

Publish with us
Submit an article

About this journal

Explore
Browse all articles & issues

Latest issue

Subscribe
Alerts & RSS feed

+ Purchase a subscription



Managing Editor

Dr. Daisy Fan

Bournemouth University, UK

Associate Editor:

Dr. Woody Kim

Florida State University, USA

Editorial Assistant

Qinghui Li

Nankai University, China

Editorial Board:

Billy Bai, *University of Nevada, Las Vegas, USA*

Seyhmus Baloglu, *University of Nevada, Las Vegas, USA*

Ricarda B. Bouncken, *University of Bayreuth, Germany*

Liping A. Cai, *Purdue University, USA*

Rachel J.C. Chen, *University of Tennessee, USA*

Christina Geneqing Chi, *Washington State University, USA*

Evangelos Christou, *Alexander Technological Institute of Thessaloniki, Greece*

Frederick Demicco, *University of Delaware, USA*

Dogan Gursoy, *Washington State University, USA*

Ying Hua Huang, *San Jose State University, USA*

Kam Hung, *The Hong Kong Polytechnic University, Hong Kong*

Journal of Quality Assurance in Hospitality & Tourism

tandfonline.com/action/journalInformation?show=editorialBoard&journalCode=wqah20

HomeAll JournalsJournal of Quality Assurance in Hospitality & TourismEditorial Board

Journal of Quality Assurance in Hospitality & Tourism

Enter keywords, authors, DOI, ORCID etc

This Journal

Advanced searchCitation search

Publish with us

Submit an article

Explore

Browse all articles & issues

Latest issue

Subscribe

Alerts & RSS feed

Purchase a subscription

About this journal

Michael L. Kasavana, (Emeritus) Michigan State University, USA

Erdener Kaynak, Pennsylvania State University at Harrisburg, USA

Lisa Hyunjung Kim, Daegu University, Republic of Korea

Woody G. Kim, Florida State University, USA

Nazmi Kozak, Anadolu University, Turkey

Francis A. Kwansa, University of Delaware, USA

Rob Law, The Hong Kong Polytechnic University, China

Kam Hon Lee, (Emeritus) The Chinese University of Hong Kong, China

Erwin Losekoot, NHL Stenden University of Applied Sciences, Leeuwarden, The Netherlands

Kenny Jianming Luo, City University of Macau, Macao, SAR

Martin Luštický, University of Economics, Prague, Czech Republic

Emily Ma, University of Massachusetts, USA

Vincent Magnini, Virginia Polytechnic Institute & State University, USA

Anna Mattila, The Pennsylvania State University, USA

Li Miao, Oklahoma State University, USA

Patrick Moreo, University of South Florida Sarasota-Manatee, USA

Alastair M. Morrison, Purdue University, USA

Suzanne Murrmann, Virginia Polytechnic Institute & State University, USA

William C. Norman, Clemson University, USA

H. G. Parsa, University of Denver, USA

Abraham Pizam, University of Central Florida, USA

Eve Lianping Ren, Macao Institute for Tourism Studies, Macao, SAR

Bill Ryan, Oklahoma State University, USA

Chris Ryan, The University of Waikato, New Zealand

Zvi Schwartz, University of Delaware, USA

Marianna Sigala, University of South Australia Business School, Australia

J. Bruce Tracey, Cornell University, USA

Eliza C. Tse, University of Missouri, USA

Muzaffer Uvsal, University of Massachusetts, USA

10:03 AM

2/9/2022

🏠 Journal of Quality Assurance in Hospitality & Tourism

Enter keywords, authors, DOI, ORCID etc

This Journal ▾ 🔍

Advanced search Citation search

- Publish with us
Submit an article ▾
- About this journal ▾
- Explore
Browse all articles & issues ▾
- 📄 Latest issue
- Subscribe
Alerts & RSS feed ▾
- + Purchase a subscription

Turgut Var, *Izmir University of Economics, Turkey*
Klaus Weiermaier, *Innsbruck University, Austria*
Joseph West, *Florida International University, USA*
Kun Zhang, *Nankai University, Tianjin, China*

Founding Editor:

Sungsoo Pyo, *Kyonggi University, Republic of Korea*

Consulting Editors:

K.S. (Kaye) Chon, *The Hong Kong Polytechnic University, China*
C.R. Goeldner, *University of Colorado at Boulder, USA*
Jafar Jafari, *University of Wisconsin-Stout, USA*

Browse journals by subject

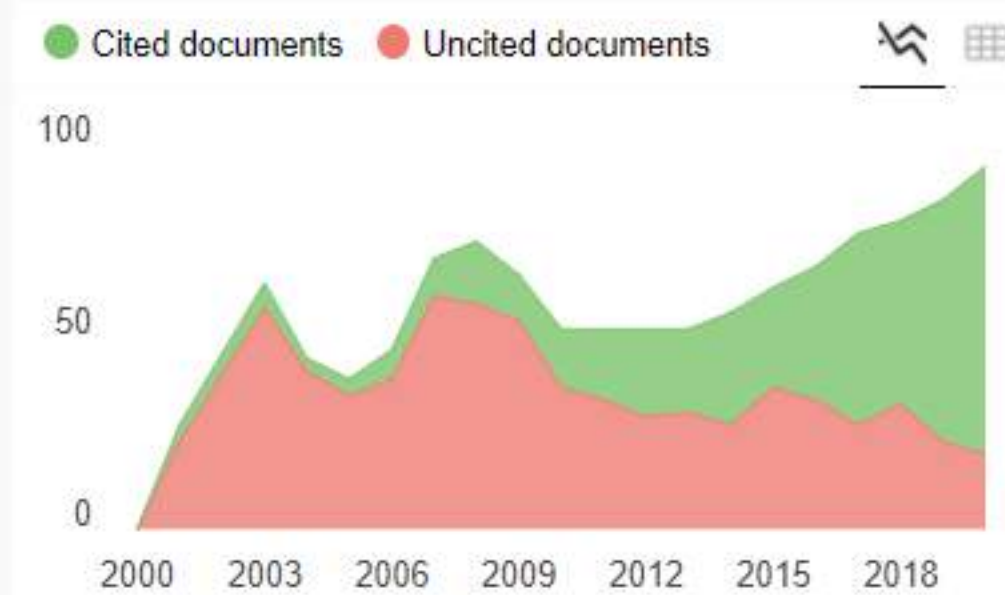
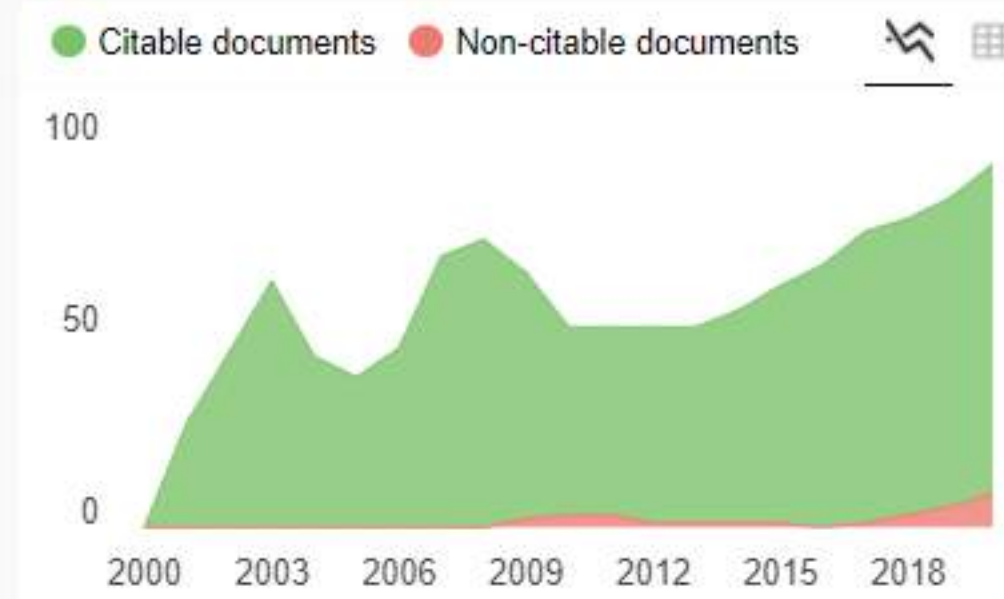
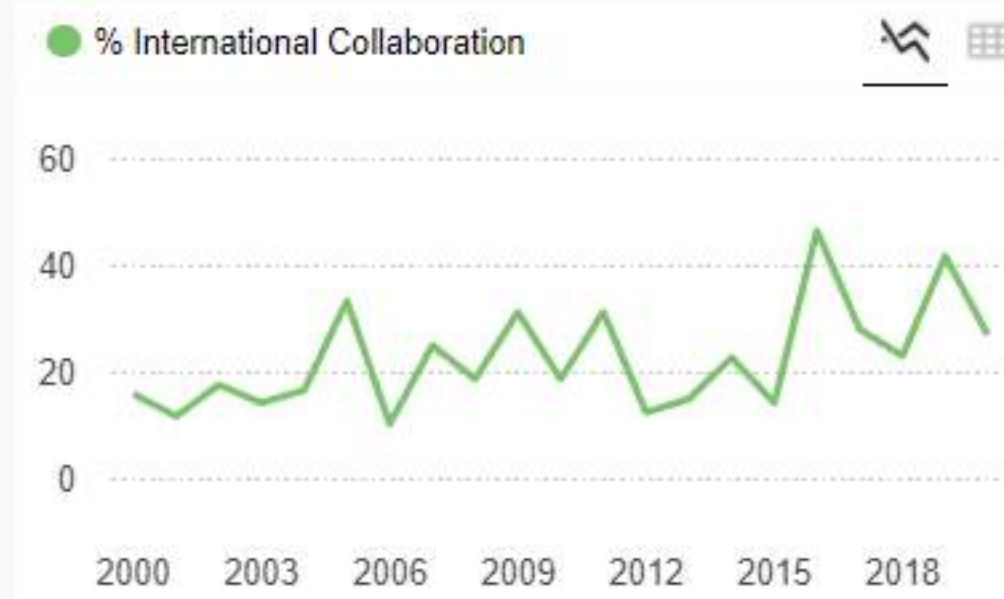
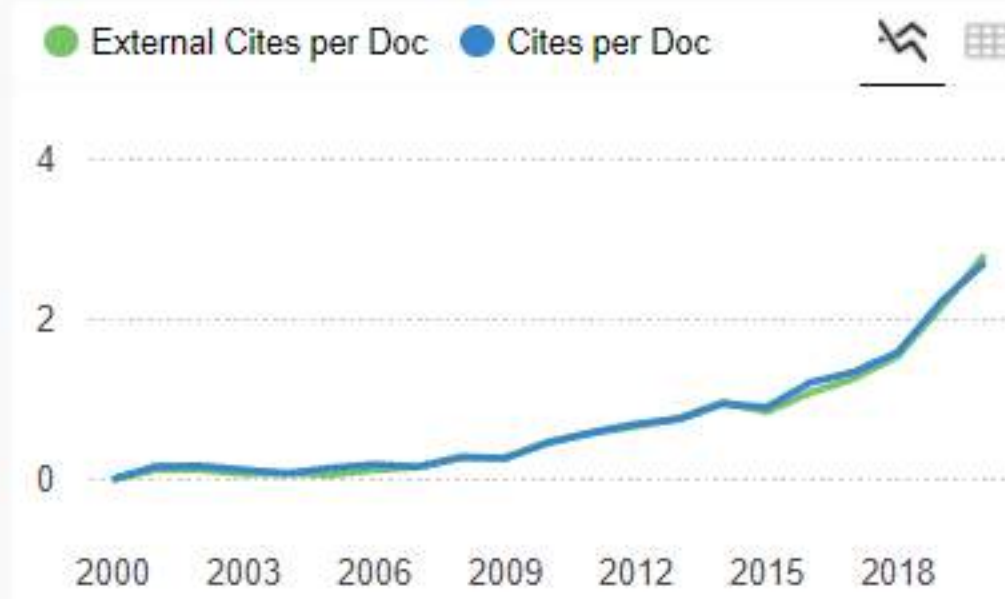
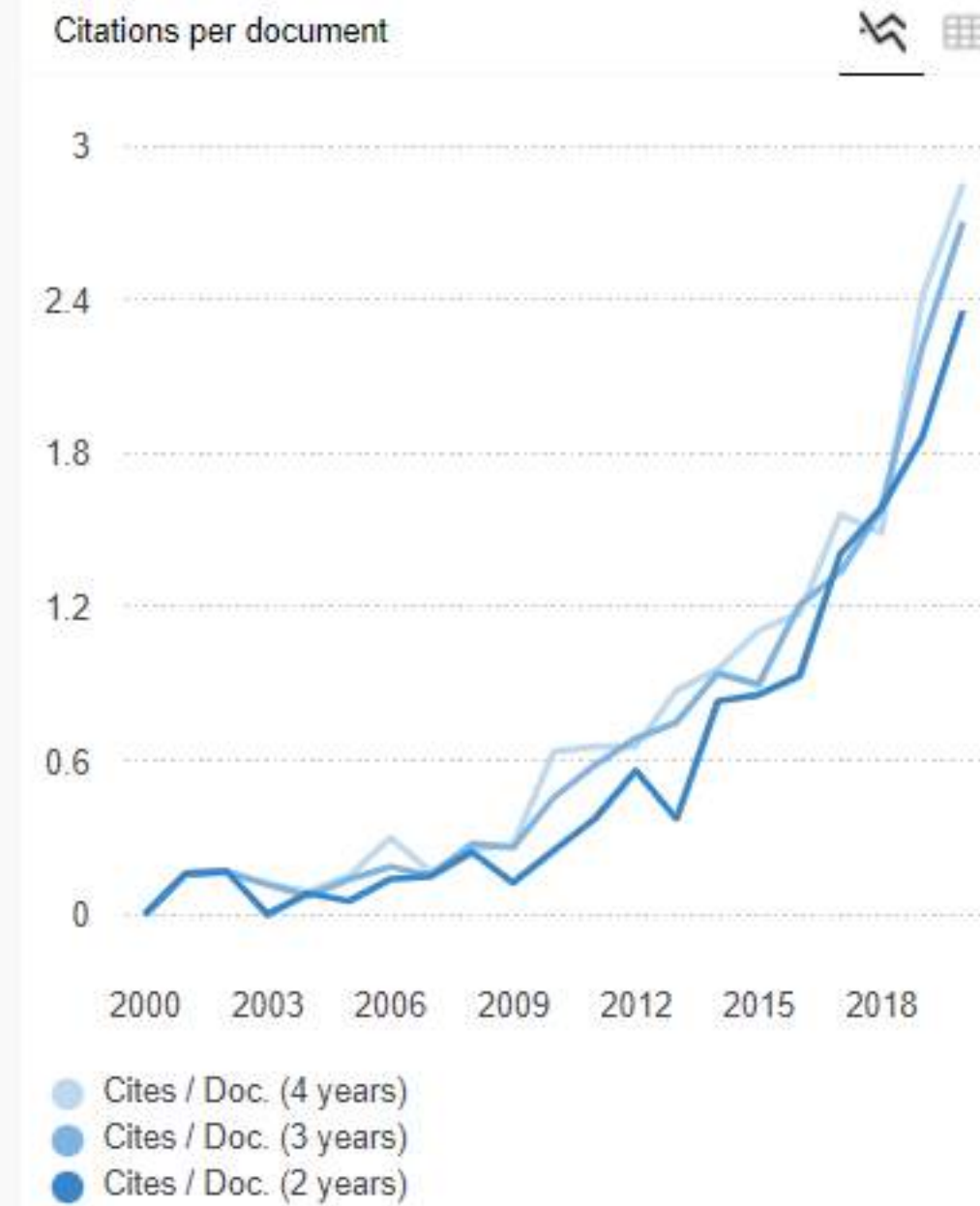
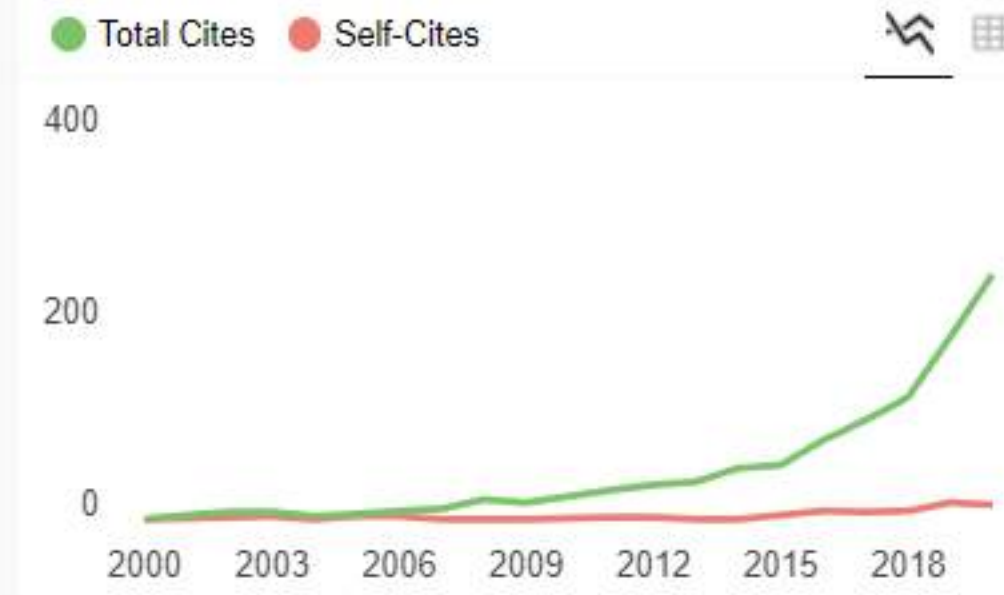
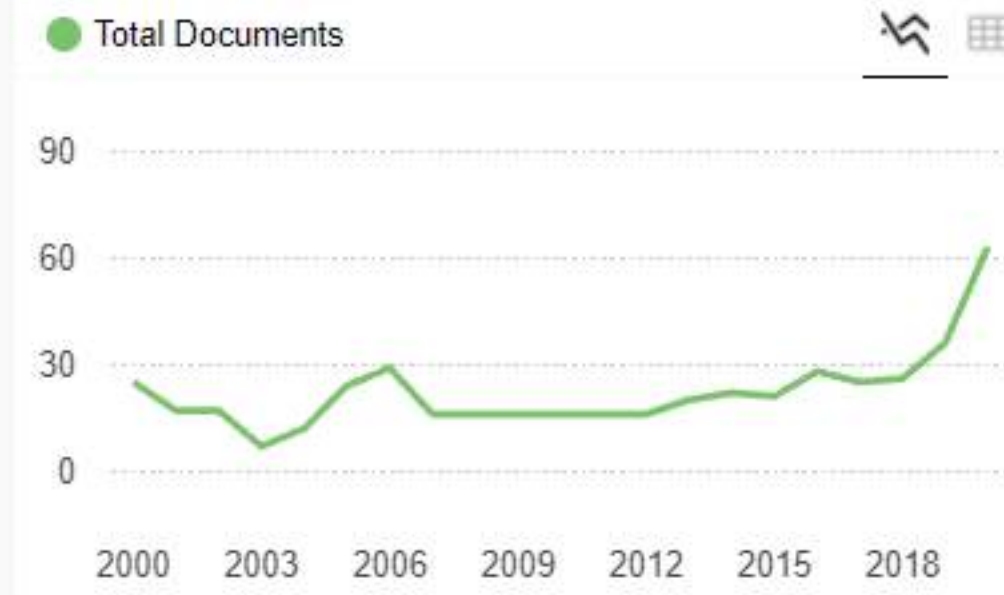
Back to top ⬆

Area Studies	Economics, Finance, Business & Industry	Health and Social Care	Physical Sciences
Arts	Education	Humanities	Politics & International Relations
Behavioral Sciences	Engineering & Technology	Information Science	Social Sciences
Bioscience	Environment & Agriculture	Language & Literature	Sports and Leisure
Built Environment	Environment and Sustainability	Law	Tourism, Hospitality and Events
Communication Studies	Food Science & Technology	Mathematics & Statistics	Urban Studies
Computer Science	Geography	Medicine, Dentistry, Nursing & Allied Health	


```
ref.current.scrollLeft = 0;
expanded.windowWidth = refreshHeight();
```

roptai

Open



Journal of Quality Assurance in Hospitality and Tourism

Q2 Tourism, Leisure and Hospitality Management best quartile

SJR 2020 0.62

powered by scimagojr.com

← Show this widget in your own website

Just copy the code below and paste within your html code:

```
<a href="https://www.scima
```

SCImago Graphica

Explore, visually communicate and make sense of data with our **new free tool**.

[Get it](#)

Ads by Google

[Stop seeing this ad](#) [Why this ad?](#)



The Effect of Ergonomic Aspects on Customers' Convenience at Restaurant in Surabaya

Herry Christian Palit, Monika Kristanti & Yoel Wibowo

To cite this article: Herry Christian Palit, Monika Kristanti & Yoel Wibowo (2020) The Effect of Ergonomic Aspects on Customers' Convenience at Restaurant in Surabaya, Journal of Quality Assurance in Hospitality & Tourism, 21:1, 31-49, DOI: [10.1080/1528008X.2018.1563017](https://doi.org/10.1080/1528008X.2018.1563017)

To link to this article: <https://doi.org/10.1080/1528008X.2018.1563017>



Published online: 06 Jan 2019.



Submit your article to this journal [↗](#)



Article views: 64



View related articles [↗](#)



View Crossmark data [↗](#)



Citing articles: 1 View citing articles [↗](#)



The Effect of Ergonomic Aspects on Customers' Convenience at Restaurant in Surabaya

Herry Christian Palit ^a, Monika Kristanti^b, and Yoel Wibowo^b

^aDoctoral Program of Medical Science, Faculty of Medicine, Udayana University, Denpasar, Indonesia; Department of Industrial Engineering, Faculty of Industrial Technology, Petra Christian University, Surabaya, Indonesia; ^bHotel Management Program, Faculty of Economics, Petra Christian University, Surabaya, Indonesia

ABSTRACT

This research aims to reveal whether ergonomic aspects possess any influence toward restaurant customers' convenience. These ergonomic aspects comprise visual display, anthropometric, and environmental ergonomic which indicators were identified from an extensive literature review. The research employed both subjective and objective method measurement. Data from the subjective method were collected by using questionnaire from 100 customers in a restaurant in Surabaya, then Partial Least Squares - Structural Equation Modeling (PLS-SEM) were performed to investigate the effect of ergonomic aspects toward restaurant customers' convenience. Data from the objective method were collected from direct observation or measurement. The results revealed that both anthropometric and environmental ergonomic possessed a positive significant effect on the customers' convenience, despite being not applicable to the visual display aspect. Meanwhile, the conformity between direct measurement and ergonomic standards showed that 52.38% of the ergonomic standards of this restaurant had already been fulfilled. The implications of this present study are also concluded in this paper.

KEYWORDS

Ergonomic aspects; visual display; anthropometric; environmental ergonomic; customers' convenience

Introduction

According to International Ergonomic Association (IEA), ergonomic (human factors) can be defined as “the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, in order to optimize human's well-being and overall system performance”. Furthermore, it is also mentioned that “ergonomic encourages a holistic approach involving physical, cognitive, social, organizational, environmental, and other relevant factors” (IEA, [n.d.](#)). For instance, the goal of ergonomic is to create jobs, systems or products safe, effective, efficient,

CONTACT Herry Christian Palit,  herry@petra.ac.id  Department of Industrial Engineering, Petra Christian University, Siwalankerto 121-131, Surabaya, East Java, Indonesia

Color versions of one or more of the figures in the article can be found online at www.tandfonline.com/wqah.

© 2019 Taylor & Francis Group, LLC

healthy, satisfying, convenience, and even enjoyable for human being (Kroemer, 2017; Wilson, 1995).

So far, there have yet to be found any research related to the effect of the ergonomic aspects on customers' convenience in the restaurant. Several studies in ergonomic at various countries are focused on the investigation of work-related health and musculoskeletal disorder in restaurant workers (Chyuan et al., 2004; Dempsey & Filiaggi, 2006; Gentzler & Smither, 2012; Hwang et al., 2011; Ilban, 2013; Nanyan & Charrada, 2016; Salleh, Sukadarin, & Zakaria, 2017; Subramaniam & Murugesan, 2015; Xu & Cheng, 2014). Besides, all these studies do not employ multivariate analysis for their data analysis.

In restaurants, ergonomic aspects for a customer are closely related with the restaurant's atmosphere (Heung & Gu, 2012; Jang, Ha, & Park, 2012; Kotler, Bowen, & Makens, 2003; Sulek & Hensley, 2004). Kotler et al. (2003) mentioned that the restaurant's atmosphere had become an essential factor for a customer in deciding a dining place; besides price, quality, and service. Heung and Gu (2012) stated that the restaurant's atmosphere possessed a positive impact on customer's satisfaction and behavioral intentions. Sulek and Hensley (2004) proposed that a dining atmosphere should be considered in order to provide a dining experience. Another study by Jang et al. (2012) found that the restaurant's atmosphere affected customer's positive emotions. Restaurant's atmosphere is captured through the stimulation of five human senses, namely sight, sound, scent, touch, and taste. Some indicators being used in restaurant's atmosphere are interior and exterior design, table setting, decorations, music, lighting, scent of the restaurant, seating arrangement, facility layout, furniture, colors, restaurant's cleanliness, and cleanliness of server's uniform (Heung & Gu, 2012; Jang et al., 2012; Sulek & Hensley, 2004).

The main difference between ergonomic and restaurant's atmosphere is in their attributes or indicators. The indicators of ergonomic are more technical, specific, and measurable. Furthermore, the study in ergonomic should involve both subjective and objective measurement methods simultaneously in the data analysis. Both methods can be used in laboratory and field studies, although only objective measurement in the field can be naturalistic and noninterfering with human behavior (Wilson, 1995). From ergonomic perspective, the indicators of restaurant's atmosphere mentioned earlier are related to environmental ergonomic, anthropometric, and visual display.

Based on the previous studies, it can be seen that the measurement from customer's perspective is related to customer satisfaction, behavior intentions, dining experience, and customer's positive emotion. Provided there is still no research specifically investigating customer's convenience in restaurant ergonomic perspective, a room for research in this area is therefore available. This research is aimed to reveal whether ergonomic aspects

(involving environmental ergonomic, anthropometric, and visual display) possess any effect on customers' convenience.

Literature review and hypothesis

Ergonomic and customer's convenience

Ergonomic is the application of scientific principles, methods, and data drawn from various disciplines toward the development of engineered systems in which people play significant roles (Kroemer, 2017). In other words, ergonomic focuses on the way to fit a particular work (equipment, tools, methods, as well as working environment and organization) according to the capability, ability, and limitation of human (Manuaba, 2007).

Convenience is one of the factors being a benchmark in determining whether an ergonomic research regarding ergonomic is considered to be successful. The following will be several definitions of convenience, as seen from ergonomic and health studies perspective: according to Kolcaba (2003), convenience is a condition where human's individual and holistic (physical, psychological, and spiritual) basic needs have been fulfilled. Sanders and McCormick (1993), on the other hand, defined convenience as a feeling dependent on the human bearing that circumstance. Furthermore, it is also explained that the convenience toward a product is dependent on both the physical function of the product itself and each of the individual's perception. Based on the mentioned definitions, it can be concluded that convenience is someone's perception toward his or her surrounding circumstance or environment (involving utilized or surrounding objects) either physically, psychologically, or spiritually.

Humans assess their environment based on the stimulus going into themselves through six senses, delivered by nerves later, then processed by brain to finally produce an assessment. Not only biological-physical problem is involved but also feeling. Sound, illumination, smell, temperature, and many other stimulants are absorbed simultaneously prior to being processed by brain. Brain itself will provide a relative judgment on whether a particular circumstance is either convenience or not (Satwiko, 2009).

According to Kelley (1958), customers do not purchase service or goods by a mere consideration toward cost but also by considering convenience, satisfaction, and service: these are the main values influencing customers' decision in shopping. The feeling of convenience felt by the customers will contribute in positive and continuous synergy in goods and service transactions. This means that convenience indeed becomes one of the important factors being considered by the customers while performing a transaction.

In this research, the measurement toward restaurants' customers is merely reviewed from both physical and psychological aspects. Physical convenience

is felt as a condition in which the human's body is free from any pain (or sickness), and/or any handicap in performing any activity. Meanwhile, psychological convenience is felt as a condition in which the human's mind is free from any concern or fear, uncertainty, insecurity, tense, and other unpleasant negative feelings (Kolcaba, 2003).

Ergonomic and its aspects

Branches or domains of specialization within ergonomic are physical ergonomic, environmental ergonomic, cognitive ergonomic, and organizational ergonomic. Ergonomic aspects related with customers' convenience in a restaurant comprise physical and environmental ergonomic; therefore, this research is focused on measuring those aspects.

Physical ergonomic

Physical ergonomic is an ergonomic study involving human anatomy, anthropometric, physiological, workplace layout, posture and movement (including musculoskeletal), biomechanics, display, and other elements related with human's physical activities (Chakrabarti, 2005; Kroemer, 2017). Physical ergonomic aspects investigated in this research are visual display and antropometric.

About 80% of the information input to the human's brain is produced by visual stimuli. Moreover, according to Kroemer (2017), font size has become one of the factors influencing how fast human eyes are able to receive information within a visual display planning. One of the fields analyzing about font size is typography. Typography itself refers to a set of font characteristics. There are several font characteristics, such as the ratio between font width and height (stroke width), font type, and font height. Another factor should be considered in designing a visual display is the content. The content or information of visual display should be informative, concise, clear, readable, eye-catching, and proportional between font size and pictures (Freivalds & Niebel, 2014; Sanders & McCormick, 1993). Any failure in visual display ergonomic may result in the inconvenience in our eyes (as eyes themselves tend to be accommodating) (Kroemer, 2017).

Based on the explanation, the first hypothesis from this research is therefore

H₁: Visual display aspect has a positive effect toward restaurant customers' convenience.

Anthropometric is originated from the word "anthro", which means human, and "metrics", which means a measurement. Anthropometric is

a study specialized in measuring human's body in order to formulate size differences between each individual or groups (Panero & Zelnik, 2003). In a dining area, anthropometric study is required not only on table and chair conformity toward users' anthropometric dimension but also on the space between chairs and space between tables. Furthermore, Panero and Zelnik (2003) have also provided anthropometric data toward the dimension of furnitures, the space between tables and chairs, and the other dimension within a restaurant's dining area.

Basically, the standardized measurement of the space between tables and chairs in a table set is related to each other. This can be observed directly in restaurants, in which the aforementioned 'space between tables' also refers to the chairs attached to that table. The space (between tables and chairs attached to the table) functions not only as the moving space belong to the customers (whenever he/she needs to go inside or outside that table set), but also as the server's area in addressing the customers.

If the design of a product, a facility, and tools have already corresponded with the anthropometric data from their users, then the users may perform their activities comfortably in a long period of time (Panero & Zelnik, 2003). Previous ergonomic researches toward restaurants employees have shown the appearance of musculoskeletal disorder felt among people, especially on those working on the kitchen (Nanyan & Charrada, 2016; Subramaniam & Murugesan, 2015; Xu & Cheng, 2014). Facilities and equipment's failure in corresponding with the employees' anthropometric data has greatly contributed in the disorder. During the earlier stage, inconvenience was the mere symptom. On the later stages, the inconvenience triggered health disturbance (in which the musculoskeletal disorder becomes the dominant symptom).

Based on the elaboration, the second hypothesis of this research can therefore be concluded:

H₂: Anthropometric aspect has a positive effect on restaurant customers' convenience.

Environmental ergonomic

Environmental Ergonomic is an ergonomic study investigating the relation between humans and their limitations within a physical working environment, covering illumination (lighting), sound, climate, air circulation, and vibration. Environmental ergonomic affects human's health, convenience, ability, and willingness to perform (Kroemer, 2017; Sanders & McCormick, 1993). In this research, physical working environment being investigated comprises air circulation, climate, illumination, and sound.

Air circulation allows fresh air to enter the building in the desired amount. Kroemer (2017) distinguishes air circulation into two: natural (enabled by

installing each of fixed and temporary ventilation in amount of 5% from the total room size) and mechanical (enabled by using a fan or air-conditioner support). It has been commonly known that almost all restaurants prefer to use mechanical air circulation by an air-conditioner.

Climate is the combination of air temperature, humidity, air movement, and radiation. However, air temperature and humidity play the most important role of climate (Kroemer, 2017). Air temperature and humidity affect not only people's comfortability in a room but also their well-being and performance. Humidity means the amount of water contained within the air, measured by relative humidity in percentage. In the tropical area, the recommendation of ergonomic standard for comfortable room temperature is 23–26°C, with 40–60% of humidity.

Illumination refers to the amount of light in a working platform needed to run a particular activity effectively (Kroemer, 2017). A decent illumination enables an individual to see his or her working objects clearly and quickly. Too much intensity in illumination triggers glare, which is an effect caused by an excessive amount of light absorption. In general, the suitable illumination levels of ergonomic standard in the dining area is 150–200 lux.

Sound is heard whenever ears are detecting a difference in pressure, mechanical compression, or longitudinal wave creeping through a particular medium. In general, the permissible sound level considered safe for human is not exceeding 85 dB. There are two kinds of sound: pleasant and unpleasant sound or noise (Kroemer, 2017). One example of pleasant sound in a restaurant is music. Previous researches have pointed that music significantly influences restaurants' customers. According to North, Shilcock, and Hargreaves (2003), music influences restaurant customer's spending. Wilson (2003) investigated that music had a significant effect on customer's purchase intentions in a restaurant.

Based on the elaboration toward, the third hypothesis of this research is therefore

H₃: Environmental ergonomic aspect has a positive effect on restaurant customers' convenience.

Figure 1 illustrates the conceptual model suggestion from a research investigating the relation between latent variables (constructs).

Research method

The instrument

There are two kinds of data collection methods in ergonomic methodology: direct observation (or direct measurement or objective method) and indirect

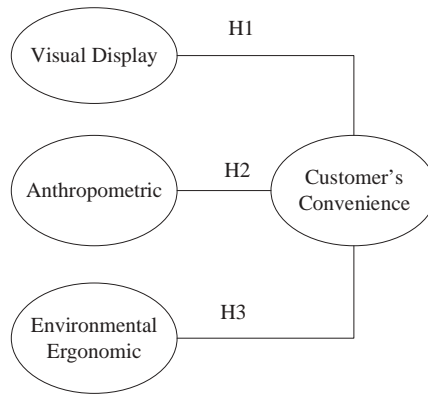


Figure 1. Research conceptual model.

observation (also referred to as subjective method). The objective method refers to the collection of information on subject performance (either directly from the observers themselves or from objective recordings) comprise quantitative and qualitative data; while subjective method refers to the collection of information from subjects concerning their interpretations on what they are doing, feeling, or thinking, or other associated individuals (Wilson, 1995).

In this research, the questionnaire was utilized as part of the subjective method. The questionnaire was developed based on the literature review. The questionnaire was divided into two parts. The first part of the questionnaire consisted of demographic questions. The second part examined the respondents' perception toward visual display, anthropometric, environmental ergonomic, and customers' convenience in the restaurant. The perception of respondents was measured by 27 indicators (Appendix 1). The visual display's indicators were adopted from Sanders and McCormick (1993), Freivalds and Niebel (2014) and Kroemer (2017). The anthropometric's indicators were adopted from Panero and Zelnik (2003). The environmental ergonomic's indicators were adopted from Sanders and McCormick (1993) and Kroemer (2017), and the customers' convenience indicators were adopted from Kolcaba (2003). The level of agreement with given statements was assessed using a five-point Likert-type scale, with anchors "strongly disagree" as 1 and "strongly agree" as 5.

The objective method was conducted through direct observation (measurement) on the restaurant's dining area toward the indicators (21 indicators) found in each aspect, some of them requiring particular tools. The result was then compared with the ergonomic standard of each indicator (referring to their conformity, as explained in the previous part of this research). Letters' typography dimension (related with both visual display and anthropometric dimension) was measured by using anthropometer measuring set. Other tools, such as Heat Index WBGT Meter and

Luxmeter, were also utilized to measure air temperature, air humidity, and light intensity.

Data analysis

The questionnaires were distributed in one of the famous restaurants located in Northern Surabaya. A judgmental sampling method was utilized to collect data. The criteria used in selecting the sample involved the following: respondents were at least aged 17 years and older; and had visited the restaurant within the last 3 months (Kristanti, Soedarto, & Widjaja, 2016).

Since the population was infinite, the number of samples was calculated by using unknown population formula (Sugiyono, 2010). The calculation of the sample functioned $\alpha = 5\%$ ($Z = 1.96$) and margin of error = 10% that resulted in a minimum sample of 96 respondents. In this research, 100 respondents were asked to complete the questionnaire. This research utilized Partial Least Squares - Structural Equation Modeling (PLS-SEM) due to its insensitivity toward the sample's size. This approach handled both very small and very large samples. PLS-SEM was particularly useful in generating estimates even with very small number of samples, which was as low as 30 or less (Hair, Black, Babin, & Anderson, 2010). In addition, PLS-SEM achieved high levels of statistical power even if the sample size was relatively small, for example, 100 samples only. PLS-SEM was also robust when applied to highly skewed data (Hair, Sarstedt, Ringle, & Mena, 2012). In this research, the data were not normally distributed as they had a p -value $< .05$.

Moreover, Hair et al. (2012) pointed out that a variety of PLS-SEM applications had been developed in recent years. It could be used for (1) confirmatory analysis to empirically test a construct's measurement model; (2) impact-performance matrix analysis; (3) response-based segmentation techniques; (4) guidelines for analyzing moderating effects; (5) nonlinear effects; and (6) hierarchical component models. These enhancements expanded PLS-SEM's usefulness as a research tool in marketing and social science.

There were several steps in using PLS-SEM. First, by assessing the measurement model (outer model) including convergent validity, discriminant validity, and composite reliability. The measurement model was conducted to ensure that the indicators, along with their constructs, were valid and reliable upon being used as the measurement. Second, by analyzing the inner model or path analysis. The inner model analysis was performed to ensure that the structural model was both robust and accurate (Hair et al., 2010). A rule of thumb for factor loading was that standardized loading estimates should be .5 or higher, and ideally .7 or higher. In this research, the standardized loading estimates used .6 or higher. An average variance extracted (AVE) of .5 or higher was a good rule of thumb suggesting adequate convergence. The rule of thumb for reliability was that .7 or higher (Hair et al., 2010).

Results

Demographic profile of the respondents

Most of the respondents were 17–25 years old (48%); female (58%); possessing bachelor degree as their final education (59%); and had already been working (65%) as professionals, entrepreneurs, and government officials. In relation with the customers' behavior, most of them had visited once in 3 months (67%), had stayed for more than 1–2 hr there (82%), had spent IDR 50,000 – IDR 100,000 per pax on each visit, had gone friends or lovers (64%), and had been enjoying pop music (43%) (Kristanti et al., 2016).

The measurement model (outer model)

Convergent validity

The convergent validity model was determined based on the loading factor value of each indicator toward their constructs. Based on the counting toward each loading factor, it was revealed that 3 from 27 earlier indicators were having loading value of $\leq .60$. They included the height of ordering counter/cashier being considered as convenience for the customers (a6), concise menu (vd5), and readable signage upon being read from outside of the restaurant (vd10); thus, those three indicators were eliminated. Post recounting process, 24 valid indicators were found to be valid (loading factor $\geq .60$), as displayed in Table 1 (the shaded area).

Convergent validity can also be seen from the AVE value. Based on the AVE value displayed on Table 2, it was found that AVE in each construct was $\geq .50$. Therefore, all constructs could be considered valid.

Discriminant validity

The next model validity measurement was through discriminant validity. Discriminant validity was evaluated by comparing whether the loading value from each indicator within their construct is greater than their cross loading values (Table 1). Table 1 points that loading factor value from each indicator was greater than their cross loading value, therefore, concluding that all of the constructs had been considered valid.

Composite reliability

The reliability of the research's structural model could be observed from its composite reliability value. As seen in Table 2, composite reliability value from each construct was $\geq .8$. As the reliability criteria were considered good if only the score had reached $\geq .7$, then the model reliability could be concluded as good.

Table 1. Loading factor value and cross loading value from 24 indicators.

Coding	Anthropometric	Environmental ergonomic	Customers' convenience	Visual display
a1	.718	.426	.473	.336
a2	.755	.577	.534	.399
a3	.842	.559	.589	.522
a4	.803	.510	.572	.481
a5	.749	.506	.559	.409
el1	.542	.736	.574	.407
el2	.631	.843	.712	.490
el3	.593	.821	.647	.535
el4	.409	.751	.593	.612
el5	.369	.697	.529	.493
el6	.418	.751	.577	.488
el7	.524	.795	.675	.660
el8	.587	.760	.653	.638
kk1	.644	.731	.886	.547
kk2	.650	.765	.926	.564
kk3	.606	.680	.880	.592
vd1	.325	.470	.452	.696
vd2	.279	.418	.297	.683
vd3	.458	.639	.571	.792
vd4	.407	.442	.449	.686
vd6	.435	.505	.430	.747
vd7	.515	.529	.519	.739
vd8	.306	.429	.334	.644
vd9	.373	.498	.429	.673

Table 2. Construct, mean, standard deviation, AVE, and composite reliability.

Construct	Mean	SD	AVE	Composite reliability
Anthropometric	3.456	.043	.600	.882
Environmental ergonomic	3.661	.059	.594	.921
Customers' convenience	3.617	.060	.805	.925
Visual display	3.546	.125	.503	.890

Path analysis (inner model) and hypothesis test

Evaluation toward the inner value model was conducted by observing the coefficient of determination (R^2). Figure 2 revealed that R^2 was .707, indicating that the structural model of this research possessed a good goodness-of-fit. It means that the customers' convenience variability (that was able to be explained by visual display, anthropometric, and environmental ergonomic) was 70.7%.

The result of the hypothesis testing is displayed in Table 3. As displayed in Table 3, anthropometric aspect (H_1) and environmental ergonomic (H_2) had a positive effect on customers' convenience with a significance value of $\alpha = 5\%$. Visual display aspect (H_3) also possessed a positive effect, despite being insignificant. Therefore, both anthropometric and environmental ergonomic aspects had a positive effect significantly on the customers' convenience, in which the environmental ergonomic itself contributed the most, as seen from its coefficient value of 0.566.

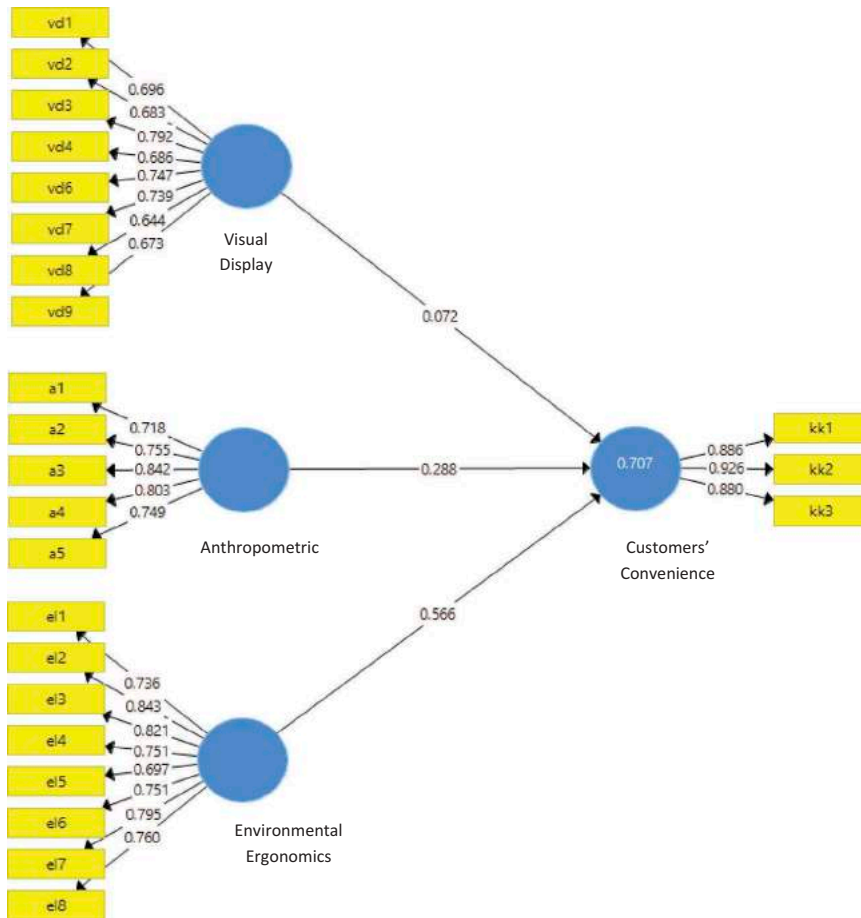


Figure 2. PLS path model of this research.
(source: Output from SmartPLS software)

Table 3. Path analysis and hypothesis test.

Hypothesis	Path	Original Sample	T-statistics	Result
H ₁	Anthropometric → customers' convenience	.288**	3.536	Accepted
H ₂	Environmental ergonomic → customers' convenience	.566**	6.261	Accepted
H ₃	Visual display → customers' convenience	.072	.959	Rejected

** $p < .05$.

Discussion and conclusion

Visual display aspect analysis

Table 1 shows that from all of the eight visual display indicators, eye-catching colors on the menu (vd3) became the most self-explanatory indicator toward

visual display variable (loading value = .792). This implied that eye-catching colors used on the menu board had a significant impact on the restaurant visual display aspect. In this restaurant, the colors on the menu board were indeed eye-catching, yet the letters were blurry and unreadable, therefore, causing a difficulty upon respondents in catching the information within.

According to the suggestions provided by the respondents, there were a lot of weaknesses within the restaurant visual display aspect, which mostly were related to the menu. The followings were the compilations of the customers' complaints, in relation to the menu problem.

First, the restaurant utilized two devices to display the menu: menu board and menu display (in iPads). While menu board contained lists of foods and beverages, menu display provided presentation pictures toward foods and beverages being sold (some of it were not equipped by proper naming) without any remark regarding the taste, ingredients, and many other related items. This prolonged customers' time while making order as they had to see the menu board first then compared it with the menu display, therefore requiring cashiers' assistance in the decision-making process. The second problem is related with the adopted counter-system as well as the menu limitation, which forces the customers to perform standing queue for an extended long period. Third, font size used on the menu board was smaller than typography measurement standard, therefore, causing difficulty in customers' ability in reading. Due to insignificant menu function, customers should occasionally ask the cashier upon deciding their preferences.

In relation to the signboard, a lot of the respondents agreed and were being neutral toward the statement saying "The restaurant signboard can be easily spotted and informative as well." Nevertheless, based on the observation, the restaurant signboard was not functioning optimally in delivering information toward the customers. Whenever the customers went into the restaurant, they were greeted by a greeter, who referred them to the ordering counter, by priorly asking about the amount of guest as well as the desired sitting area (indoor or outdoor). By the greeter's assistance, customers were neither required to search nor even see the ordering counter signboard. Toilet signboard was also less functioning, as the customers who had never visited the restaurant would prefer asking the employee regarding the location of the toilet.

Based on the comparison conducted between the eight indicators toward visual display ergonomic standards (Sanders & McCormick, 1993; Freivalds & Niebel, 2014; Kroemer, 2017), there were five corresponding indicators, while three others failed to correspond (vd4, vd6, and vd7). This implied that visual display aspect in the restaurant was actually decent enough, in which 62.5% of the total visual display indicator had corresponded with the ergonomic standards. Despite high conformity level found in the ergonomic standards, this aspect did not possess significant influence toward the customers' convenience. Nevertheless, this did not mean that visual display aspect

deserved no attention from the owner. From the interview toward the customers, they indeed mentioned that both menu and signboard had been important for them. In reality, effectivity on both menu and signboard was found to be very low, as the customers tended to perform a direct approach by asking toward the restaurant's staff (cashier or greeter). This was the reason why the visual display aspect possessed no significant influence toward customers' convenience.

Anthropometric aspect analysis

Anthropometric aspect possessed positive influence toward customers' convenience. The statement was supported by Panero and Zelnik (2003), who argued that someone might perform his or her activities comfortably in an extended period of time if the product, facility, and equipment had already met his or her anthropometric data.

In relation with anthropometric aspect, the space between tables (a3) and chairs (a4) were two most self-explanatory indicators toward anthropometric variable. The space between tables had loading value of .824, while the loading value of the space between chairs was of .803.

Inside the dining area, there were spots pointing to the overly close space between tables. Indoor area tended to have overly tight space on both between tables and chairs, not only on the space between medium bench table with box table next to it but also on the space between the standard tables. In the outdoor area, the space between tables was relatively more distant except on the space between sofa tables, space between long bench tables and barrel tables, and the space between barrel tables and box tables.

Tables' height, width, and the shape of the chairs were also contributed significantly in explaining anthropometric, as they also possessed high loading value. Based on the result, there were found many incompatibilities on the measurement toward seven types of tables and chairs in the restaurant, and one of them was on the medium bench tables and chairs.

According to the measurement conducted by comparing anthropometric data standards, medium bench chairs were 1.8 cm and the tables were 3.8 cm higher than the standard. Customers were feeling discomfort as they felt that the tables were higher than the chairs. Several visitors of this restaurant had delivered several complaints regarding the chairs in the indoor area (not having any backrest/back support). Those chairs triggered weariness upon being used for a period of time. Overly short tables had also triggered the inconvenience, as they forced the users to consume their meals in a bending position.

According to the comparison between those five indicators toward the anthropometric data standards, no match (0%) with the anthropometric data standards was found. Despite the anthropometric aspect possessed significant influence toward customers' convenience, in reality, still, a lot of facilities

were yet to meet the anthropometric data standardization, therefore, requiring the owner to pay more attention to it.

Environmental ergonomic aspect analysis

Anthropometric aspects possessed positive influence toward customers' convenience, as relevantly. This statement went relevantly with the arguments delivered by several ergonomic experts, who claimed that environmental ergonomic affected human's health, convenience, ability, and willingness to perform an activity (Kroemer, 2017; Sanders & McCormick, 1993).

Upon seen from the environmental ergonomic aspect, the most self-explanatory indicator was the air circulation (ventilation) inside the restaurant, which helped the customers to feel comfortable (el2), with a loading value of .843. As explained, the restaurant area was divided into indoor and outdoor. Air-conditioners were used on the indoor area, while fans were used on the outdoor area. According to the respondents, the indoor area was prioritized as it was both cooler and fresher than the outdoor area, despite have already been equipped with fans. Several other respondents argued that the outdoor area was actually being more private than the indoor and had been selected primarily by smoking customers; nevertheless, a hot temperature pushed some of these respondents to sit indoor.

According to the comparison between eight indicators toward environmental ergonomic standards (Kroemer, 2017), six of eight indicators had conformed. In other words, it can be concluded that the restaurant had already fulfilled 75% of the environment ergonomic standard. Environmental ergonomic, as the most influential ergonomic aspects (as seen from its coefficient value), also possessed the highest conformity level among the other ergonomic aspects. The owner, therefore, was actually required to maintain (improve, if possible) the conformity between these aspect indicators toward the ergonomic standards in order to provide its customers' convenience.

Customers' convenience analysis

From the perspective of the customers' convenience, kk2 indicator (stating that the customers are feeling relaxed) was the most self-explanatory indicator toward customers' convenience aspect. Nevertheless, the loading value from both kk1 and kk3 were found to be beyond .85; therefore, those three customers' convenience indicators also required attention from the restaurant owner.

Conclusion

This research concludes that both environmental ergonomic and anthropometric are having significant positive influence toward customers' convenience aspect, while at the same time, visual display aspect is insignificant.

Therefore, the restaurant owner is required to prioritize both environmental ergonomic and anthropometric indicators, especially on the indicators having a high loading value toward both ergonomic aspects.

The ergonomic aspects analysis on the whole indicators (21 indicators) had objectively shown that 11 indicators already conformed with the ergonomic standards, while the remaining 10 did not. Thus, around 52.38% of the ergonomic standards have already been fulfilled by this restaurant.

The structural model of this research has a good goodness-of-fit with the R^2 value of .707. It can be concluded that the visual display, anthropometric, and environmental ergonomic aspects may elaborate the variability of the customers' convenience in amount of 70.7%.

Implications

This part of the research elaborates the implications as seen from the theory and managerial development perspective suitable for the practitioners.

Theoretical implications

As seen from the theory perspective, the main contribution from this research is that restaurants' ergonomic aspects, involving anthropometric and environmental ergonomic, possess several impacts toward their customers' convenience (both physically and psychologically). This research reconfirms ergonomic experts' arguments who have proposed that one of the aims of ergonomic study is to provide convenience toward users through the result of structural model testing, in which the ergonomic aspects adopted in this research may elaborate the high level on the customers' convenience variability (in amount of 70.7%).

Other contributions from this research are reflected from the adopted indicators which pay respect toward the customers' capability, ability, and limitation, therefore, causing no troubles in the customers' convenience and health. Furthermore, the adopted indicators have technical/engineering, as well as specific and measurable traits, therefore, enabling a measurement and analysis by using subjective and objective approach methods. It is obvious that the result of the analysis can be created to be more comprehensively by joining both approaches.

This research provides several suggestions and solutions for multidisciplinary problem analysis. Multidisciplinary analysis can be functioned as an alternative approach in social and humanistic researches' problem-solving. Naturally, if any problem involving human is complexe, then multidisciplinary analysis can be one of the promising alternatives.

Managerial implications

An important contribution from this research toward the practitioners and restaurant owners is involving the use of ergonomic aspects to maintain and improve customers' convenience. Practitioners and restaurant owners are suggested to focus not only on the restaurant concept (service type, dishes on the menu, dining room decoration and ambience, food style, serving style, food presentation, food smell, and many others) but also toward ergonomic aspects within the management. A precise combination between the restaurant's concept and ergonomic aspects may provide convenience among the customers. As an example, if a restaurant considers itself as a fast food restaurant, then its tables' and chairs' height and space need to be adjusted according to the ergonomic standard, despite no soft cushion is provided (as its management does not expect the customers to stay for too long). If that restaurant adopts colored lamp to provide a particular ambience toward the customers, then the management is still required to pay attention toward an appropriate lighting intensity (lux) to prevent any disorder in the customers' sight. Therefore, determining priority on the ergonomic indicators becomes an important consideration for the sake of the customers' convenience.

In addition, due to engineering/technical, measurable, and specific traits of the ergonomic indicators, any improvement effort committed by the owner and/the management can be more specific and clear; which eventually may assist them on the decision-making.

Limitations and future research

As happened in every research, this research has several limitations that can be addressed in future. First, the findings of this study were limited to one service setting or one restaurant. Further research using more restaurants is needed to establish the generalizability of the findings. Nevertheless, any restaurant becoming the following research subjects are suggested to be the ones with a similar concept, in order to prevent bias on the research due to the lack of data homogeneity.

This study was conducted using a limited number of sample. Therefore, the following researches are suggested to adopt a bigger sample. Bigger sample from more restaurants having a similar concept may increase the significance level from the influence of the visual display aspect.

This research has also only adopted questionnaire and direct measurement for the ergonomic aspects. In the future research, it is suggested to utilize interview toward the customers to gain more insight for the customers' convenience, in order to produce a more precise result.

Last, this research only views the customers' convenience through ergonomic aspects. The next researches are suggested to include other factors

such as dimensions on service quality, as it was found that there were still 29.3% of the convenience variability caused by factors other than the ergonomic aspects. Furthermore, structural model development from this research can also be conducted by considering whether ergonomic aspects possess a direct relationship toward customers' satisfaction or require customers' convenience as its mediator variable. This is based on the aim of the ergonomic study, which also focuses on the users' satisfaction (Kroemer, 2017; Manuaba, 2007; Wilson, 1995).

ORCID

Herry Christian Palit  <http://orcid.org/0000-0002-0349-5059>

References

- Chakrabarti, D. (2005). Ergonomic/human factors: Human aspect of technology, directions", Indian Institute of Technology Kanpur. [Special issue]. *Product Design and Media Communication*, 7(1), 41–47.
- Chyuan, J. Y., Du, C. L., Yeh, W. Y., & Li, C. Y. (2004). Musculoskeletal disorders in hotel restaurant workers. *Occupational Medicine*, 54(1), 55–57. doi:10.1093/occmed/kqg108
- Dempsey, P. G., & Filiaggi, A. J. (2006). Cross-sectional investigation of task demands and musculoskeletal discomfort among restaurant wait staff. *Ergonomics*, 49(1), 93–106. doi:10.1080/00140130500415225
- Freivalds, A., & Niebel, B. (2014). *Niebel methods, standards, and work design* (13th ed.). Singapore, Singapore: McGraw-Hill.
- Gentzler, M. D., & Smither, J. A. (2012). Using practical ergonomic evaluations in the restaurant industry to enhance safety and comfort: A case study. *Work*, 41(1), 5529–5531. doi:10.3233/WOR-2012-0872-5529
- Hair, J., Sarstedt, M., Ringle, C., & Mena, J. (2012). An assessment of the use of partial least squares structural equation modeling in marketing research. *Journal of the Academy of Marketing Science*, 40(3), 414–433. doi:10.1007/s11747-011-0261-6
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis* (7th ed.). Upper Saddle River, NJ: Prentice Hall.
- Heung, V. C. S., & Gu, T. (2012). Influence of restaurant atmospherics on patron satisfaction and behavioral intentions. *International Journal of Hospitality Management*, 31(4), 1167–1177. doi:10.1016/j.ijhm.2012.02.004
- Hwang, J. J., Jung, M. C., Kim, H. J., JungChoi, K. H., Bahk, J. W., & Lee, I. S. (2011). Evaluation of working postures of catering workers in a restaurant. *Journal of the Korean Society of Safety*, 26(5), 81–88.
- IEA. (n.d.). *Definition and domains of ergonomic*. Retrieved from <http://www.iea.cc/whats/index.html>
- Ilban, M. O. (2013). Musculoskeletal disorders among first class restaurant workers in Turkey. *Journal of Foodservice Business Research*, 16(1), 95–100. doi:10.1080/15378020.2013.761016
- Jang, S., Ha, A., & Park, K. (2012). Effects of ethnic authenticity: Investigating Korean restaurant customers in the U.S. *International Journal of Hospitality Management*, 31(3), 990–1003. doi:10.1016/j.ijhm.2011.12.003

- Kelley, E. J. (1958). The importance of convenience in consumer purchasing. *Journal of Marketing*, 23(1), 32–38. doi:[10.1177/002224295802300105](https://doi.org/10.1177/002224295802300105)
- Kolcaba, K. (2003). *Comfort theory and practice: A vision for holistic health care and research*. New York, NY: Springer.
- Kotler, P. T., Bowen, J. T., & Makens, J. (2003). *Marketing for hospitality and tourism* (3rd ed.). Upper Saddle River, NJ: Prentice Hall.
- Kristanti, M., Soedarto, F. C., & Widjaja, A. H. (2016). *Analisa aspek ergonomi di restoran Pipe & Barrel Surabaya terhadap kenyamanan karyawan dan konsumen* (Unpublished undergraduate thesis). Petra Christian University, Surabaya, Indonesia.
- Kroemer, K. H. E. (2017). *Fitting the human: Introduction to ergonomic/human factors engineering* (7th ed.). Boca Raton, FL: CRC Press.
- Manuaba, A. (2007). A total approach in ergonomic is a must to attain humane, competitive and sustainable work systems and products. *Journal of Human Ergology*, 36(2), 23–30.
- Nanyan, P., & Charrada, M. B. (2016). Effect of restaurant types on compensation claims for work-related musculoskeletal disorders in France. *International Journal of Occupational Safety and Ergonomics*, 24(2), 324–328. doi:[10.1080/10803548.2016.1270544](https://doi.org/10.1080/10803548.2016.1270544)
- North, A. C., Shilcock, A., & Hargreaves, D. J. (2003). The effect of musical style on restaurant customer's spending. *Environment and Behavior*, 35(5), 712–718. doi:[10.1177/0013916503254749](https://doi.org/10.1177/0013916503254749)
- Panero, J., & Zelnik, M. (2003). *Human dimension and interior space*. (D. Kurniawan, Trans.). Jakarta, Indonesia: Erlangga.
- Salleh, N. F. M., Sukadarin, E. H., & Zakaria, J. (2017). Preliminary study of musculoskeletal complaints and ergonomic risk factors among catering workers. *Asia Pacific Environmental and Occupational Health Journal*, 3(1), 39–43.
- Sanders, M. S., & McCormick, E. J. (1993). *Human factors in engineering and design* (7th ed.). New York, NY: McGraw-Hill.
- Satwiko, P. (2009). *Pengertian kenyamanan dalam suatu bangunan*. Yogyakarta, Indonesia: Wignjosoebroto.
- Subramaniam, S., & Murugesan, S. (2015). Investigation of work-related musculoskeletal disorders among male kitchen workers in South India. *International Journal of Occupational Safety and Ergonomics*, 21(4), 524–531. doi:[10.1080/10803548.2015.1096063](https://doi.org/10.1080/10803548.2015.1096063)
- Sugiyono. (2010). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Bandung, Indonesia: CV Alfabeta.
- Sulek, J. M., & Hensley, R. L. (2004). The relative importance of food, atmosphere, and fairness of wait: The case of a full-service restaurant. *Cornell Hospitality Quarterly*, 45(3), 235–247. doi:[10.1177/0010880404265345](https://doi.org/10.1177/0010880404265345)
- Wilson, J. R. (1995). A framework and a context for ergonomic methodology. In J. R. Wilson & E. N. Corlett (Eds.), *Evaluation of human work: A Practical ergonomic methodology* (pp. 1–29). London, Great Britain: Taylor and Francis.
- Wilson, S. (2003). The effect of music on perceived atmosphere and purchase intentions in a restaurant. *Psychology of Music*, 31(1), 93–112. doi:[10.1177/0305735603031001327](https://doi.org/10.1177/0305735603031001327)
- Xu, Y. W., & Cheng, A. S. K. (2014). An onsite ergonomic assessment for risk of work-related musculoskeletal disorders among cooks in a chinese restaurant. *Work*, 48(4), 539–545. doi:[10.3233/WOR-131805](https://doi.org/10.3233/WOR-131805)

Appendix 1. Indicators of ergonomic aspects

Aspects	Indicators	Coding
Visual display	Pictures are able to explain foods and beverages within the menu book.	vd1
	Pictures and fonts size on the menu are proportional.	vd2
	Color adopted on the menu are eye-catching.	vd3
	Contents of the menu are informative.	vd4
	Contents of the menu are concise.	vd5
	Contents of the menu are clear.	vd6
	Contents of the menu are readable.	vd7
	Signboards (toilet, ordering, cashiering counters, etc.) are readable.	vd8
	Signboards (toilet, ordering, cashiering counters, etc.) are informative.	vd9
	Signage can easily be spotted and read from outside of the restaurant.	vd10
Anthropometric	Tables' width provides a discretion for the customers in moving while dining.	a1
	Tables' and chairs' height are proportional; therefore, the customers are able to sit for a longer time.	a2
	The space between tables enables the customers to move around decently.	a3
	The space between chairs in a table is not overly close.	a4
	The shape of the chairs enables the customers to sit comfortably for a longer time.	a5
	The height of the ordering and cashiering counter are comfortable for the customers.	a6
Environmental ergonomic	The room temperature makes the customers enjoying the restaurant comfortably.	el1
	The air circulation inside the restaurant makes the customers enjoying the restaurant comfortably.	el2
	Humidity inside the restaurant is normal.	el3
	Illumination inside the restaurant causes not too much glare.	el4
	Illumination inside the restaurant causes not too much shadow.	el5
	Sunlight getting into the restaurant causes not too much shadow.	el6
	The genre of music played makes the customers enjoying the restaurant comfortably.	el7
	Music volume is neither too loud nor to low.	el8
Customers' convenience	Customers are feeling relaxed inside the restaurant.	kk1
	Customers are feeling happy in performing activities inside the restaurant.	kk2
	Customers are not having any difficulty in performing activities inside the restaurant.	kk3