



Structural Equation Model Evaluating Katz's Triplet Managerial Skills and Its Relationship to Human Capital

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Received : December 5, 2023

Revised : December 14, 2023

Accepted : December 15, 2023

Online : December 29, 2023

Abstract

This study examines the structural equation model that assessed the relationship of technical skills, conceptual skills, interpersonal skills, and human capital in the food processing industry. The research utilized a model fit, construct reliability, and validity structural equation modeling technique following the reviewed literature. The 204 samples were selected from food processing entrepreneurs in Metro Manila, Philippines. Questionnaires with rating scales were used as research tools, and a random sample procedure was used. A confirmatory factor analysis was used for analyzing model fit, reliability, and validity. A structural model and path analysis were used to examine the link. According to the findings, the model perfectly fits the factual data and indicates an admissible level of validity and reliability. The results positively correlated with Technical Skills, Conceptual Skills, and Interpersonal Skills. Moreover, Human Capital acted as an additional variable to test its relationship with Katz's triplet Managerial Skills, and the findings indicate that Technical Skills, Conceptual Skills, Interpersonal Skills, and Human Capital are correlated. Based on these results, there is a need to augment the technical expertise and conceptual skills pertaining to food processing and offer training that focuses on cultivating interpersonal skills, particularly proficient communication. To improve human capital, it is important to adopt strategies that enhance employee performance. These encompass enhancing proficiency in marketing, financial management, production management, and opportunities for advancement. Future studies should employ qualitative or mixed methods to thoroughly explore the study.

Keywords *Katz's Triplet Managerial Skills, SEM, human capital, food and beverage processing industry*

INTRODUCTION

The food processing sector, which encompasses food and beverage processing, is the most dominant primary industry in the Philippines. In 2022, the manufacturing of food products in the Philippines generated a gross value added of roughly 1.8 trillion Philippine pesos ([Statista Research Department, 2023](#)). The food processing industry is currently the most important contributor to food production, as it exists to satisfy the growing population's demand for food. The food processing industry is currently a significant contributor to food production.

Consequently, many food manufacturing industries are currently under unparalleled pressure to implement numerous sustainable technologies, innovate, and meet stringent productivity and performance standards ([Hassoun et al., 2022](#); [Chakka et al., 2021](#)). The majority of businesses are owned by a sole proprietor, which is typical of micro, cottage, and small businesses. The food processing industry encompasses several key sectors, namely fruits and vegetables, fish and marine products, meat and poultry products, flour and bakery products, beverages and confections, dairy products, food condiments and seasonings, food supplements, bottled water, food snacks, and oils and fats. As a result of increased trade liberalization, a wide variety of imported processed foods are now readily available on the market, making it difficult for local food processors to maintain market share and introduce new products. The industry contributes roughly 30% of the annual GDP ([Oxford Economics, 2021](#)). Domestic processors encounter numerous obstacles, including one of the highest energy costs in Asia, the need for

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technological improvements and packaging innovations to become more competitive globally, inadequate post-harvest and storage facilities, and insufficient farm-to-market transportation infrastructure.

As indicated in the report of the [Philippine Institute for Development Studies \(2018\)](#), the economic performance of microfood industries has been hampered by low productivity levels and increased assembly efforts. It could be argued that the primary driver of growth and development is not external support but rather the organization's DNA, its preparedness and receptivity to internal learning, and the pursuit of creative activities to transform and thrive in a challenging environment. One good example is being innovative in terms of strategy in achieving a mission ([Mulyaningsih, 2021](#)).

Consequently, managers' ability to overcome various productivity-related obstacles is contingent upon their managerial skills. Entrepreneurs who engage in managerial roles require organizational and interpersonal skills positively related to business performance. Startups require managers to be in a constant state of motion, consistently implementing an all-hands-on-deck strategy every day, and to be extremely involved with the smallest daily action, as opposed to large organizations, where business entrepreneurs frequently limit themselves to graphing growth, expansion, long-term planning, and setting organization direction on a larger scale. It is feasible to place administrators of microfood industries somewhere between the two limits, requiring them to oversee activities of all kinds and forms. Microfood processing industries are constantly developing, combating, and addressing retention, employee engagement, and productivity issues; however, they have a well-defined purpose, comprehensive attributes, and the ability to evolve, which a manager can successfully leverage. Managing entails the implementation of a versatile yet adjustable approach to dealing with work procedures and systems in accordance with the growth of enterprises and employees. To more effectively attest, modify, or prevent approaches, a manager must know when and how to alter or discontinue using approaches, tools, and procedures that are intended to produce or hamper outputs.

The food processing industry underwent significant changes brought about by 4IR. As a consequence of the industrial revolution that occurred recently, Industry 4.0 (4IR), the food industry has undergone constant and rapid change. As a result of these developments, technical skills improved productivity ([Akyazi et al., 2020](#)). This is substantiated by [Calabrò et al. \(2020\)](#), who found a positive relationship between technical skills and human capital, especially in the aspect of firm innovativeness. Human capital was also claimed to rely on conceptual skills rather than cognitive abilities. ([Singh et al., 2021](#)). In addition, human capital development, which correspondingly encompasses conceptual skills like knowledge, expertise, and proficiency, optimizes organizational performance, generates revenue, and adds value; therefore, it is indispensable for gaining a competitive advantage ([Ameyaw et al., 2019](#)).

It has also been established that interpersonal skills are linked to human capital due to their critical role in knowledge assimilation, organization, and innovation. These skills can be enhanced by implementing performance management strategies within an industry ([Azarova & Makareva, 2022](#)). Many previous academic studies center on the relationship between Technical, Conceptual, and Interpersonal Skills. However, a few studies were written on Katz's Triplet Managerial skills and their relationship with Human Capital in the food processing industry. Based on the factors above, this study aims to address this question: Is there a relationship between Technical Skills, Conceptual Skills, Interpersonal Skills, and Human Capital? Thus, this research aims to construct a structural equation model (SEM) that examines and determines the relation amongst technical skills, conceptual skills, interpersonal skills, and human capital in the food processing industry.

LITERATURE REVIEW

In [Katz's \(1986\)](#) theory, "Skills of an Effective Administrator", the successful manager holds three distinctive managerial skills: conceptual, interpersonal, and technical skills. As explained by [Katz and Kahn \(1978\)](#), management skills can be categorized into three main categories: technical, involving securities planning and organization; human, involving human relationships and people skills; and interpersonal. Motivating and moral skills, as well as conceptual, knowledge-based, and technical skills, are related to the organization's service ([Ibay & Pa-alisbo, 2020](#)).

Managers may possess effective skills to increase employee productivity. Among these are technical skills. [Katz \(1974\)](#) provides a classic yet theoretical definition of competencies as processes, strategies, and approaches that enable managers to comprehend a particular topic or problem. These characteristics can provide managers with reliable information regarding organizational structures and employee traits. Technical skills are called hard skills, which entail technical abilities related to a specific sector ([Dolce et al., 2020](#)). However, there appears to be a transition in focus from hard skills, which pertain to specific disciplines and technologies, to soft skills, which are concerned with interpersonal interactions. These skill-sets also apply to the use of technology demanded by IR4.0 ([Guzmán et al., 2020](#)). Future-proof managers should possess the essential competencies identified by [Lei and Skitmore \(2004\)](#) in an Australian survey conducted in South-East Queensland. Among the identified abilities, technical skill was ranked topmost ([Obradović, 2018](#)).

[Katz \(1974\)](#) delineated conceptual skill as the capacity to perceive the entire enterprise, including the interdependence of its functions and how modifications to one component can impact the others. Notably, managers with *conceptual skills* are comfortable discussing the ideas that influence an organization and the complexities involved ([Northouse, 2019](#)). Conceptual skills are the dispositions that empower an individual to comprehend intricate circumstances and, ultimately, produce innovative solutions ([Kathayat, 2022](#)). In order to partake in the growth, organization, and decision-making processes, managers also need conceptual abilities. In order to achieve high employee productivity, they must be familiar with the organization's work and operations and possess these conceptual skills. It may be advantageous for organizations to recruit, develop, and promote emotionally intelligent administrators with strong cognitive ability and management skills ([Kim, 2020](#)). In their study, [Barinua and Okolo \(2022\)](#) investigated the influence of skill acquisition on business growth. Skill acquisition refers to the process of applying previously acquired knowledge and abilities to novel situations. It is an action that an individual progressively refines until it becomes second nature to execute the necessary abilities ([Kathayat, 2022](#)).

In addition, managers have interpersonal skills, which include the abilities that enable managers to comprehend the abilities required for coordinating and organizing their actions as well as others. These findings from [Wolf \(2018\)](#) determined the necessary abilities for operations managers to lead their staff properly. The examination of enterprise managers' interpersonal communication abilities is a matter of critical importance. Strong employee relationships and interpersonal skills are positively correlated with team performance and, indirectly, with increased productivity ([Gaur, 2019](#)). Additionally, [Koster and Bloem \(2018\)](#) point out that improved interpersonal skills in the workplace with regard to relations boost the innovation performance of an organization. Interpersonal communication skills encompass the aptitude to engage in social interactions with individuals in an effective and appropriate manner ([Jiang, 2018](#)). The skills or competencies that microentrepreneurs must possess include the capacity to discern market opportunities, the ability to work effectively in teams, and the capability to articulate thoughts and produce reports with proficiency. This capability is evident in interpersonal skills ([Anggraeni & Tarmidi, 2021](#)). The study's findings identified interpersonal skills, as opposed to negotiation and persuasion skills, as the most essential competency. Additionally, [Ingram et al. \(2019\)](#) proved that

interpersonal skills, which include the recognition and management of emotions in others, have a direct impact on venture performance.

Human capital, which comprises an organization's leaders and employees, is vital to its success (Dias, 2017). Human capital is the most essential form of capital since individuals are what truly matter (Zainuddin et al., 2020). Because human capital is an intangible asset, assigning value to human capital is a perennial challenge (Ruiter, 2021; Leddy, 2017). The significance of the human capital concept and its evaluation ought to be predicated on the correlation between employee contributions and the organization's competitive performance. In contrast to the readily available instruments utilized to quantify the value of tangible assets, standards universally held for assessing the worth of individuals are not established (Zainuddin et al., 2020). Previous definitions of human capital typically focus on its economic value and the prospective returns obtained from investing in it. Contemporary human capital research takes a comprehensive and inclusive approach to the term, going beyond viewing persons solely as an economic entity. It considers many factors, including subjective wellness, happiness, intellect, spirituality, and dignity (Khomutnikova, 2019). Human capital comprises a set of skills, expertise, abilities, and qualities that are integral to the capacity to assimilate and organize knowledge, as well as to foster innovation. However, human capital research has historically emphasized learning and education (Azarova & Makareva, 2022). Mumladze and Lomachynska (2021) assert that human capital is a fundamental element of an economy focused on innovation. It stimulates labor productivity and manufacturing efficiency, and its development and reproduction necessitate favorable conditions. Human capital in businesses enhances economic growth by boosting employee productivity and prioritizing added value as the primary measure of financial and economic performance (Khvalyova & Khvalyov, 2021).

In addition, a firm's human capital consists of technical and interpersonal skills, also referred to as people or social skills, and firms should invest in human capital, including a highly educated workforce and experienced managers, to improve their capabilities and develop firm-specific skills and competencies (Green, 2000; Capozza & Divella, 2018). In order to validate these previous conclusions, this study aimed to study Katz's Triplet Managerial Skills and Human Capital relating to the food processing industry in Metro Manila, Philippines.

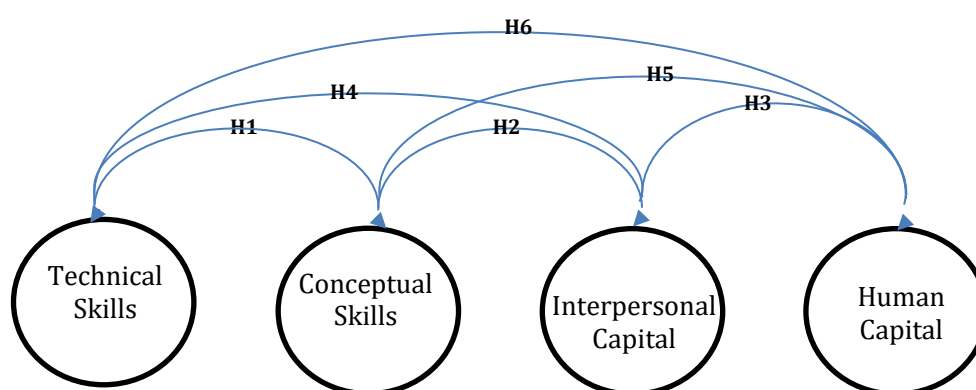


Figure 1. Conceptual Framework

Figure 1 presents the Conceptual Framework or the paradigm of the study that depicts the relationship among latent variables: Technical Skills, Conceptual Skills, Interpersonal Skills, and Human Capital. It amplifies the hypotheses stating that (H1) a relationship exists between Technical Skills and Conceptual Skills; (H2) a relationship exists between Conceptual Skills and Interpersonal

Skills; (H3) a relationship exists between Interpersonal Skills and Human Capital; (H4) a relationship exists between Technical Skills and Interpersonal Skills; (H5) a relationship exists between Conceptual Skills and Human Capital; and, (H6) a relationship exists between Technical Skills and Human Capital.

RESEARCH METHOD

Methodology

This paper is a social science research that employs quantitative methods. The sample population involved entrepreneurs in the food processing industry in Metro Manila, Philippines. A random sampling method was utilized. Based on the data provided by the DTI (Department of Trade and Industry) as of June 30, 2023, there are 430 food processing industries in Metro Manila, Philippines. Cochran's formula with a 50% population proportion, 5% margin of error, and 95% confidence level was used to compute the sample size. Thus, a sample of 204 respondents was required. The target number of respondents returned from this sample size was 100 percent. Each sample was given a self-administered survey form with a rating scale by the researcher/s. The goal was to collect survey responses from 204 entrepreneurs in the food processing industry in Metro Manila, Philippines on August 23, 2023 – October 30, 2023, between 12:00 pm and 3:00 pm. Entrepreneurs in the food processing industry took the survey in their office and took approximately 5 minutes each to complete it anonymously. Here, an entrepreneur was defined as a legitimate owner or business partner who directly manages and supervises the industry on the day they took the survey. The questionnaire was classified into three parts: Katz's Triplet Managerial Skills, Human Capital, and Demographic Profile. Questionnaires were administered based on actual social situations wherein all the measurements were transcribed from English to Tagalog or Filipino. Respondents were assured that their identities and personal information would be strictly confidential to ensure ethical considerations. The information provided will not be publicly revealed without their explicit consent, and no third parties will have access to it without permission. The provided information was then analyzed through the statistical program Smart PLS 4.0 for research only. SmartPLS 4.0 is an all-encompassing and user-friendly software application designed to examine the relationships between latent variables and sets of observed variables (Sarstedt & Cheah, 2019).

Measures

The demographic section in the questionnaire consisted of age, sex, family size, annual income, and education. Katz's Triplet Managerial Skills was a 5-item rating scale from Mostafa et al. (2012) measuring conceptual skills. An example item was: "Creates and implements strategic plans for better performance and productivity." A 5-item rating scale was also utilized for Human Capital by Felício et al. (2012), measuring knowledge and professional proficiency. An example item was: "Developmental opportunities are provided to employees (skills-development/training, continuing education courses.)"

Data Analysis

The data gathered were cleaned and qualified 204 samples. These were analyzed using a model fit, construct reliability, and validity structural equation modeling technique based on reviewed literature to test the research hypotheses. The fundamental impetus behind the employment of this statistical technique was the provision for testing multiple latent variables while delineating the relationship between them. In accordance with the objectives of this study, confirmatory factor analysis was performed first to test the model's dependability and construct validity to verify if they fit with factual data. Second, to hypothesize the investigation, a structural

equation model with path analysis was built in this case. The process of analysis, from preprocessing of data to structural regressions path analysis as well as visualization of data, was meticulously executed using Smart PLS 4.0, a statistical computer language.

FINDINGS AND DISCUSSION

The data analysis results were segregated into two segments: descriptive statistics, which provided an overview of the samples, and inferential statistics, which were used to test the hypotheses.

Table 1. Demographic Profile of Respondents

Respondent's Profile	Frequency	Percentage
<i>Sex</i>		
Male	66	32.35
Female	138	67.65
<i>Age</i>		
16 to 29 years old	11	5.39
30 to 39 years old	28	13.72
40 to 49 years old	129	63.24
50 years old and above	36	17.65
<i>Family Size</i>		
5 household members and below	103	50.49
6 to 10 household members	99	48.53
10 household members and above	2	0.98
<i>Annual Income</i>		
₱250,000 and below	23	11.27
₱250,001 to ₱400,000	134	65.69
₱400,001 to ₱800,000	28	13.73
₱800,001 to ₱2,000,000	10	4.90
₱2,000,001 to ₱8,000,000	6	2.94
₱8,000,001 and above	3	1.47
<i>Education</i>		
High School Graduate	41	20.10
Graduate or Professional Degree	74	36.28
College or Associate Degree	74	36.27
Vocational or Technical	15	7.35

The cleansed data and screened 204 samples were statistically analyzed, including inferential and descriptive parts. As per the descriptive aspect, females comprised almost the majority of the sample (67.65%), 40 to 49 years of age (63.24%), with 5 household members and below (50.49%) with an annual income of ₱250,000 to ₱400,000 (65.69%), and graduate of professional degree (36.28%).

The confirmatory factor analysis was further scrutinized to check the compatibility with the factual evidence or data. This consisted of a validation of the latent variable's structural model to delve into the relationship between manifest variables by means of correlation. The various assumptions of absolute fit and fit indices criteria are shown in the next table.

Table 2. Fit indices criterion

Fit Indices	Criterion	Source
Chi-Square (χ^2)	Not significant	Hair et al. (2013)
Relative Chi-square (χ^2/df)	Less than 3	Hair et al. (2013)
Goodness-of-Fit Index (GFI)	More than .90	Chau (1997)
Comparative Fit Index (CFI)	More than .90	Bentler (1990)
Tucker-Lewis Index (TLI)	More than .90	Browne and Cudeck (1993)
Root Mean Square Error of Approximation (RMSEA)	More than .08	Byrne (2001)
Standardized Root Mean Square Residual (SRMR)	More than .08	Hair et al. (2009)

Referring to Table 3 and Figure 2, confirmatory factor analysis model fit indices were exhibited and the measurement model visualization was delineated.

Table 3. Structural equation model fit indices

Model	χ^2	df	p	χ^2/df	CFI	TLI	GFI	RMSEA	SRMR
CFA	63.49	14.00	0.00	4.53	0.99	0.99	0.96	0.06	0.01

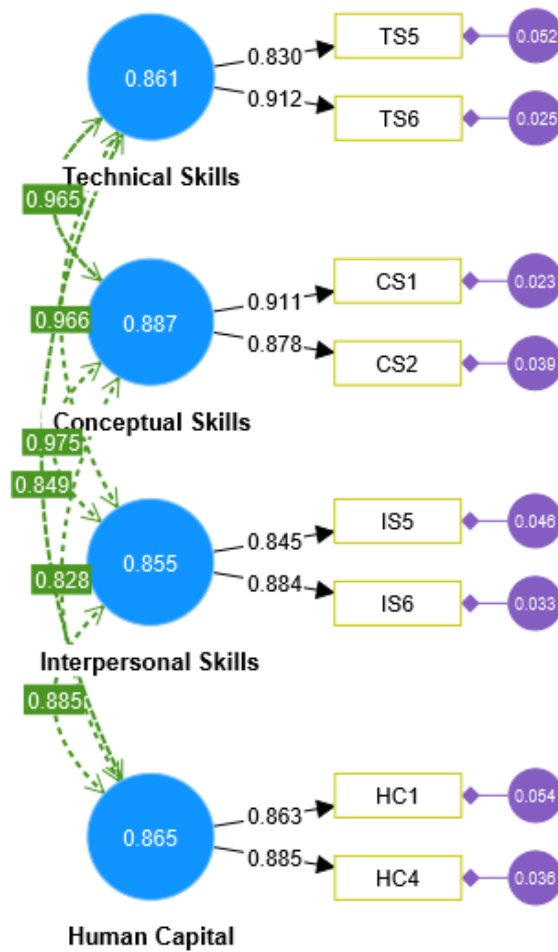


Figure 2. Measurement Model

With regard to the fit indices of the measurement model, the said model was deemed moderately fit with the factual data. All fit indices almost met the criterion. Consequently, there is no need to modify the model. In congruence with Table 4, the following are presented: confirmatory factor analysis estimated, standard coefficients, reliability coefficient of Cronbach's Alpha, composite reliability, and convergent and discriminant validity.

Table 4. Construct reliability and validity

Construct	Cronbach's Alpha (standardized)	Cronbach's Alpha (unstandardized)	Composite reliability (rho c)	Average variance extracted (AVE)
Conceptual Skills	0.888	0.886	0.887	0.8
Human Capital	0.866	0.863	0.865	0.764
Interpersonal Skills	0.855	0.855	0.855	0.748
Technical Skills	0.862	0.861	0.861	0.76

The results also indicate that the coefficients derived from confirmatory factor analysis were statistically significant. Cronbach's Alpha was employed to assess the internal consistency reliability of the instrument, revealing that all sections of the instrument exhibited satisfactory levels of reliability. In addition, a composite reliability score was computed to assess the reliability. The conventional minimum criterion for Cronbach's Alpha and composite reliability was set at 0.7 or above, indicating an appropriate degree of reliability.

Hair et al. (2013) described convergent validity as one in which the degree to which the measures of a construct converged in having a significant level of shared variation. The AVE or the average variance extracted can also be utilized in the calculation of the convergent validity. On the other hand, the minimum threshold for extracted average variance was set at 0.5 or above the former, which indicated an adequacy of convergence.

Discriminant validity, as shown in Table 5, refers to the level or the degree to which measures of a construct are categorically differentiating from other constructs. The Fornell-Larcker criterion is one of the most popular techniques used to check the discriminant validity of measurement models (Fornell & Larcker, 1981). According to this criterion, the square root of the average variance extracted by a construct must be greater than the correlation between the construct and any other construct.

Table 5. Discriminant validity – Fornell-Larcker criterion

	Conceptual Skills	Human Capital	Interpersonal Skills	Technical Skills
Conceptual Skills	0.894			
Human Capital	0.828	0.874		
Interpersonal Skills	0.975	0.885	0.865	
Technical Skills	0.965	0.849	0.966	0.872

Following the confirmatory factor analysis method, structural regression was also fitted and shown. With only four latent variables, this model was judged a model fit, and the measurement and structural models were relatively alike. As stated by Hair et al. (2013), the fit indices of the measurement model and structural model fit indices may potentially share an identical specific number. The structural model consisted of 4 latent variables. Technical Skills, Conceptual Skills,

Interpersonal Skills, and Human Capital were hypothesized to be correlated. By referring again to Table 3 and Figure 2, the results of analysis and model fit indices, including factor loadings, demonstrated a structural model congruent with factual data.

Based on the foregoing results of analysis, the confirmatory factor analysis was performed, and the SEM with path analysis was also created. Both were a moderate fit to the factual data. The distinctive feature that sets this research apart from others was the context of theory testing on the study, which stemmed from Katz's Triplet Managerial Skills: Technical Skills, Conceptual Skills, and Interpersonal Skills. Human Capital was supplemented in the study of relationship and model construct. The study highlighted a significant relationship between technical, conceptual, and interpersonal skills.

As it was hypothesized earlier, human capital, technical skills, conceptual skills, and interpersonal skills are correlated (see Figure 2). The results pertaining to the correlation between conceptual skills and technical skills, which exhibited higher correlation values, were interpreted in the same manner as the previous study conducted by [Etomes \(2021\)](#). Regarding conceptual and interpersonal skills, [Laghari and Jafri \(2022\)](#) discovered that conceptual and interpersonal skills are positively correlated with regard to performance. In relation to human capital and interpersonal skills, the capability to comprehend and react suitably to one's emotions, attitudes, conduct, motivations, and aspirations is fundamental to interpersonal skills. Human capital is predicated on the punctual completion of tasks ([Monica et al., 2022](#)). There also exists a correlation between technical and interpersonal skills, as successfully implementing these skills significantly influences performance ([Winarto, 2018](#)). Additionally, [Calabrò et al. \(2020\)](#) and [Azarova and Makareva \(2022\)](#) assert that human capital and technical skills correlate with innovativeness. Finally, conceptual skills hold significant value within the human capital framework, where the primary determinants of firms' competitiveness are intangible attributes of their labor forces ([Ciuhu & Vasile, 2019](#)).

As aforementioned, technical skills, conceptual skills, interpersonal skills, and human capital are correlated. Regarding the recommendation, economic growth in recent decades has been reliant on the food processing industry, which has been established through the utilization of an affordable and skilled labor force. In the era of digitalization, it is imperative for the workforce to possess advanced qualifications and be prepared to acquire new skills through intensive training and hands-on experience. This is due to a growing number of businesses; online technology is being more utilized for jobs, learning, and retail transactions ([Leong et al., 2021](#)). In order to enhance the technical knowledge and conceptual skills related to food processing, it is advisable to provide organizational programs that specifically target the development of interpersonal skills, with a particular emphasis on effective communication with individuals from varied backgrounds. Human capital can be enhanced in the food processing sector by building capacity, implementing methods that boost employee performance, and advancing food processing technologies. These also include improving skills in marketing, accounting, and production management, as well as providing growth opportunities.

CONCLUSIONS

With regard to the proposed structural model mentioned, it is clear that there is a correlation among technical skills, conceptual skills, interpersonal skills, and human capital. As per previous studies ([Zuhri, 2020](#)), a correlation exists among human capital, conceptual skills, technical skills, and interpersonal skills; these elements are determinants of collaboration and individual performance within enterprises. There is a remedy to these risks. The sector is appropriate to augment the technical expertise and conceptual skills pertaining to food processing and offer training that specifically focuses on the cultivation of interpersonal skills, with a particular

emphasis on proficient communication with individuals from diverse backgrounds. To improve human capital in the food processing industry, it is important to prioritize capacity building, adopt strategies that enhance employee performance, and advance food processing technologies. These encompass enhancing proficiency in marketing, financial management, production management and fostering avenues for advancement.

LIMITATION & FURTHER RESEARCH

This study has two relevant limitations that should be addressed in future research. First and foremost, this study is quantitative. Future research may employ qualitative or mixed explanatory research methods, as they might potentially probe deeper and yield richer results when qualitative and quantitative techniques are integrated. Second, this study is cross-sectional. The end outcome is merely a snapshot of time. Finally, there is a need to investigate the impact of technical skills, conceptual skills, interpersonal skills, and human capital on the food processing industry's profit.

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