SEGMENTATION USING CUSTOMERTS LIFETIME VALUE: HYBRID K-MEANS AND ANALYTIC HIERARCHY PROCESS

THESIS

In partial fulfilment of the requirements

for the Degree of Master of Science in Management

from Institut Teknologi Bandung

By

Radit Rahmadhan

Student ID: 29020003

(Master Program of Science in Management)



INSTITUT TEKNOLOGI BANDUNG  
2022

ABSTRACT

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Write abstract in English here. The font size in the abstract is 12, times new roman characters and not written in bold. Abstract consists of 500-800 words. The first sentence of the abstract is three spaces from the last line of the name of study program. The first word or the beginning of a new paragraph should be separated by a single space from the last sentence of the preceding paragraph. Abstracts are written in English and consist of 500-800 words. The end of abstract, which is still in the sheet of this abstract but in separate line from abstract, ended with keyword (keywords). Keywords (keywords) written at the bottom of the abstract are words, which are related and derived from the abstract. **IT SHOULD NOT BE** derived / taken from the body/ text of the thesis. The minimum numbers of keywords are 4 single words or a single meaningful two-word combination and maximum number of keywords are 7 single words or a single meaningful two-word combination.

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ABSTRAK

*SEGMENTASI MENGGUNAKAN NILAI SEUMUR HIDUP PELANGGAN: HIBRIDA K-MEANS DAN PROSES HIERARKI ANALITIK*

*Oleh*

Radit Rahmadhan

29020003

*(Program Studi Magister Sains Manajemen)*

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SEGMENTATION USING CUSTOMERTS LIFETIME VALUE: HYBRID K-MEANS AND ANALYTIC HIERARCHY PROCESS

HALAMAN PENGESAHAN

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Approved

December

Supervisor

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HALAMAN PERUNTUKAN

*In dedication to my beloved parents, brothers, and family, supervisor and advisor, and friends who always support me.*

# STATEMENT OF AUTHORSHIP

I hereby declare that I am the sole author of this thesis and to the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made. I further declare that this thesis has not been previously submitted to obtain a degree at this or any other higher education institution.

Signature:

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# ACKNOWLEDGEMENTS

The introduction page is printed on a new page. On this page, the Masters’ students may have the opportunity to express their gratitude in writing to other mentors and or individuals who have provided guidance; advise and critics; as well as to those who have assisted in conducting the research; whether individuals or bodies that have provided financial assistance, and so forth.

In the forewords, authors may use all kinds of writing varieties. However it is advisable to keep it in a standard written sentences. Acknowledgments should be made in excessive and limited only to the "scientifically related".

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Chapter I Introduction

**I.1 Background**

Electricity is a vital energy for the sustainability of human activities both for individuals, community groups and the industrial world (a). As the development of electrical energy is more widely used to carry out activities with enormous benefits where various equipment to meet the needs of life are operated using electrical energy (b). Community activities tend to increase over time. The increase in activities encourages an increase in the operation of equipment with electric power. (sdasdasd). During the electricity consumption period from 2015 to 2020, Indonesia experienced an increase in electricity consumption of around 98.99% with business customers dominating the largest electricity consumption (1). PT PLN Persero is the only electricity provider in Indonesia that provides higher power for all regions, including West Sumatra. While the electricity demand of business customers is increasing, power outages often occur up to a high frequency of four times a month. Based on the results of the data analysis that has been carried out, power outages cause the average electricity usage time of business customers to be below 50 hours per month. This is due to customers who use power above 200 thousand during peak load rather than electricity outside peak hours. During non-peak load hours, the usage is low.

Based on this, power companies should understand the characteristics of customers' electricity usage to maximize electricity distribution. For example, the low consumption of business customers due to power outages (under 50 hours per month) can be improved. Customer segmentation is one way to understand and map customer preferences. According to previous research, customer segmentation refers to the grouping of customers based on similar characteristics [3]. Thus, customer segmentation can be utilized to predict prospective actions in consuming services. That customers use

and build relationships and increase customer commitment to build a solid business [3][4].

Some previous research discussed customer segmentation on customer electricity consumption [4], [7], [8], [10], [12]. and electricity demand [7], [9]-[11]. The research context is more about finding new customer behavior patterns in consuming electricity and more methods that use a combination of K-Means and Self Organizing Maps (SOM) and other clustering methods [4], [7], [8], [10], [12].

Other studies use regression methods for customer segmentation [7], [9]-[11], they want to predict future electricity consumption to meet electricity demand from customers. The results of some previous studies provide recommendations for optimizing the use of electricity against the electricity that has been provided [4], [7], [8], [10], [12]. There are also other studies on analyzing customer characteristics by applying the K-Means Clustering model by analyzing tariffs, power, the number of bills paid and then from the results of the model. The concept is used in Customer Relationship Management (CRM) to gain insight or make company business decisions [11].Previous research on customer segmentation is generally based on total electricity consumption per day [4], [7], [8], [10], [12]. Other studies only analyzed tariffs, electricity, and total bills by combining K-Means and CRM [11].

Correspondingly, this research study aims to fill the gap by developing a segmentation model that can reflect electricity consumption behavior. The findings can help electricity companies improve their strategies in targeting customers according to their characteristics. We include three variables in the development of the segmentation model: power capacity, peak load consumption, and non-peak load consumption. We used K-means, Analytic Hierarchy Process (AHP) approach, and customer lifetime value aspects. The dataset used is the customer transaction data of PT PLN Persero West Sumatra Region from 2019 to 2020.

**I.2 Research objectives**

The previous section highlighted the need for an accurate electricity consumption customer segmentation prediction model that can divide customers based on the right segmentation. It also discusses the appropriate marketing strategy according to the characteristics of their customers. Therefore, this thesis focuses on developing a hybrid model of electricity consumption customer segmentation in West Sumatra Zone using electricity customer transaction data from January 2019 to December 2020. The prediction model is developed based on a hybrid model that is a combination of machine learning, namely K-Means Clustering, Analytic Hierarchy Process (AHP) approach, Customer Lifetime Value (CLV) Aspect and Customer Relationship Management (CRM).

For this purpose, the research questions are formulated as follows:

1. How to develop an accurate customer segmentation model according to the characteristics of electricity customers using West Sumatra Zone business customer transaction data?
2. How to implement marketing strategies according to customer criteria based on the results of the customer segmentation model?

**I.3 Research questions**

Considering the research question formulated above, the objectives of this study are defined as follows:

1. To develop a hybrid model of customer segmentation to find the right grouping of electricity customers according to their consumption patterns.
2. To apply the concept of Customer Relationship Management (CRM) Strategy according to the characteristics of its customers in order to meet the demand for electricity effectively.

**I.4 Research approach and methods**

This thesis is a design science study that focuses on developing a hybrid model of customer segmentation models. This research uses data on business customer transactions of PT PLN Persero in West Sumatra region from January 2019 to December 2020. This research adopts the predictive analytics framework by Shmueli & Koppius (2011) to develop a hybrid segmentation model, which consists of data collection, data preparation, model development, model evaluation, model usage and reporting. study]

**I.5 Research Scope and Limitations**

To emphasize the focus of this study, the research scope and limitations are defined as follows:

1. This study focuses on the electricity consumption of business customers specific to the Padang region. The selection of variables used power capacity, peak load consumption, and non-peak load consumption. Further research could investigate a wider selection of regions and a deeper selection of variables.
2. This study used one month of business customer transaction data. Future studies can use one year or more to be further examined as input for segmentation models.
3. This study examines proposals using a combination of machine learning models namely K-Means Clustering, Customer Lifetime Value and Customer Relationship Management (CRM) strategies. Other advance methods can be investigated in further research.

I.6 Writing structure

This thesis is organized as follows: Chapter I presents the overview of the research background, research questions and correspondence objectives, research approach and method, research scope and limitations, and the writing structure of this thesis. Chapter II reviews related literature, identify the knowledge gap and presents the position of this study. Chapter III discusses the research philosophy, paradigm and methodology used in this study, which consist of data collection, data preparation, choice of variables, clustering model, and marketing strategy. Chapter IV presents the empirical results and analysis of the proposed hybrid segmentation model. Finally, Chapter V concludes the findings of this study, contributions, and present limitations alongside suggestions for future research.

Chapter II Literature Review

Each new chapter should start with an odd numbered page. Use the “Page Break” facility in Microsoft word to add a blank page if the last paragraph of a chapter is on the odd page.

The literature review chapter covers the flow of thought and scientific development in the topic of study. Essentially, the research results of a researcher is not a new discovery that stands alone but something that is related to the results of previous researches. The literature review should be elaborating the results of previous researchers with the problems studied by masters’ students in such way that provides an overview of the development of knowledge underlying the writing of the thesis. The literature review shows the expertise of masters’ students in the fundamental science related to the issues reviewed. **Therefore, the literature review is NOT a description of common methods and / or basic theoretical that will be used.**

The literature review should be arranged in accordance with the order of the development of the knowledge. The literature review also contains reviews of the references and demonstrates why and how the student chooses the topic of study.

**The literature review can be inserted into the contents of the chapter** (in accordance with the requirements of writing and principle in each discipline of science) **and should not be written in separate chapter**.

The thesis outline for Literature Review Section is as follows:

**II.1 Introduction**

[This section introduces Chapter II]

**II.2 Past studies on “A”**

[This section critically reviews previous literature on “A” in more details]

**II.3 Past studies on “B”**

[This section critically reviews previous literature on “B” in more details. Past studies on other related topics can be inserted in next sections.]

**II.4 Proposed Research**

[This section summarizes past literature that have been explained in previous sub-sections in SOTA Tables, Fish Bones Diagrams, and other mind mapping diagrams to lead to research gaps and research questions]

**II.5 Proposition and/or Hypotheses [if applicable]**

[This section develops the propositions/hypotheses based on the underlying theories, past literature, critical review and argument]

**II.6 Chapter Summary**

[This section provide a summary of Chapter II]

Example of image which its size exceeding

the left and right margin of the paper

Figure II.1 Example on how to write an image title that does not exceed one line

If the title of the figure consists of one line, it should be placed symmetrically (centered) according to the margin of paper that can be printed. If the title of the figure consists of two or more lines, it should be aligned as justifies text. In this case, the second line of the title and so forth is a continuation of the first line. The initial letter writing begins under the first letter on the first line of the title of the figure (use the hanging paragraph facility available in Word Processor). Example of formatting the title of the figure consists of one line is shown in Figure II.1".

Attachments can be tables, figures, etc. which are (considered) as not the main body of the Thesis. The Appendix MUST BE referred in the thesis text with the format: "Appendix A". The examples of how to refer the appendices are as followed: Appendix A, Appendix B, Appendix C, Appendix D, Appendix E, and Appendix F.

Chapter III Research Methodology

The title of the chapter cannot be directly followed by the title of the subchapter, there must be at least a pharagraph explaining the whole chapter (you have to insert the sentence between the title of the chapter and the title of subchapter). It is not allowed to sequentially write title of the chapter, title of subchapter, and title of sub subchapter. Insert at leat 1 (one) paragraph between the title of the chapter and the title of the sub chapter or between title of the sub chapter and title of the sub subchapter.

The thesis outline for Research Methodology Section is as follows:

**III.1 Introduction**

[This section introduces Chapter III]

**III.2 Data**

[This section describes the source of data, the data frequency selection, and the ethical issues in doing this research or in collecting the data (please disclose whether ethical issues have been treated especially when collecting primary data. If there are no ethical issues please explain.)]

**III.3 Research Methods**

[This section explains the research strategy selection (such as Experiment, Survey, Case Study, Action Research, Grounded Theory, Ethnography, Archival Research, Mixed); the proposed research models to answer the research questions or to test the hypotheses, developed from past literature; lists and explains the dependent and independent variables, developed from past literature; the reliability and validity tests that are going to be used in this research (if applicable)]

**III.4 Chapter Summary**

[This section provides a summary of Chapter III]

III.1 Please write down the title of subchapter

Example of writing a long equation, the cuts will be done on the sign of arithmetic operation or equal sign. It does not need all the equations to be numbered. The equation number is placed in the lower right corner as follows:

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where:

*c* = ray speed

*r* = position

and so on.

Write a new paragraph here by adding 1 line space. Each new paragraph should consist of several sentences. The explanation of the symbol used in the equation can be written in the form of sentence e.g. the radiant radians are represented by the symbol *L*, ŝ is the vector of light travel and so on or in bullet points.

Examples of short writing are as follows:

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The continuation sentence, which is not a new paragraph, should be written without adding line space between the equations and the continuation sentence.

Each figure in the thesis text is numbered and should be referred to the body text of the thesis. Figure III.1 shows examples of the formatting the title of the figure with a description of components a, b, and c in the figure.

a

b

c

Sample image with sizes, which do not exceed

the left and right margin of the paper

Figure III.1 Example of the title of the figure that has several parts (a) the first subfigure title, (b) the second subfigure title, and (c) the third subfigure title.

Examples of short table title and figure format are shown in Table III.1:

Table III.1 The value of objective function.

|  |  |
| --- | --- |
| Object | Objective Function |
| 1 | 2,44x 10-6 |
| 2 | 2,90x 10-4 |
| 3 | 2,87x 10-5 |

Table III.2 The Condition of rice in North Sumatra in 3 years (1969 - 1971) (Last name of author, Year)\*.

|  |  |  |  |
| --- | --- | --- | --- |
| Year | Rice Production  (Tonnes) | Rice Consumption  (Tonnes) | Import of Riceb  (Tonnes) |
| 1969  1970  1971 | 676,60  691,65  755,56 | 731,75  748,87  789,10 | 70,60  40,51  46,27 |

1. People Agriculture Office, North Sumatera Province
2. Export-import realization and list of export of goods development of North Sumatra, the North Sumatra Province Ministry of Trade representatives, page 14.
3. \*Note: if the table is quoted from a paper or book then it is necessary to write the name of the author / writer, agency, or other sources.

Chapter IV Results and Analysis

The title of the chapter cannot be directly followed by the title of the subchapter; there must at least a paragraph explaining the whole chapter (you have to insert the sentence between the title of the chapter and the title of subchapter). Insert at least 1 (one) paragraph between the title of the chapter and the title of the sub chapter.

The thesis outline for Results and Analysis Section is as follows:

**IV.1 Introduction**

[This section introduces Chapter IV]

**IV.2 Results** [the title can be modified to show the answer to each research question]

[This section shows the results and the analysis. Another section could be added to show and explain more results to different research questions)]

**IV.3 Chapter Summary**

[This section provides a summary of Chapter IV]

IV.1 Example of Writing Subchapter Which Consists Words of More than One Line

Examples of title of chapters and subchapters that consist of more than one line are shown in the chapter titles IV and chapter IV.1. The last line of the title of the chapter **shall not** be directly followed by the title of sub chapter (without inserting the sentence between the title of chapter and the title of sub chapter). Moreover **it is not allowed** to sequentially write the **title of chapter**, **the title of sub chapter**, and **the title of sub subchapter** without inserting the sentence between those three. Insert at least 1 (one) paragraph between title of the sub chapter and title of the sub subchapter.

IV.1.1 Example of Numbering and Locating Title of Sub subchapter

Write new paragraph here after inserting 1 line space. Each new paragraph should consist of several sentences.

IV.1.2 Example of Numbering and Locating Title of Sub subchapter

Write new paragraph here after inserting 1 line space. Each new paragraph should consist of several sentences.

IV.1.3 Example of Numbering and Locating Title of Sub subchapter

Write new paragraph here after inserting 1 line space. Each new paragraph should consist of several sentences.

Figure IV.1 shows an example of formatting the title of a graph, which is still expressed as a figure. This is due to the thesis guide book which is stated that the term figure includes figures; illustrations; graphs; diagrams; floor plans; maps; charts; monograms; flow charts; and portraits. The figure should be printed on the paper used for the script (Thesis). Original figure should be made with printer or plotter or similar quality printers. The letters, numbers, and other punctuation marks used in the figure should be clear. Meanwhile, Figure IV.2 shows examples of reference in writing on the figure quoted from papers or books, so the name of the writer / author, agency, or other sources needs to be cited.

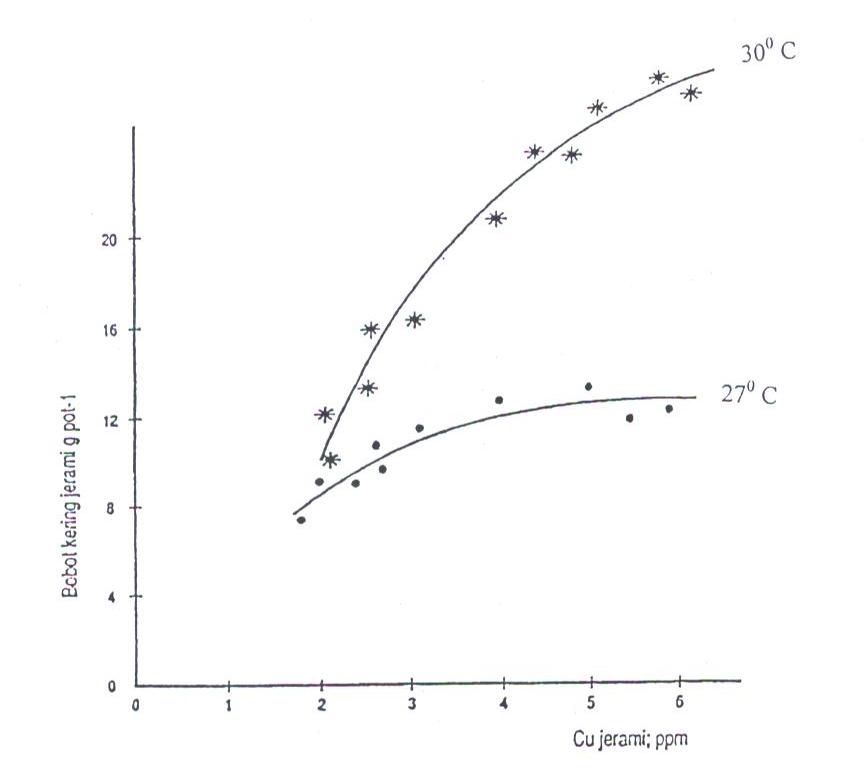


Figure IV.1 The relationship between dried weight straw and Cu straw wheat

plant that be planted at two experimental temperature for 6 weeks.



Figure IV.2 The separation of two dimensions of phospholipid essence from human erythrocytes. Solvent: chloroform – metanol – light oil – wáter (8: 8: 6: 1) in the first dimensión and aceton – chloroform – metanol – wáter (8: 6: 2: 2: 1) in the second dimensión (Last name of autor, Year).

These are examples of abbreviations writing in thesis. These are some of abbreviations that included in the abbreviations and symbols list e.g. High Performance Liquid Chromatography (HPLC), Nuclear Magnetic Resonance (NMR), and Polymerase Chain Reaction (PCR).

Chapter V Summary and Conclusion

This section provides a summary and conclusion of the study (Chapters I to V). Please ensure that the (practical) implications of the findings to the relevant stakeholders (literature, business, government, and society) and future research are provided.

REFERENCES

Davenport, T. H. (1998): Putting the enterprise into the enterprise system, *Harvard Business Review*, **July-August 1998**, 1-11.

Eisenhardt, K. M. (1989): Building theories from case study research, *The Academy of Management Review.* **14** (4), 532-550.

Hasan, M. M., and Habib, A. (2017): Firm life cycle and idiosyncratic volatility, *International Review of Financial Analysis,* **50**, 164-175.

Karniouchina, E. V., Carson, S. J., Short, J. C., and Ketchen Jr, D. J. (2013): Extending the firm vs. industry debate: does industry life cycle stage matter?, *Strategic Management Journal*, **34**, 1010–1018.

Li, M., Cao, X. J., Wang, L., Deng, L. (2016): The product-service lifecycle management based on sustainable development, *Service Operations and Logistics, and Informatics (SOLI), 2016 IEEE International Conference on The Product-service Lifecycle Management Based on Sustainable Development IEEE Xplore Document*, 200-205.

Maijanen-Kylaheiko, P. (2014): Pursuit of change versus organizational inertia: a study on strategic renewal in the Finnish broadcasting company, Masters’ Program Thesis, Lappeenranta University of Technology, 50-59

Stark, H. (1998): The dynamics of surface adsorption, *Proceedings of the International Congress on Current Aspects of Quantum Chemistry,* London, U.K., Carbo R., ed., Prentice Hall, 24 – 36.

Sundin, E. (2009): Life-Cycle Perspectives of Product/Service-Systems: In Design Theory, 31-49 in Sakao, T. and Lindahl, M., ed., *Introduction* *to Product/Service-System Design*, Springer-Verlag, London.

Swanson, R. A., and Chermack, T. J. (2013): *Theory Building in Applied Disciplines*, Berret-Koehler Publishers Inc., San Francisco, 112-117.

Vargo, S. L., Maglio, P. P., and Akaka, M. A. (2008a): On value and value co-creation: service systems and service logic perspective, *European Management Journal*, **26**, 145– 152.

Vargo, S. L., and Lusch, R. F. (2008b): From goods to service(s): Divergences and convergences of logics, *Industrial Marketing Management,* **37**, 254–259.

**References from Newspaper:**

Article title. (Date). *Newspaper Name*, page. XX.

Informant (Date). Article title. *Newspaper Name*, page. YY.

Pengelolaan diusulkan satu lembaga. (16 Oktober 2015). *Kompas*, hal. 14.

Saidi, A. I. (16 Oktober 2015). Semiotika laut. *Kompas*, hal. 6.

**References from Film or Television:**

Figure Name (The Position of the Figure). (Date). *Event Name* [Event type]. Television Station Name/ Film Producer: City

Sagantoro, A. (Producer). (2011). *The Raid* [Life Image]. PT. Merantau Films and XYZ Films: Jakarta.

Arlusi, R. and Ginting E. (Executive Producer). (21 Oktober 2015). *Mata Najwa* [Television broadcast]. Metro TV: Jakarta.

**References from website:**

Data Air Mampu Curah periode 1950 – 2000 is a grid data (reanalysis) from *National Centre for Environmental Prediction* (NCEP), data is obtained from website: http://www.esrl.noaa.gov/psd/data/gridded/data .ncep.reanalys2.html. Downloaded on May 5, 2013.

Data Indeks DM periode 1901 – 2000 the result of reanalysis from *Japan Agency for Marine Earth Science and Technology* (JAMSTEC), data is obtained from website: http:/www.jamstec.go.jp/frcgc/research/d1/iod/kaplan\_sst\_dmi\_new.txt. Downloaded on Oktober 28, 2013.

Peta Pola Suhu Permukaan Laut (SPL) di Samudra India Ekuatorial, data is obtained from website: http://www.jamstec.go.jp/frsgc/research/d1/iod/. Downloaded on Agustus 2, 2012.

Note:

1. Types of references writing formats are as follow:

First reference is **magazine** written by single authors.

Second reference is **journal** written by single author.

Third reference is **journal** written by 2 authors.

Fourth reference is **journal** written by more than 2 authors.

Fifth reference is reference publish through **conference**.

Sixth reference is masters’ program **thesis**.

Seventh reference is **proceeding**.

Eighth reference is **book** that each chapter written by different authors and there is editor/s.

Ninth reference is **book**.

Tenth and eleventh references are references written by the same main author but published at different time.

1. Additional criteria regarding appropriateness for inclusion in the references follows the prevalence in each discipline of science and is governed by the KPPs-Faculties.
2. It is not allowed to cite from **newspaper**, **radio** or **TV** unless it is used as research object. The references form website is also written in alphabetically order, not necessarily numbered.
3. If any master program thesis used as reference, the format is as shown by the eleventh reference.
4. This section lists all references that have been cited in the document in alphabetical order. Please follow a citation/reference style as required by ITB. To make this easier, you may use Endnote, Mendeley or other bibliography management software to organise the citation/references.

APPENDICES

This section shows all appendices that support the discussion in the thesis. Please mention each appendix in the thesis to link them to the content.

Appendix A Example of Approval Page Contains Two Supervisors

THESIS TITLE; FONT; TIMES NEW ROMAN; CAPITAL LETTER; 14; BOLD; SINGLE SPACE

By

Student Name

Student ID: 2900001

(Masters’ Program of Science in Management)

Institut Teknologi Bandung

Approved

Supervisor Team

Date ............................(date month year)

Supervisor

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(Name of Supervisor)

Appendix B Example of Writing Appendix Titles

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Appendix B Example of Writing Appendix Titles (continuance)

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Appendix C Please Write the Title of the Appendix

C1. Please Write the Title of the Sub Appendix

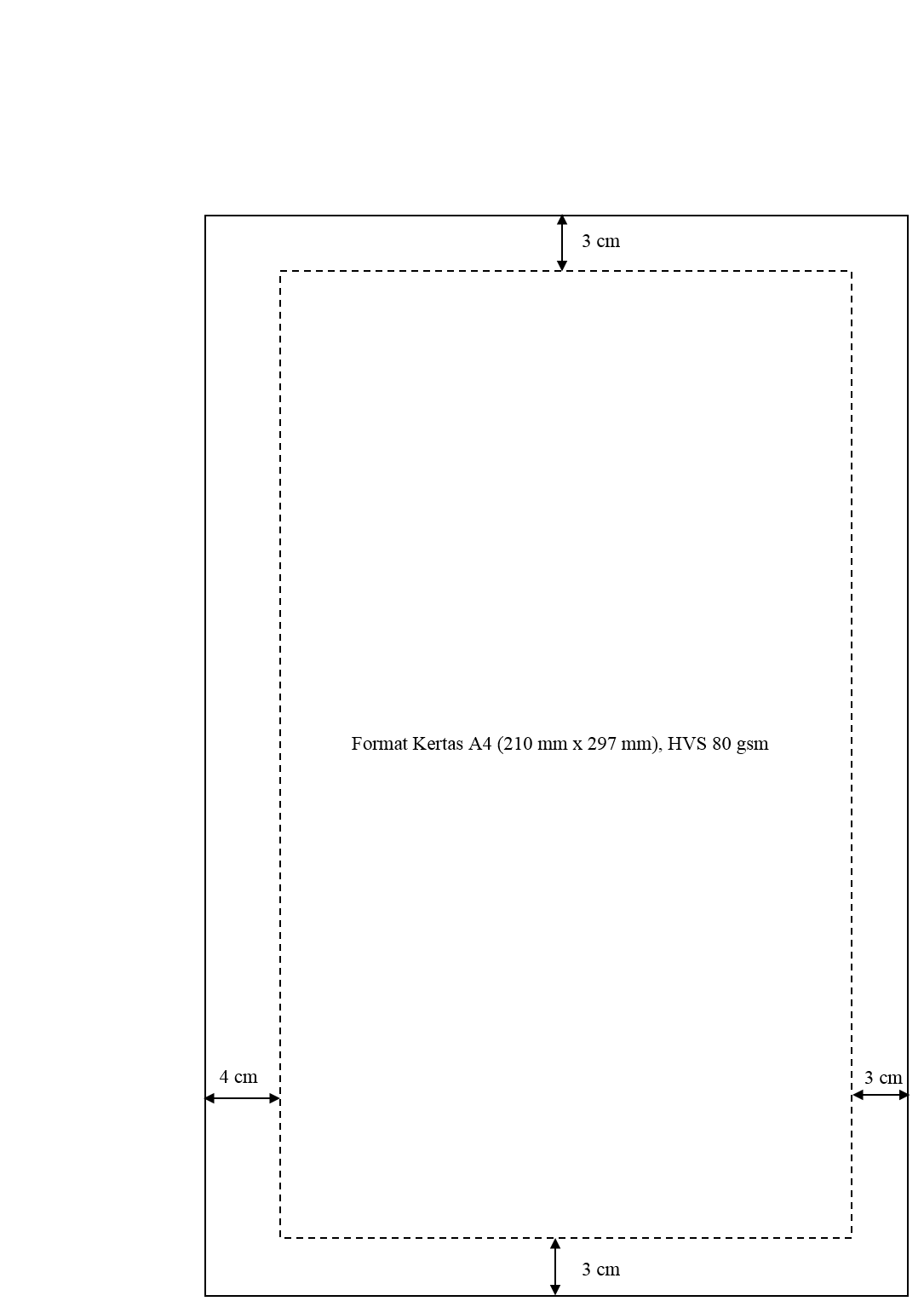
Write a new paragraph here by adding 1 line single space. Each new paragraph should consist of several sentences.

C2. Please Write the Title of the Sub Appendix

Write a new paragraph here by adding 1 line single space. Each new paragraph should consist of several sentences.

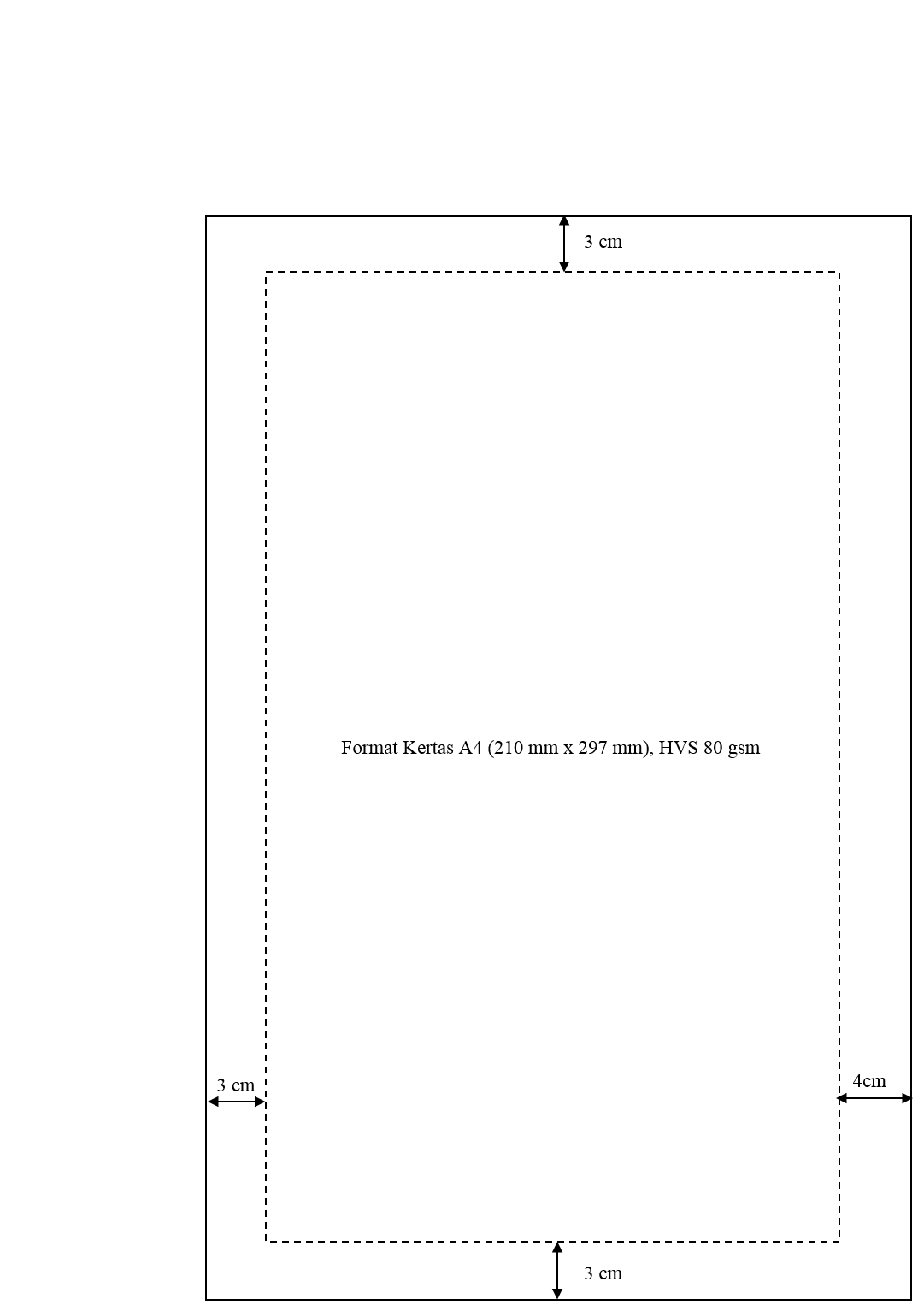
Note: The Appendix may consist of several pieces. The appendix may contain additional notes; formula derivation; calculation examples; raw research data; etc., which, if incorporated into the body of the thesis will interfere the explanation smoothness in the body of thesis. Each appendix is numbered in the capital letters of the Latin alphabets A, B, C, ... and so on. The appendix is preceded by a page containing only the word APPENDICES (size 14, bold) in the middle of the page and given the page number. The appendix can be tables, figures, and so on which (is considered) not a major part of the thesis. The appendix MUST be referred in the thesis body with the format e.g. "Appendix A".

Appendix D Example of Margin for Odd Pages (if the thesis Document is Printed Both Sides)



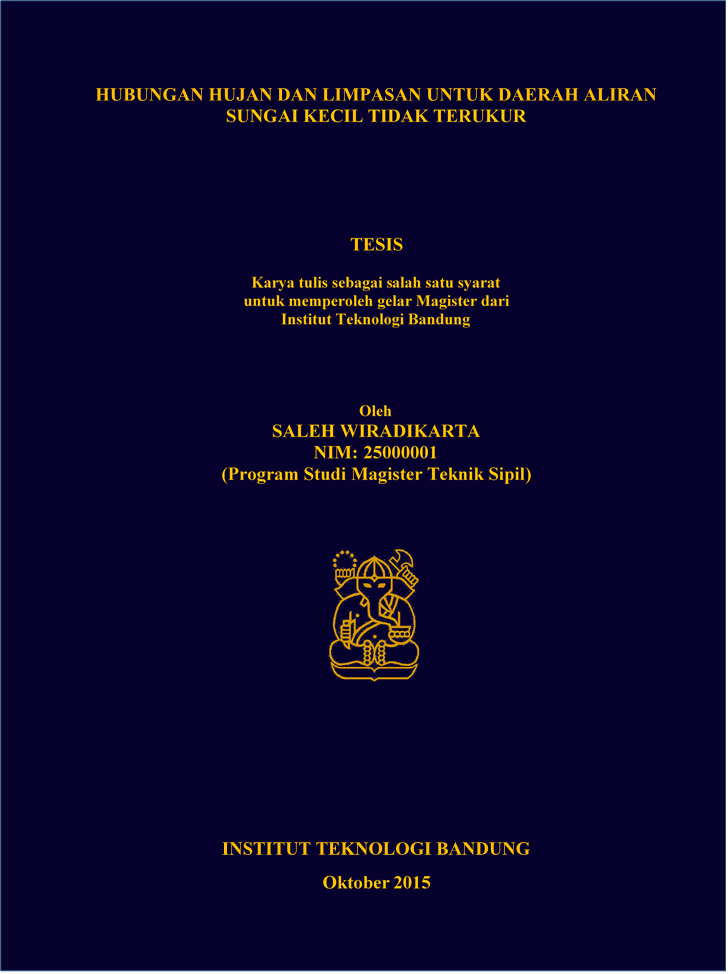
Note: The above illustration is not an actual measure. Author can use thicker paper if needed, for example: if a printout looms into the back of the paper.

Appendix E Example of Margin for Even Pages (if the Thesis Document is Printed on Both Sides)



Note: The above illustration is not an actual measure

Appendix F Example of Thesis Cover and Binding



Catatan:

1. The final thesis script should be bound by hard cover, Dark Blue (Biru Dongker), Omega No.10 paper type, and the writing on the cover is printed with gold ink.

2. Author name, Studnet Number, Thesis Title, ITB logo, month and year should be written on the side part of the cover. The name of month (January – December) on the side part of the cover should be abbreviated as: Jan, Feb, Mar, Apr, Mei, Jun, Jul, Ags, Sep, Okt, Nov, dan Des.