows that pro-activeness (β = 0.145), competitive aggressiveness (β = 0.231), risk-taking (β = 0.087), and autonomy (β = 0.119) all had positive regression coefficients while

Table 3 Regression Analysis Showing the Effect of Entrepreneurial Orientation on Business Performance

Variables	Standardized Regression Coefficient (β)	T value	P value
Constant		1.600	0.110
Pro-activeness	0.145	2.729*	0.007
Competitive aggressiveness	0.231	3.956*	0.000
Risk taking	0.087	1.415	0.158
Innovativeness	-0.028	-0.469	0.639
Autonomy	0.119	1.889	0.060

Note: Significant at 0.01 (99%)

innovativeness (β = -0.028) had a negative regression coefficient. An important dimension of entrepreneur orientation is the business's willingness to innovate and rejuvenate its market with creative processes and the development of new ideas through experimentation, such as positively affect business performance [41, 42]. In contrast, however, the result of this study shows a negative regression between innovativeness and business performance among medium-sized family businesses. It can be inferred from this that while businesses may be encouraged to pursue and support innovations, medium-sized family businesses may experience challenges converting innovative ideas into profitable business products, lines, or services. This is further affirmed by Idowu (2013) [28] that organizational innovativeness among SMEs in Nigeria had no relationship or influence on business financial performance. However, the T-values shown in Table 3 reveal that pro-activeness (β = 0.145, p $\leq$ 0.05), and competitive aggressiveness (β = 0.231, p $\leq$ 0.01) are the only dimensions of entrepreneurial orientation that have a significant effect on the business performance of small and medium-sized family enterprises. This implies that the least unit increase in the degree of pro-activeness among medium-sized businesses will lead to an approximately 14.5% increase in business performance. The result is in consonance with Azlin et al. (2014) that pro-activeness is one of the entrepreneurial predictors which affect business performance among SMEs. Moreover, a unit increase in the competitive aggressiveness of family businesses contributes a 23.1% increase to the performance of the business. The result of the study shows that each dimension of entrepreneurship relates to performance in different ways and with varying degrees of effect. This further corroborates Cassillas *et. al.,* 2010 that a business can show high levels of entrepreneurial orientation in some dimensions but not necessarily in all of them and that each dimension of entrepreneurial orientation can be related to performance in a different way. Similarly, Hughes and Morgan (2007) [43] found that not all dimensions of entrepreneurial orientation have a significant influence on business performance. Hence, not all entrepreneurial orientations will always result in improved business performance. Competitive advantage has the strongest positive effect on business performance as shown in previous studies. It can be inferred that for the medium-sized family business to increase performance, they have to be intensely competitive, ready to take offensive measures against threats by competitors, striving for first mover advantage, and bold enough to take action when faced with opportunities. This is in agreement with Covin and Lumpkin (2011) [44] and Matchaba-Hove et al. (2015) [45].

5 Conclusion

The study showed that most of the medium-sized businesses reported pro-activeness, competitive aggressiveness, profit-taking, and innovativeness dimensions as vital elements of entrepreneurial orientation while a larger percentage assumed a risk-aversive orientation. These factors, with the exception of innovativeness, had positive effects on business performance. The more oriented the medium-sized businesses were to innovations, the lesser their performance. Summarily, it was established that entrepreneurial orientation had a positive and significant relationship with the business performance of medium-sized businesses. It becomes important that medium-sized businesses should promote the entrepreneurial competencies of employees by creating structures that support and reward such sterling qualities while working for an existing company or business. The study opines that these medium-sized businesses require institutional support in terms of meaningful investment in infrastructural development in order to provide a conducive business climate that supports innovation.

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RESEARCH ARTICLE

Factors undermining quality of medical-care services delivered by a physician in today's medical-care market country-wise: Statistical analysis

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Abstract: This study aims to decide factors that are affecting a physician's quality of medical-services in today's medical-care market country-wise such as Bangladesh. It further describes the relationship among the factors and then decides its influence affecting the physician's quality of medical-care services. Here primary data was collected from patients and patient-attendants in different private and government hospitals found in Dhaka City. This data statistics are used in this study for quantitative research approaches to conduct the goals. The dependent variable "quality of medical-services (PQMCS)" is regressed on six explanatory variables: a) pharmaceutical products promotional impact b) lengthy prescription c) unnecessary test requirements d) spending less time e) poor communication with patients and f) requirements for longer staying in hospital (private hospitals cases) etc. These characteristics were gathered from survey-opinions of patients and patient-attendants. These data statistics are used to decide the validity of the model. All multiple regression assumption tests were found to be valid. According to regression analysis, it was found that each of the explanatory variables have a substantial negative impact on a physician's quality of medical-services in the medical-care market. The analysis from one-way ANOVA reveals that patients and patient-attendants have similar feelings of the six independent variables that undermine a physician's quality of medical-services on duty. Results from this study can be used by policymakers as well as leaderships of hospitals (government and private) for policy-design and for administrative approaches addressing today's problem of medical-care market in Bangladesh. Since most physicians are employed either in government or in private sector or in both sectors, it is obvious that enforcing effective management systems can be instrumental curtailing the magnitudes of the problem soon. Obviously, in this case both government & private hospitals must work together for the interest of Bangladeshi-society, which can ensure quality & sustainable medical-care market soon in Bangladesh. The findings of this study can be a synopsis of medical-care services in today's business-driven world country-wise where undertaking further study on policy-design can be instrumental.

Keywords: medical-care service-market, Hippocratic oath, misuse of services, economic externalities, deadweight loss

1 Introduction

In today's world, people mostly behave with business-mentality without considering moral obligations in society. The service market, particularly the medical-care market is appeared to be vulnerable. Because of supplying medical-services, physicians or hospitals receive capitation payments, fees-for-services, and other fees. However, today it is the most criticized profession in world-economy country-wise such as Bangladesh [1]. Both internal and external factors in medical-care market-private-sector & public-sector of Bangladesh undermine the quality of medical-services of physicians in profession [1].

However, Akim Rahman's findings [1], particularly, the statistical analysis part was limited only to the identification of these factors, which raises question: how much each of the factors influences the quality of medical-service of a physician in medical-care market?

The answer to the question posed is expected to be uncovered by statistically analyzing the effect of each factor that undermines physicians' quality of medical-service in today's medical-care market. So, the current study takes on the tasks and fills the gap in literature. It further describes the relationship among the factors and then determined its influence affecting a physician's quality of medical-care services.

Based on conveniency and appropriateness statistical analysis and testing, the chosen factors from literature [1] are i) pharmaceutical products promotional impact ii) lengthy prescription

iii) unnecessary test requirements iv) spending less time v) poor communication with patients and vi) requirements for longer staying in hospital.

To the best of my knowledge, there is no *prior* empirical study on exploring factors that undermine quality of medical service provided by a physician. This study, therefore, aims to fill this research gap by empirically exploring a physician's perspectives on factors affecting the quality of medical-care services.

2 Literature review

Quality is a well-recognized concept in our real-life activities. And it can inform us for further efforts to develop effective strategies to improve service systems where medical-care services are no exception [2]. Here the value of services and its relationship with people's lives, quality assurance and quality promotion have received growing attention where patients have increasing expectations from a physician's services in today's medical-care market [1, 3]. Since the 21st Century is a business-driven world where both a consumer, *i.e.*, a patient and a service-provider *i.e.*, a physician in the medical-care market are not hesitant to take advantage as opportunity arises.

To marginalize this dilemma in medical-care market, the SERVQUAL model has been applied in several countries to measure the service quality in hospitals and health services These countries are Romania [4], Turkey [5], Saudi Arabia [6], Bangladesh [7] and Iran [8]. In these countries, the SERVQUAL model has been used to evaluate beliefs of service quality by medical university students [9, 10] and by patients at hospitals, primary health care centers and other health centers [8, 11].

According to the SERVQUAL model, a service provider must be able to supply five critical elements of service: a) reliability b) assurance c) tangibility d) empathy and e) responsiveness. However, some of these elements are missing in today's medical-care services provided by a physician country-wise such Bangladesh.

A recent study [1] where data statistics were collected from three groups namely patients, attendants of the patients, and the doctors in Bangladesh, shows in Table-1 that 79% attendants show negative perceptions on doctor's cordiality towards patients. On trusting doctors, 78% shows negative beliefs in Bangladesh medical-care service market. The estimated overall weighted mean is 2 (two), which also confirms the current doctor-patient relationship to be poor in Bangladesh. On overall belief that 90% people believe that "*patients-work-for-doctors*" in medical-care market. (see Table 1)

Table 1 Attendant belief and patient feeling toward the doctors in Bangladesh

Indicators	Attendant Perception			Patient Perception		
	(+) in %	(-) in %	Mean	(+) in %	(-) in %	Mean
Delivered treatment cordially	20.0	78.9	2.2	48.2	51.8	3.21
Delivered treatment with responsibility	30.0	70.0	1.9	22.9	77.1	2.51
Invested adequate time	24.5	75.5	2.2	26.8	73.2	2.77
Supplied mental support	30.0	70.0	2.1	49.0	51.0	3.18
Listened to the patient attentively	20.5	79.5	2.3	33.2	66.8	3.2
Patient was satisfied with medical-care service	33.0	67.0	1.9	34.6	65.4	2.9
Described the disease / health issue	30.0	79.0	2.1	27.2	72.8	2.8
Explained the prescriptions clearly	33.0	67.0	2.0	23.0	77.0	2.9
Felt like influenced by a pharma/ commission agent	75.2	24.8	2.1	46.0	54.0	3.0
No discrimination found in services	10.0	90.0	2.0	33.0	67.0	2.9
Having trust on the doctor as service provider	22.8	77.2	1.9	31.0	69.0	3.1
Overall feeling: Felt like "doctor*s-work-for-patients*" in healthcare market	15.0	84.6	2.0	35.0	65.0	2.9

Notes: Respondents = 100 where Public = 30, Private = 60 nonprofit = 10; Source: Author (Rahman, 2022a)

In contrast, 52% of patients, which is smaller than attendant percentage, show negative beliefs on doctors' cordiality issue. On trust issue, 69% patients show negative belief on trusting doctors in Bangladesh. In this case the estimated overall mean is 2.9 (three), which confirms a poor doctor-relationship in Bangladesh. On overall belief - Felt like "*doctors-work-for-patients*" in healthcare market, 65% patients expressed negative perceptions. In other words, 65% people believe that "*patients-work-for-doctors*" in today's medical care market in Bangladesh.

Few studies have investigated service quality in the health sector, but to my knowledge no study has yet been conducted on the quality of medical-care services provided by a physician in a hospital or in a doctor's private chamber. In a recent study, Akim Rahman's findings [1] were limited only to the identification of the factors, which may undermine the quality of medical-services provided by a physician in medical-care market in Bangladesh. In literature [1, 12] the identified factors are i) pharmaceutical products promotional impact ii) lengthy prescription iii)

unnecessary test requirements iv) spending less time v) poor communication with patients and vi) requirements for longer staying in hospital.

Thus, it is reasonable to raise the question: how much each of the factors influences the quality of medical-service of a physician in the medical-care market?

The answer to the question posed is expected to be uncovered by statistically analyzing the effect of each factor that undermines physicians' quality of medical-services in today's medical-care market. So, the current study takes on the tasks and fills the gap in literature. It further describes the relationship among the factors and then determined its influence affecting a physician's quality of medical-services in today's medical-care market.

To the best of my knowledge, there is no *prior* empirical study on exploring factors that undermine quality of medical-care services provided by a physician. This study, therefore, aims to fill this research gap by empirically exploring a physician's perspectives on factors affecting the quality of medical-care services.

3 Objectives of the study

This study aims to statistically cross-examine the existence of the factors [1] and then measure the influence of each factor i.e., each explanatory variable that undermines a physician's performance in medical-care market in Bangladesh.

The specific goals are as follows:

(1) To examine the factors undermining the quality of medical-care services provided by a physician;

(2) To rank the relative intensity of the factors undermining physician's performance as perceived by the respondents in the survey.

(3) To examine the feeling of the patients and patient-attendants towards the relative intensity of factors undermining a physician's performance by analysis of variance.

4 Research hypotheses development

To achieve the research goals, six hypotheses are formulated. They are as follows:

Ha1: There is a positive relationship between promotional impact of pharmaceutical products and physician's quality of medical-care services.

Ha2: There is a positive relationship between lengthy prescription and a physician's quality of Medical-care services.

Ha3: There is a positive relationship between unnecessary test requirements and the quality of Medical-care services of a physician.

Ha4: There is a positive relationship between spending less time and the quality of medical-services of a physician.

Ha5: There is a positive relationship between poor communication with patients and quality of Medical-care services of a physician.

Ha6: There is a positive relationship between requirements for longer staying in hospital and quality of medical-care services of a physician.

5 Research method

5.1 Research design

This study used a descriptive survey and causal explanatory design to decide the cause-and-effect relationship between a physician's quality of medical-care services and the factors affecting it.

5.2 Populations and Sample size

The total population of this study was 150 patients and patient-attendants who took part from hospitals run by the government, private and nonprofit organization where all these hospitals were in Dhaka City.

5.3 Instruments of data collection

This survey used a structured questionnaire. The first section of the survey-form collects organization and respondent information. Part two of the questionnaire holds the above found six items that affect the quality of medical-care services of a physician [12]. In other words, for respondents' assessments, or responses on dependent variable "quality of medical-care services" and on six independent variables namely i) Promotional impact of pharmaceutical product, ii) Lengthy prescription iii) Unnecessary test requirements iv) Spending less time v) Poor communication with patients and vi) Requirements for longer staying in hospital were

incorporated into the survey-questionnaire for data collection. Here each statement required the respondents to rate the attributes in the context of quality of services on a 5-point Likert scale.

5.4 Data analysis techniques

In the medical-care market, particularly in hospitals or in any other medical institution, physicians and nurses take care of their patients. So, this study concentrates only on physicians' roles in the medical-care market where physicians handle answering patients' questions, diagnosis the causes that have made them to be patients, writing prescriptions, and advising patients for ensuring better health-condition etc.

This study uses direct and indirect factors that influence physician's services to evaluate the quality of services. It is well recognized that the quality of medical-care services offered by a physician can be measured based on the feedback by the patient or patient's attendant [1]. Thus, this evaluation is based on factors that can influence a physician's roles such as a) answering patient questions b) diagnosis the causes that have made the individual to be patient c) writing a prescription and d) advising patients for ensuring better health-condition.

Obviously, physician's ability in subject area is not in question in this study. However, factors as mentioned above can influence a physician's roles even if the physician may or may not recognize it in practice. For analysis purposes, these factors [12] are denoted as follows:

Quality of medical-care-services = QMCS
Promotional impact of pharmaceutical product = PIPP
Lengthy prescription = LP
Unnecessary test requirements = UTR
Spending less time = SLT
Poor communication with patients = PCWP and
Requirements for longer staying in hospital = RLSH

So, the mathematical relationship between the dependent variable (QMCS) and the independent variables particularly PIPP, LP, UTP, SLT, PCWP and RLSH can be written as follows:

Quality of medical-care-services = QMCS = f(PIPP, LP, UTR, SLT, PCWP, RLSH).

In other words, QMCS = $f(x_1, x_2 \ldots x_6)$ where

x_1 = Promotional impact of pharmaceutical product = PIPP
x_2 = Lengthy prescription = LP
x_3 = Unnecessary test requirements = UTR
x_4 = Spending less time = SLT
x_5 = Poor communication with patients = PCWP and
x_6 = Requirements for longer staying in hospital = RLSH

In this study, the techniques ANOVA and OLS are used as follows:

Quality of medical care services (QMCS) = f(PIPP, LP, UTR, SLT, PCWP, RLSH)

So, the linear multiple regression equation is as follows:

QMCS = β_0 + β_1 PIPP + β_2 LP + β_3 UTR + β_4 SLT + β_5 PCWP + β_6RLST+ € where

QMCS is the dependent variable. β_i(where i = 0, 1, 2 .... 6) are the coefficients and € is an error variable and PIPP, LP, UTR, SLT, PCWP and RLSH are independent variables.

6 Findings and discussions

6.1 Demographic information of respondents

Survey questionnaires were distributed to 150 patients and patient-attendants in three hospitals (a government hospital, private hospital, and nonprofit runs hospital). However, 148 responses were collected where two respondents fell behind completing the Survey Form. The completed questionnaires were collected on the spot after completion by the respondents. Table 2 supplies respondent demographics where 75% respondents were patients, and 25% respondents were patient-attendants. Sixty-five respondents (65%) have bachelor's degrees.

Table 2 Demographic information on respondents

Character	Respondents' Profile	Frequency	Percentage
Education	Diploma	45	30.40
	Bachelor's degree	70	47.23
	Master's degree	33	22.30
Age	30 – 40 years	12	8.11
	41 – 50 years	22	14.86
	51 – 60 years	37	25.00
	61 – 70 years	77	52.02
Types of respondents	Patients	102	68.92
	Patient-attendants	46	31.08

6.2 Reliability

For ensuring the reliability of the data collection, the Cronbach's coefficient alpha (α) was used to evaluate the internal consistency among items included in each factor. As a general guideline, an instrument's internal consistency should be at least 0.70. Table 3 shows that all variables' alpha (α) values are greater than the threshold value. Therefore, the result shows that the questionnaire is more dependable.

Table 3 Reliability test

Variables	Number of items on the scale	Cronbach's on the Alpha	Decision
Quality of medical care services	8	0.924	Reliable
Pharm. products promotional impacts	10	0.824	Reliable
Lengthy prescription	10	0.735	Reliable
Unnecessary test requirements	10	0.905	Reliable
Spending less time	10	0.910	Reliable
Poor communication with patients	10	0.902	Reliable
Requirements for longer staying in hospital	10	0.914	Reliable
Overall	58	0.949	Reliable

6.3 Regression assumption tests

In this study data were checked for confirming Classical Linear Regression assumption before conducting the regression analysis, which is discussed in this section.

6.3.1 Test of normality

The Shapiro Wilk test is a non-graphical test whereby if the test results are insignificant i.e., above 0.05, it implies that the data used in this study follows the normal distribution. However, when the p-value for variable is less than 0.05 or equal to (p-value $\leq$ 0.05, which shows significant), it shows that the data is not good for the OLS analysis. On normality test here, the statistical measures are hypothesized as follows:

H_0: Normal distributed errors

H_a: Nonnormal distribution error

Table 4 Test of normality

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual	0.082	148	.015	0.989	148	0.325

The results obtained from the Shapiro-Wilk test in Table 4 show that all the variables had a p-value greater than (0.05). Therefore, it can be concluded that the residual value is normally distributed so that the regression analysis procedures have been fulfilled.

6.3.2 Test for multicollinearity

According to Gujarati and Porter (1999), explanatory variables should not show a high correlation with each other because that may cause unrealistic results during regression. The Variance Inflation Factor (VIF) and Tolerance were used in this study to see if there was a multicollinearity effect between the variables.

Ho: There is a multicollinearity problem

Ha: There is no multicollinearity problem

As shown in Table 5, all the VIF column values are less than ten, and Tolerance values are greater than ten, showing no multi-collinearity between the explanatory variables. As a result, we did not reject the null hypotheses. Here the VIF values should be less than 5 to guarantee collinearity is not an issue in your model.

Table 5 Collinearity statistics

Model	Collinearity Statistics Tolerance	VIF
Pharmaceutical products promotional impact	0.477	1.047
Lengthy prescription	0.567	1.140
Unnecessary test requirements	0.966	1.067
Spending less time	0.534	1.022
Poor communication with patients	0.433	1.011
Requirements for longer staying in hospital	0.943	2.08

Notes: Dependent variable: Quality of medical care services (QMCS)

VIF is the reciprocal of the tolerance value ; small VIF values shows low correlation among variables under ideal conditions VIF < 3. However, it is acceptable if it is less than 10. Hair *et al.* (2011) proposed that multicollinearity exists if the VIF value is greater than five and the tolerance value is below 0.20.

My view is that a VIF of even five indicates there is quite a problem with the independent variables being highly correlated with each other. Ten is absurdly high, which means it is exceedingly difficult to sensibly interpret the regression coefficients. It depends upon the model, in my case, I want to keep specific indicators and took "5" as the maximum level of VIF as a reference. The regression results lose meaning with levels of collinearity that high - indeed authors like Ringle say VIF of 5 is OK .... but if you are modelling a bunch of IVs that correlate with each other at like r = 0.80 or more it becomes pointless.

6.3.3 Correlation analysis

The Pearson correlation matrix result in Table 6 shows a positive correlation between the dependent and independent variables. The relationship between Quality of medical-care services and the predictor variables was found to be positively correlated and significant.

Table 6 Pearson correlation coefficient

	PIPP	LP	UTR	SLT	PCWP	RLH	QMCS
Pharm products promotional impact (PIPP)	1						
Lengthy prescription (LP)	0.001	1					
Unnecessary test requirements (UTR)	0.616**	-0.025	1				
Spending less time (SLT)	0.647**	0.022	0.536**	1			
Poor comm. with patients (PCWP)	0.091	0.205*	0.115	0.121**	1		
Requirements for longer staying (RLH)	0.172**	0.211*	0.211**	0.146	0.146	1	
Quality of medical care services (QMCS)	0.707**	0.402**	0.220**	0.634**	0.659**	0.502**	1

Notes: ** Correlation is significant at 0.01 level 2 tailed; * Correlation is significant at 0.05 level 2 tailed.

6.3.4 Multiple regression analysis

(1) Coefficient of determination

The coefficient of determination shows the proportion of variance in the dependent variable (QMCS) explained by the study's explanatory variables. Table 7 shows 78.1 % of the changes in the QMCS could be attributed to the combined effect of the predictor variables. However, 21.9 % of the variance is explained by other factors that are not covered in the study.

Table 7 Fornell-Lecker criterion

Model	R	R Square	Adjusted R Square	Std Error of the Estimate
1	0.888	0.788	0.781	0.30308

Notes: Predictors: PIPP, LP, UTR, SLT, PCWP and RLH; Dependent Variable: Quality of medical care services (QMCS)

(2) Overall significance of the model

The ANOVA tests whether the overall regression model fits the data well. If the p-value is $<$ 0.05, the regression model is a good fit for the data. So, Table 8 shows that the p-value < 0.05. Thus, it is found that the model is statistically significant with ($R^2 = 0.788$, $F(5, 142) = 105.773$, $p < 0.000$).

Table 8 Overall model fit

Model	Some of Squares	df	Mean Square	F-value	Sig.
Regression	48.579	5	9.176	105.773	0.000
Residual	13.033	142	0.092		
Total	61.633	147			

Notes: Predictors: PIPP, LP, UTR, SLT, PCWP and RLH; Dependent Variable: Quality of medical care services (QMCS)

(3) Hypothesis testing

A significant test is performed to decide whether independent variables influence the dependent variable. If the p-value is below 0.05, the results have a significant effect. The results of the significance test are shown in Table 9.

Accordingly, by looking down at the standardized beta coefficients column, it is observed that process ($\beta = 0.380$, $p < 0.000$), Promotional impact of pharmaceutical product (PIPP) with ($\beta = 0.373$, $p < 0.000$), Lengthy prescription (LP) ($\beta = 0.240$, $p < 0.000$), Unnecessary test requirement (UTR) ($\beta = 0.230$, $p < 0.000$), Spending less time (SLT) ($\beta = 0.230$, $p < 0.000$), (0.230), Poor communication with patient (PCWP) ($\beta = 0.378$, $p < 0.000$) and Request for longer staying in hospital (RLSH) ($\beta = 0.311$, $p < 0.000$) respectively is positively

Table 9 Variables' level of significance

Model			Standardized Coefficients Beta	t	Sig.
(Constant)	-1.791	0.382		-4.687	0.000
PIPP	0.331	0.050	0.373	6.678	0.000
LP	0.314	0.089	0.139	3.515	0.000
UTR	0.232	0.067	0.240	4.740	0.000
SLT	0.214	0.049	0.230	4.407	0.001
PCWP	0.255	0.040	0.378	4.441	0.000
RLH	0.321	0.021	0.311	9.471	0.000

Notes: Dependent Variable: Quality of medical care services (QMCS)

related to Quality of medical-care services offered by a physician in medical-care market in Bangladesh. Further, the 'sig' column tells whether the variable is making a statistically significant unique contribution. If $p < 0.05$, it shows that the variable is making a significant and unique contribution to the prediction of the dependent variable.

(4) ANOVA

The results of the ANOVA test are shown in Table 10. It has been seen that factors such Promotional impact pharmaceutical products, Lengthy prescription, Unnecessary test results, Spending less time, Poor communication with patient and Requirement for longer staying in hospital had the value of an insignificant value of more than 0.05, showing the same point of view about the factors influencing Quality of medical-care services of a physician in medical-care market in Bangladesh.

Table 10 ANOVA results

Variables		Sum of Squares	df	Mean Square	F-value	Sig.
PIPP	Between Groups	0.036	2	0.018	0.033	0.967
	Within Groups	78.581	145	0.542		
	Total	78.617	147			
LP	Between Groups	0.041	2	0.020	0.256	0.782
	Within Groups	12.004	145	0.083		
	Total	12.044	147			
UTR	Between Groups	0.075	2	0.038	0.083	0.921
	Within Groups	65.076	145	0.438		
	Total	65.077	147			
SLT	Between Groups	0.092	2	0.046	0.094	0.910
	Within Groups	71.081	145	0.490		
	Total	71.087	147			
PCWP	Between Groups	0.802	2	0.401	0.096	0.384
	Within Groups	60.306	145	0.445		
	Total	60.022	147			
RLH	Between Groups	0.911	2	0.341	0.098	0.546
	Within Groups	78.001	145	0.556		
	Total	78.022	147			

7 Discussion and interpretation of the findings

The model analysis results revealed that the entire hypothesis in the Quality of medical-care services is significant and makes a unique contribution to the prediction of the dependent variable. This finding is supported by the study of (Juran, 1992; S. Shanmugapriya and Subramanian, 2015). The summary of the regression model and hypothesis test is presented in Table 11.

8 Conclusion

Based on statistical analysis, this study aims to decide the factors that are introduced in literature by the current author on affecting the quality of medical-care services offer by a physician in today's medical-care market country-wise such as Bangladesh. It further examines and describes the relationship among the factors and then decides its influence affecting the physician's quality of medical-care services. Here primary data was collected from patients and patient-attendants in different private and government hospitals found in Dhaka City. This data statistics are used in this study for quantitative research approaches to conduct the goals. The dependent variable "quality of medical-services (PQMCS)" is regressed on six explanatory variables: a) pharmaceutical products promotional impact b) lengthy prescription c) unnecessary

Table 11 Summary of Hypothesis Testing

Hypothesis		P-value	Decision
Ha1:	There is a positive relationship between promotional impact of pharma products and physician's quality of medical-care services.	0.000	Accepted
Ha2:	There is a positive relationship between lengthy prescription and a physician's quality of medical-care services.	0.000	Accepted
Ha3:	There is a positive relationship between unnecessary test requirements and the quality of medical-care services of a physician.	0.000	Accepted
Ha4:	There is a positive relationship between spending less time and quality of medical-care services of a physician.	0.000	Accepted
Ha5:	There is a positive relationship between poor communication with patients and quality of medical-care services of a physician.	0.000	Accepted
Ha6:	There is a positive relationship between requirements for longer staying in hospital and quality of medical-care services of a physician.	0.000	Accepted

test requirements d) spending less time e) poor communication with patients and f) requirements for longer staying in hospital (private hospitals cases) etc. These characteristics were gathered from survey-opinions of patients and patient-attendants. These data statistics are used to decide the validity of the model. All multiple regression assumption tests were found to be valid. According to regression analysis, it was found that each of the explanatory variables have a substantial negative impact on a physician's quality of medical-services in the medical-care market. The analysis from one-way ANOVA reveals that patients and patient-attendants have similar feelings of the six independent variables that undermine a physician's quality of medical-services on duty. Results from this study can be used by policymakers as well as leaderships of hospitals (government and private) for policy-design and for administrative approaches addressing today's problem of medical-care market in Bangladesh. Since most physicians are employed either in government or in private sector or in both sectors, it is obvious that enforcing effective management systems can be instrumental curtailing the magnitudes of the problem soon. Obviously, in this case both government & private hospitals must work together for the interest of Bangladeshi-society, which can ensure quality & sustainable medical-care market soon in Bangladesh. The findings of this study can be a synopsis of medical-care services in today's business-driven world country-wise where undertaking further study on policy-design can be instrumental.

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RESEARCH ARTICLE

Research on the impact of artificial intelligence on the employment environment of labors in China

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Abstract: Purpose: The development of artificial intelligence technology can undoubtedly trigger profound changes in the labor market. Empirical analysis of the impact of artificial intelligence on the employment environment and its mechanism can propose effective paths to optimize the employment environment, which can effectively promote the improvement of the employment environment for Chinese labors and the stability of the employment situation. Based on the limitations of the development of artificial intelligence technology in China, this study focuses on studying its impact on the employment environment in the short term, and the long-term effects on the employment environment in China will become the author's future focus and research direction. Methodology: This study uses quantitative research methods, based on Panel data of 30 provinces in China from 2009 to 2019, and uses program computer software Stata 17.0 for data processing and empirical analysis. Conclusion: AI technology has a significant positive role in promoting the employment environment, and the new Information infrastructure represented by the Internet is conducive to promoting the positive moderating of AI on the employment environment. Through further research, it was found that the employment environment improvement effect of AI technology has regional differences, with a greater impact on the employment environment in the eastern region than in the western region, while the impact on the central region is not significant.

Keywords: AI technology, employment environment, information infrastructure, empirically analysis

1 Introduction

As one of the typical representatives of scientific and technological innovation achievements, AI is highly valued by the Chinese government. In a certain sense, this has formed a guiding role for the development of AI. Just as industrial automation upgrades in the past have changed the entire labor market, AI will have the same effect. WordSmith, an AI editor at The Associated Press, a New York news agency, and ROSS, an artificial intelligence lawyer in San Francisco are just real cases where AI technology improves work efficiency and then triggers changes in the labor market . In terms of research on the impact of AI on jobs, domestic and foreign scholars have made more in-depth research on employment impact, which is mainly reflected in the employment Substitution effect and creation effect of AI [1, 2]. The impact of AI on total employment depends on the relative strength of the two effects, that is, the result of the net effect. This is where scholars currently have great disagreements. Although the impact of AI technology on total employment is uncertain, relevant scholars have reached a consensus on the conclusion that it has a heterogeneous impact on the employment structure. For labor groups of different genders, skills, regions, and industries, the effect and degree of AI 's impact on them are not the same [3–5]. The study of the impact of AI on the labor force is, in the final analysis, the study of the impact of changes in human demand, while the employment environment reflects the relationship between people and labor materials. Therefore, while AI affects the labor market, it will inevitably cause changes in the employment environment. The notice of the State Council on printing and distributing the "14th Five-Year Plan" employment promotion plan mentioned: "The application of intelligent technologies such as AI is accelerating, and the employment substitution effect continues to appear; the international environment is becoming increasingly complex, and the instability and uncertainty have increased significantly. Potential shocks need to be vigilant and guarded against. By optimizing the employment environment of laborers, the level of income and protection of rights and interests of laborers should be improved. The working conditions of laborers should be improved, the protection of rights and interests of laborers should be strengthened, and the sense of gain and satisfaction of laborers should be enhanced, so that the majority of laborers can achieve decent Labor and all-round

development" [6]. Therefore, it is urgent and realistic to take the effect of AI on the employment environment of laborers as the subject of research.

This article is based on the entire macroeconomic level of China and focuses on research issues. Panel data from 30 provinces in China from 2009 to 2019 are selected to empirically analyze and test the impact of artificial intelligence technology on the employment environment. This research will not only enrich the understanding of the relationship between intelligence and employment, make up for the insufficient research on external constraints (employment environment) of labor employment in existing literature, but also conduct further empirical tests on the impact of artificial intelligence technology on the overall employment environment in China, and identify the moderating factors of the relationship between the two variables. Finally, based on its mechanism process, it is hoped to provide reference for the relevant policy formulation of the Chinese government, To achieve a perfect match between artificial intelligence and Chinese labor, and promote the positive development of China's labor force.

2 Literrature review and reseach hypothesis

The task model introduces factors such as industrial robots, automation, and artificial intelligence into the production function, so that macroeconomists can analyze the far-reaching impact of these revolutionary production methods. Zeira (1998) [7] was one of the pioneers of the task model, which introduced the use of machines into theoretical models for analyzing economic growth. Acemoglu & Restrepo (2017, 2018a, 2019) [8–10] further developed the task model on this basis.

Research on the employment impact of AI on jods is divided into pessimists and optimists. Schumpeter's theory of "destructive creation" believes that technological innovation is the source of economic growth, while low-end tasks will continue to be eliminated. Faced with the computerization of work tasks, future jobs, especially occupations involving low-skilled and repetitive tasks, face the risk of automation [11]. The effect and probability of technological substitution are greater, thus showing the polarization of the labor market [12]. Optimists believe that AI can replace some mechanically repetitive tasks, but the essence of human work is a combination of creativity and complexity, and this kind of work cannot be replaced. The skill compensation theory and the Means-Ends Theory (Means-Ends Theory) also believe that the development of AI is a means, although it will bring about the reduction or transfer of some employment, but by creating new demand for skills, it will make some Laborers' skills are enhanced and better job opportunities are provided, with the ultimate goal of improving productivity and quality of life. George et al. (2018), Autor (2019) believe that the demand for new skills stimulated by AI may promote the transfer of labor with traditional vocational skills replaced by AI to emerging fields; John Markov in "with In the article *'Robots Dancing Together – The Future of the Era of AI'*", it is mentioned that when robots become sufficiently complex, they will be neither servants nor masters of humans, but partners of humans, and coexistence will be achieved through human- machine collaboration.

There is a virtuous circle relationship between employment environment and employment quality . Regarding the research on the impact of AI on the employment environment of laborers, there is little research in the frontier literature, and no systematic answer has been given. From the perspective of practitioners, some scholars have studied the impact of AI applications on their employment quality, using objective indicators of income level, working hours, and subjective indicators of career development and working status as the definition and measurement standards [13], studies have shown that the use of AI technology in human resource management by enterprises can improve the employment quality of HR practitioners. The dependent variable in the study can also be seen as a reflection of the individual worker's micro-employment environment in a particular workplace or organization. At the research level from a macro perspective, Chen et al. (2022) [14] regard the employment environment as an important positive evaluation indicator of the comprehensive level of employment quality , so the impact on employment quality can reflect the effect on employment environment to a certain extent. Empirical research shows that AI has a significant effect on promoting employment quality. Another empirical study found that the development and application of AI technology can significantly improve the employment environment of laborers; and play a mediating effect through the level of urbanization and labor factor income [15].

Based on the macro level, this study studies the impact of AI on the employment environment of laborers. The macro employment environment of laborers refers to the impact of the macroeconomic environment on employment, including national policies, economic environment, industrial structure, social security and other factors. Countries around the world have promoted AI to the national macro-strategy level, which is enough to see the impact of AI on the formulation of relevant national policies. It is generally believed that AI can promote the

improvement of management efficiency, resource allocation efficiency and social transaction efficiency, promote innovation and improve total factor productivity, and promote economic growth by increasing productivity [16]. Most business research institutions believe that thanks to the development and penetration of AI technology, the economic growth rate of countries around the world has increased significantly. By 2030, the global GDP is expected to grow by about 12% [17]. As an important driving force leading a new round of scientific and technological revolution, AI has mature technologies in learning and information processing. It integrates with traditional industries, generates new industrial models and promotes the transformation of traditional industries, and accelerates the upgrading of industrial structures, thereby affecting The market environment for labor employment. The penetration of information network technology and AI technology has made its application in social security more and more. The 24*7 automatic front-end support ensures that customers can query information at any time. The introduction of intelligent chat robots satisfies customers. The demand for personalized online services has improved the quality of intelligent social security services to a certain extent. In summary, this paper proposes the following hypotheses:

H1: Artificial intelligence technology can promote the improvement and enhancement of the employment environment for Chinese laborers.

Information infrastructure refers to the general term for the physical and software components used to support the flow, storage and processing of information. The goal of information infrastructure is to provide a reliable, secure, efficient and scalable information technology environment. In terms of intelligence, information infrastructure plays a key role, providing support for intelligent applications and providing the basis for intelligent decision-making and forecasting. Information infrastructure drives developments in areas such as AI, the Internet of Things, and big data. The application of information infrastructure has greatly liberated human labor, and at the same time led to the transformation of the job market, ultimately affecting the entire macro employment environment. Therefore, this paper puts forward the following hypothesis:

H2: The relationship between artificial intelligence technology and the employment environment of labors is often influenced by the construction of new information infrastructure, and this moderating variable has a positive moderating effect. (see Figure 1)

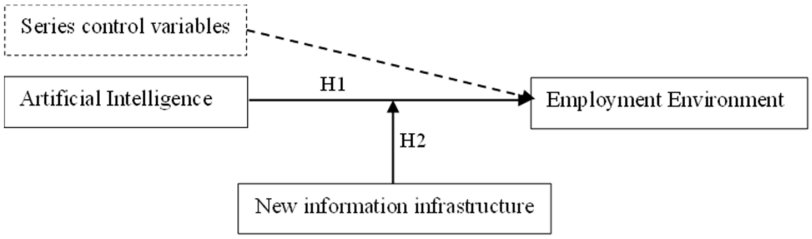

Figure 1 Research model

3 Research materials

3.1 Model setting

In order to test the impact of AI technology on China's employment environment, that is, the rationality of hypothesis H1, Drawing on the practice of Yang and Hou (2020), the measurement benchmark model is set as follows:

$$\mathrm{EV_{it}} = \alpha_0 + \alpha_1 \ln \mathrm{robot\_dens_{it}} + \sum \beta \mathrm{kControl_{it}} + \mu_\mathrm{i} + \mathrm{v_t} + \epsilon_\mathrm{it} \quad (1)$$

In the above model, i and t represent region and time respectively, EV is the explained variable employment environment, robot_dens is the explanatory variable AI technology level, Control is a set of control variables, μ and v represent region and year fixed effects respectively, ϵ represents the residual error estimated by the model. Through this model, it can be seen that it is a linear function of the employment environment (EV)and artificial intelligence technology (robot_dens). To ensure a clear study of the causal relationship between research variables, other series of variables that affect the employment environment of workers are added to the research model as control variables. The impact of the level of artificial intelligence technology on the employment environment depends on the positive and negative values of α_1, which is also one of the research purposes of this article. Based on the H1 in the chapter2, assuming α_1 is positive, artificial intelligence technology can effectively promote the improvement of the employment environment for labors. That is, the higher the level of artificial intelligence technology, the more perfect the employment environment.

3.2 Variables setting

3.2.1 Explained variable: employment environment

The employment environment can be defined as an overall assessment of the job market and various factors in the labor market in a country or region. These factors include government policy, economic development, industry structure, human capital, labor market and so on. A good employment environment can increase the employment rate, reduce the unemployment rate, increase salary levels and career development opportunities, thereby improving the quality of life of individuals and social and economic welfare.

There is no uniform measurement standard for the employment environment in the frontier literature. Some scholars describe the employment environment from the aspects of wage income differences, education expenditures, regional economic development level, labor employment structure, and transportation facilities [18, 19]. Therefore, this study combines the definition of the employment environment and the achievements of previous scholars to measure the macro-employment environment of a certain region from the aspects of employment (unemployment) rate, income level, and economic growth. Among them, economic development is expressed by per capita GDP and the proportion of tertiary industry GDP; labor market conditions are expressed by the gap between per capita income and national per capita income, and urban registered unemployment rate; social security is expressed by the level of social welfare (using urban basic medical care Insurance participation rate), transportation convenience (measured by the ratio of traffic passenger volume to the country's total population in that year). This paper calculates the weights of various indicators based on the entropy method, and uses the linear weighting method to calculate the comprehensive effect of the panel data corresponding to the employment environment to obtain the final comprehensive value of the employment environment.

3.2.2 Explanatory variable: AI

Looking back at previous literature research, there is no unified standard in China for the measurement of the level of AI technology in the entire macro economy . Some scholars have drawn on the practice of Jeff & Mi-chael, using "information transmission, computer services, and software industry-wide fixed asset investment" to measure the development level of AI. These investments can reflect the role and impact of AI in the economy. Of course, this indicator does not fully reflect the development level of AI technology, because investment does not necessarily equal the level of technology. Some scholars use the density or penetration of industrial robots as proxy variables for AI. For example, Lv et al. (2017) [20] used the density of industrial robots to measure the degree of automation of industrial manufacturing in a country or region. Han et al. (2020) [21] used the robot penetration index to measure the distribution density and use degree of industrial robots in a certain area. The penetration of industrial robots reflects the distribution density and use degree of industrial robots, and can more directly reflect the current level of AI development in my country. Therefore, this paper uses the installation density of industrial robots to measure the development level of AI. Referring to the method of Kang (2021) [22] and Lu (2021) [23], firstly, according to the installation volume of industrial robots in various industries in China announced by the IRF Alliance, and then collect the employment numbers of each province in the subdivided industries from the "China Labor Statistical Yearbook". As a percentage of total employment, use this percentage x the number of robot installations in various industries across the country.

3.2.3 Control variables

In order to identify the effect of AI technology as much as possible, this paper introduces a series of control variables based on cutting-edge research. Specifically include: socio-economic growth rate (GDP (%)), represented by the growth rate of the annual regional GDP, R&D investment level (R&D), represented by the ratio of regional R&D expenditure to GDP, social welfare level (sec) , land use The proportion of social security and employment expenditure in the fiscal expenditure of the district government indicates that the social urbanization level (urb), Expressed by the proportion of the urban population in the total population at the end of the year, the education input level (edu) is expressed by the ratio of the regional financial education expenditure to the total fiscal expenditure, and the consumption level of residents (cons) is expressed by the per capita consumption of the regional resident households as a percentage of the disposable income The proportion of the foreign investment level (fdi), expressed by the ratio of the region's foreign direct investment to GDP

3.3 Data source and description

Since 2020, the global outbreak of the new crown pneumonia epidemic has caused a huge impact on the world economy. The Chinese economy has not been spared. All major economies

have experienced a sharp drop in economic growth, which has also had a huge negative impact on the employment environment. Therefore, in order to exclude the interference of the new crown pneumonia epidemic on China's employment environment, the research sample data selected in this paper is the data of 30 provinces (autonomous regions and municipalities) in China from 2009 to 2019. Among them, the data needed to measure the employment environment come from the "China Statistical Yearbook" and "China Labor Statistical Yearbook". Through the official website of the National Bureau of Statistics of China, enter the keywords "Statistical Yearbook" and "Labor Statistical Yearbook" to obtain statistical data for each year and column, and extract the measurement data involved in the variables in the model. At present, industrial robots are the key field of AI technology application, so the industrial robot data required to measure the level of AI technology comes from the International Federation of Robotics (IFR). The data needed to measure moderator variables come from the China Internet Development Statistical Report issued by China Internet Network Information Center every year, The data was collected from the official website of the China Internet Information Center. Table 1 shows the descriptive statistics of each variable. It can be seen from the table that the technical level of AI has a minimum value of 3.874 and a maximum value of 11.87, implying that there are obvious differences in the level of AI in various regions; in addition , the minimum value of the employment environment is -0.211 and the maximum value is 0.526 , the average value is 0.0357, which can reflect the large gap in employment environment among regions.

Table 1 Descriptive statistics

Variables	Obs	Mean	Std. Dev.	Min	Max
EV	330	0.0357	0.1810	-0.2110	0.5260
lnrobot dens	330	7.8850	1.5610	3.8740	11.8700
GDP	330	0.1060	0.0731	-0.2500	0.2990
R &D	330	0.0159	0.0110	0.0034	0.0631
sec	330	0.1290	0.0322	0.0577	0.2750
urb	330	0.5640	0.1280	0.2990	0.8960
edu	330	0.1640	0.0253	0.0989	0.2220
cons	330	0.7150	0.0528	0.5620	0.8940
fdi	330	0.0157	0.0230	0.00033	0.1460

4 Research methods

4.1 Correlation analysis

By conducting correlation analysis between independent and dependent variable elements, the degree of correlation between the two variable factors can be measured. Because there needs to be a certain connection or probability between the elements of correlation in order to conduct correlation analysis. However, it should be noted that correlation does not equal causality, and further analysis is needed to determine the specific relationship between variable elements. Correlation analysis is often the first step in conducting empirical research.

4.2 Multicollinearity test

Multicollinearity refers to the distortion or difficulty in accurately estimating the explanatory variables in a linear regression model due to the existence of precise or highly correlated relationships between them. In this study, multicollinearity tests were conducted to determine whether the independent variable is highly correlated with each control variable, and whether the explanatory variable has an independent impact on the dependent variable.

4.3 Benchmark regression analysis

Benchmark regression analysis is a non-linear regression that can be used to evaluate the accuracy of models or data, as well as to calculate the parameters of variables in benchmark regression models, in order to conduct empirical analysis of regression results. By performing benchmark regression on the research model, the coefficients of the explanatory variable (artificial intelligence technology level) are obtained, and the impact of the Explained variable (employment environment) on the dependent variable is judged based on the sign, size, and significance of the coefficients.

4.4 Heterogeneity analysis

Heterogeneity refers to heterogeneity and complexity, including temporal and spatial heterogeneity. Heterogeneity analysis focuses on the temporal and spatial distribution patterns of elements. This research focuses on 30 provinces in China as research samples. Due to China's

vast territory, uneven economic development, and different market environments in different regions, there are differences in the response and acceptance of artificial intelligence technology in different regions, leading to differences in the employment environment for workers. To ensure the accuracy of the research results, it is necessary to conduct spatial heterogeneity analysis on the development level and employment environment of artificial intelligence in various regions of China.

5 Empirical nanlysis

5.1 Correlation analysis and multicollinearity analysis

Correlation analysis was carried out on the main variables in the study, and the correlation coefficients among the variables are shown in Table 2. Among them, the correlation coefficient between the level of AI and the employment environment is 0.522, which can preliminarily show that the application of AI is related to changes in the employment environment. Except for the main explanatory variable, the level of AI, the correlation between the relevant control variables and the employment environment is relatively high , such as socioeconomic growth rate, R&D investment, social security, urbanization, resident consumption and foreign investment. According to Table 3, the average VIF value of the explanatory variables is $2.31 < 5$, and the 1/VIF of each variable is less than 1, indicating that there is no multicollinearity problem in the strict sense between the explanatory variables and the control variables. The contribution of the variable to the employment environment of the explained variable is independent and significant, and the prediction effect of the model will be more reliable and accurate.

Table 2 Correlation analysis of main variables

	EV	lnrobot_dens	GDP	R&D	sec	urb	edu	cons	fdi
EV	1								
Lnrobot_dens	0.522***	1							
GDP	-0.159***	-0.294***	1						
R&D	0.751***	0.478***	-0.0680	1					
sec	-0.286***	-0.0390	-0.284***	-0.157***	1				
urb	0.799***	0.475***	-0.232***	0.786***	-0.104*	1			
edu	0.0750	0.259***	0.129**	-0.0160	-0.495***	-0.242***	1		
cons	-0.216***	-0.184***	-0.129**	-0.194***	0.118**	-0.0700	-0.351***	1	
fdi	0.705***	0.525***	-0.0400	0.538***	-0.334***	0.580***	0.103*	-0.219***	1

Note: *, ** and *** are at the significance level of 10%, 5% and 1% respectively. The following tables are the same.

Table 3 Multicollinearity analysis

Variables	VIF	1/VIF
urb	4.19	0.238505
R&D	3.05	0.328142
edu	2.46	0.406522
lnrobot_dens	2.15	0.46436
fdi	2.06	0.48602
sec	1.97	0.508475
GDP	1.34	0.747313
cons	1.27	0.785805
Mean VIF	2.31	

5.2 Benchmark regression results

In the choice of measurement method, after the Hausman test, prob $>$ chi2 = 0.0622 < 0.1, that is, at the 10% significance level, the null hypothesis that the coefficients of the random effect model and the fixed effect model are similar is rejected, that is, the fixed effect model is adopted, combined with The subject of this research is to use year fixed effects for analysis. Based on the setting of model (1), this paper conducts an empirical test on the basis of panel data from various provinces (autonomous regions and direct-controlled regions) in China. Table 4 reports the benchmark regression results. Only artificial In the case of the single influence of intelligent technology, the regression coefficient (0.007) of the main explanatory variable AI technology level is significant at the 1% level and the direction is positive. In addition, the regression coefficient (0.024) of the AI technology level is still It is significant at the 1% level and the direction is positive, which indicates that the level of AI does show a significant positive correlation with the employment environment, and that a 1% increase in the level of AI technology will improve the employment environment of laborers by 0.024%. Therefore,

Table 4 Fixed-effect benchmark regression

Variables	(1) EV	(2) EV
lnrobot_dens	0.007***	0.024***
	(17.35)	(6.68)
GDP		-0.169
		(-1.19)
R&D		4.075***
		(7.30)
sec		0.242
		(1.33)
urb		0.693***
		(11.65)
edu		1.554***
		(8.01)
cons		-0.191
		(-1.61)
fdi		2.579***
		(6.93)
Constant	-0.536***	-0.342**
	(-16.26)	(-2.45)
N	330	330
R-squared	0.245	
		0.784
province FE	YES	YES
Year FE	YES	YES

the hypothesis H1 is supported by empirical evidence. Further considering regional economic factors, the results show that regional economic factors and resident consumption levels have no significant impact on the employment environment; however, the regression coefficient of R&D input factors shows significant at the 1% level and the direction is positive , indicating that in the case of sufficient government R&D investment, the level of AI technology has a greater positive impact on the employment environment. Similarly, regional governments increase investment in social welfare, the improvement of urbanization levels, investment in education, and foreign investment The increase will help to improve the employment environment.

5.3 Moderation effect test

Information infrastructure (inter), including the carrier of data interaction and storage, computing power and network communication, provides the basic conditions required for the realization of AI. The level of information infrastructure construction reflects the quality of the macro-intelligent environment to a certain extent. The Internet is an important symbol of the information age. Scholar Tan (2022) [24] selected the Internet penetration rate to measure the construction level of new infrastructure, in order to test the effect of AI on the quality of employment. Among them, the Internet penetration rate is represented by the ratio of the number of Internet broadband households to the total population. Combined with the realization of the functions of the information infrastructure, this study will refer to Tan Yusong's measurement standards, choose the Internet penetration rate to represent the level of new infrastructure, and express it by the ratio of the number of Internet users to the total population of the year.

In the baseline regression, it has been found that the development of AI level can promote the improvement of employment environment. On the basis of this conclusion and the previous theoretical analysis, we explore in-depth research on the external dependence conditions of AI affecting the employment environment. This study introduces information infrastructure to examine how it affects the effect of AI technology on the employment environment, that is, to verify the hypothesis that H2 can is not supported by empirical evidence. Using the method of interaction items to investigate the path of AI technology affecting the employment environment, the specific econometric model is set as follows:

$$\begin{aligned} \mathrm{EV}_{\mathrm{it}} =& \alpha_0 + \alpha_1 \ln robotdens_{\mathrm{it}} + \theta inter_{\mathrm{it}} + \rho inter_{\mathrm{it}} * lnrobotdensit + \sum \beta k Control_{\mathrm{it}} \\ &+ \mu_{\mathrm{i}} + \mathrm{v_t} + \varepsilon_{\mathrm{it}} \end{aligned} \tag{2}$$

Among them, inter it is the adjustment variable, which is represented by the regional Internet penetration rate. At the same time, the cross term of inter and lnrobot_dens it is used as the explanatory variable, and the other variables are completely consistent with the model (1).

Based on the test of model (2) and sample data, in the mechanism test, the interactive relationship between the independent variable and the moderator variable is encoded as the

variable M. According to the test results (Table 5), the coefficient of the interaction term between information infrastructure and AI technology is significantly positive at the statistical level of 1% and 5% respectively under the condition of a single main explanatory variable and the introduction of control variables, which means that information infrastructure is positive Adjusting the effect of AI technology on the employment environment of laborers, that is, confirming the establishment of hypothesis H2.

Table 5 Mechanism test

Variable	(1) EV	(2) EV
M	0.028***	0.001**
	(1.07)	(2.77)
lnrobot_dens	0.050**	-0.037
	(2.43)	(-1.43)
GDP		-0.041
		(-0.58)
R&D		4.701
		(1.40)
sec		-0.438*
		(-1.75)
urb		0.897***
		(3.54)
edu		-0.109
		(-0.29)
cons		-0.130
		(-0.90)
fdi		-0.814***
		(-3.33)
Constant		-0.137
		(-0.71)
N	330	330
R-squared	0.320	0.488

Table 6 Heterogeneity Analysis

Variables	(1) EV	(2) EV	(3) EV
lnrobot_dens	0.003***	0.000	0.041**
	(0.34)	(0.03)	(5.17)
GDP	0.044	-0.242**	-0.04
	(0.28)	(-2.00)	(-0.50)
R&D	5.044***	-3.717	-2.990**
	(3.70)	(-1.26)	(-2.12)
sec	0.259	-0.732	0.384*
	(0.64)	(-1.41)	(1.72)
urb	0.530***	0.825***	0.341***
	(2.68)	(3.96)	(3.07)
edu	1.370*	-0.004	0.02
	(1.87)	(-0.01)	(0.06)
cons	-0.168	-0.627***	0.249**
	(-0.70)	(-3.03)	(2.33)
fdi	1.716***	17.713***	-8.594***
	(3.87)	(3.75)	(-2.96)
Constant	-0.505**	0.028	-0.698***
	(-2.02)	(0.12)	(-5.50)
Observations	121	99	110
R-squared	0.700	0.384	0.577
F test	0	3.76E-07	0
r2_a	0.678	0.329	0.543
f	32.61	7.006	17.22

6 Heterogeneity analysis

The Benchmark regression conclusion confirms the positive promotion effect of AI technology on the employment environment of Chinese laborers. In order to further explore the impact of AI technology on the employment environment, whether there are individual characteristics due to regional differences. Further in accordance with the regional division standards in the field of economics research, China's 30 provinces (autonomous regions and municipalities directly under the central government, excluding Tibet) are divided into three regions: eastern,

central, and western. Table 6 reports the test results of regional heterogeneity in each province, where columns (1), (2) and (3) are the regression results of the eastern, central and western regions, respectively. Column (3) The regression coefficient of the effect of AI technology on the employment environment is significantly positive at the 5% level, indicating that AI technology has a positive effect on the improvement of the employment environment in the western region. Column (1) The effect of AI technology on employment The regression coefficient of the environment is significantly positive at the 1% level, indicating that AI technology has significantly promoted the improvement of the employment environment in the eastern region; the significance is higher than that in the western region. Column (2) is an empirical test in the central region. It can be seen that the coefficient of the level of AI technology is not significant, indicating that AI technology will not help improve the employment environment in the central region.

7 Conclusion and recommendations

Based on the data of 30 provinces in China from 2009 to 2019, this paper empirically analyzes the impact of AI technology on the employment environment of Chinese laborers . A three-dimensional employment environment system including regional economy, labor market, and social security is constructed, and the entropy weight method and linear weighting method are used to measure the comprehensive effect value of the employment environment in various provinces in China; the AI technology level uses the installation density of industrial robots in each region as the index. measurement standard. According to the empirical analysis results, AI technology has a significant positive effect on the employment environment of Chinese laborers. Specifically, a 1% increase inthe level of AI technology will improve the employment environment of laborers by 0.024%. Among them, the new information infrastructure represented by the Internet in various regions will help promote the role of AI technology in promoting the employment environment. A further empirical analysis of the employment environment found that: there are significant differences in the impact of AI technology on the employment environment in the eastern, central, western and northeastern regions . The effect of region is not significant.

Combined with the above research conclusions, in order to promote the high-quality growth of China's economy and at the same time ensure the stability of the employment environment for laborers, the following policy suggestions are put forward: Firstly, the government should formulate relevant legal and regulatory frameworks that adapt to the development of AI to ensure that the rights and interests of laborers are protected . Protection, from aspects such as employment contracts, working hours management, data privacy and security. The government should plan ahead, predict the evolution trend of intelligent technology and its impact on the employment environment, and grasp the opportunities to respond. Secondly, enterprises should strengthen cooperation with government departments, educational institutions, trade unions and industry organizations from the perspective of macroeconomics to jointly cope with the challenges brought about by technological development. For laborers, enterprises should also pay attention to the reserve of human capital and invest in technical training, digital literacy and innovation capabilities, so that laborers can better adapt to changes in their work. Thirdly, to strengthen the construction of the social security system to ensure that laborers can still enjoy basic or more advantageous social security and benefits in the era of AI, including the establishment and improvement of adaptive unemployment relief, medical insurance, pension and other welfare mechanisms. More attention should be paid to job transfer and retraining support for skilled laborers , including support such as career counseling, skill conversion training, loans and subsidies, to provide opportunities for laborers affected by AI to transform, and to avoid the rich and poor caused by AI technology widening gap. The fourth is to accelerate the new information infrastructure, promote the process of digital, networked, and intelligent development of Chinese society, deepen the application in the fields of transportation, manufacturing, medical care, and life services, and promote the economic reform and development of the industry while steadily improving labor. The improvement of objective employment environment and subjective employment environment perception.

In addition, compared to developed Western countries, artificial intelligence technology in China has made breakthroughs and developed slightly later. Although the current momentum is strong, it is still in its early stages. Considering that this study is based on relevant data from various provinces in China from 2009 to 2019, and the data collection is limited, this study only analyzes the short-term effects of artificial intelligence technology on China's labor employment environment, and the long-term effects have not yet been studied.

Given the increasing aging population in China, the quantity advantage of Chinese labor force will become history, and the application of artificial intelligence technology in the labor

market will become more widespread. According to the author's prediction, in the long run, the economic benefits brought by artificial intelligence technology may compensate for short-term costs. The new round of technological revolution led by artificial intelligence technology may improve the employment environment of Chinese labor to a greater extent, this issue will also become a future research direction.

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