

## CHAPTER 6

### CONCLUSSION AND SUGGESTION

#### 6.1. Conclusion

Based on the data analysis and discussion which has been accomplished, it able to make some conclusion which answered the objective of this research. The following conclusion are:

1. Identify effect, causes, and currently detection
  - a. FMEA process analysis following three approaches, there are:
    - i. Severity approaches which founded three effects has severity scale that equal 7 and one effect with severity scale 8.
    - ii. Occurrence approaches which has two causes with occurrence rating is 7, and four causes with occurrence rating is 8.
    - iii. Detection approaches which has 5 currently detection with highest scale 8.
    - iv. RPN value is make prioritize by seen the failure mode, and get seven failure modes which the rpn value is above 100. The highest RPN is equal 448.
  - b. FMEA design analysis following three approaches, there are:
    - i. Severity approaches which founded two effects has severity scale that equal 7.
    - ii. Occurrence approaches which has three causes with occurrence rating is 8.
    - iii. Detection approaches which has 5 currently detection with highest scale 7.
    - iv. RPN value is make prioritize by seen the failure mode, and get five failure modes which the rpn value is above 100. The highest RPN is equal 440.
2. Take an action to reduce the highest failure mode based on RPN value
  - a. Recomendation action For FMEA Process
    - i. Remind and training worker to use proper tools
    - ii. Remind and training worker to performing job follow SOP
    - iii. Avoid ID Plate put in stacking way, it should aligned in the board
    - iv. Remind and give instruction to Dept. Engineering to make a new jig and standard/SOP
    - v. Fix the the oldest tools, like rivets in polishing placement board.
  - b. Recomendation action For FMEA Design
    - i. Remind and training worker to use proper tools
    - ii. Remind and training worker to performing job follow SOP
    - iii. Avoid ID Plate put in stacking way, it should aligned in the board

- iv. Remind and give instruction to Dept. Engineering to make a new jig and standard/SOP
- 3. Comparing failure modes before and after implementing FMEA
  - a. Comparison for FMEA process
    - i. Failure mode grazes has been decreased from 448 to 343
    - ii. Failure mode unperfect installed (rivets not in the proper place) has been decreased from 320 to 80
    - iii. Failure mode many defect escape to next process has been decreased from 294 to 54
    - iv. Failure mode gravure not in the special frame has been decreased from 280 to 224
    - v. Failure mode many defect escape to send abroad has been decreased from 100 to 8.
    - vi. Remind and training worker to performing job follow SOP
    - vii. Avoid ID Plate put in stacking way, it should aligned in the board
    - viii. Remind and give instruction to Dept. Engineering to make a new jig and standard/SOP
  - b. Comparison for FMEA design
    - i. Failure mode grazes has been decreased from RPN value equal 440 became 128
    - ii. Failure mode paint chip on the edge has been decreased from 440 became 128
    - iii. Failure mode gravure not in the proper depth has been decrease from 272 became 38
    - iv. Failure mode rivets not in the proper position has been decrease from 245 to 147
    - v. Failure moe gravure not in the special frame has been decrease from 160 to 20

## **6.2. Suggestion**

- 1. For company
  - a. It expected to remind worker perform better in validation and verification process by make training for them.
  - b. Remind worker to always write down the result of each process and design verification and validation, so that the failure modes will be avoid by evaluation result by finding solution as soon as possible.

- c. Remind Dept. Engineering to immediately create a jig for printing machine.
- d. For preference, it will be better when Dept. Head. QA and Dept. Head. Engineer often held brief visit to the production floor and worker give feedback by communicate with them if there is any difficulties. Do not be shut the difficulties from them. Not only both worker and dept. Head but also with supplier it should have good communication, because supplier already give the basically part and need improvement if there is any issues.

- a. For next researchers

Because of in the research, the implementation just only limit from Feb 2016 until March 2016. It should perform better on next period for seen others recommendation that accomplish yet and re-calculate when whole recommendation finish.

## REFERENCES

- Cândeia, G., Kifor, S., & Constantinescu, C. (2014). Usage of Case-based Reasoning in FMEA-driven Software. *Procedia CIRP*, 25, 93–99. <http://doi.org/10.1016/j.procir.2014.10.016>
- Carlson, C. S. (2014). Understanding and Applying the Fundamentals of FMEAs.
- Crites, J. W., Kittinger, S. W., Des, C., & Drive, V. P. (2009). Use of Failure Modes and Effects Analysis ( FMEA ) Methodology in Evaluation of Process Transfer of Ohmic Liftoff from Low-Pressure-Solvent to High-Pressure-NMP Liftoff.
- Dietz, W. (2014). *Failure Mode and Effects Analysis (FMEA): Well-Known Methodologies, But Not in Our World. Re-Engineering Clinical Trials: Best Practices for Streamlining the Development Process*. Elsevier. <http://doi.org/10.1016/B978-0-12-420246-7.00008-6>
- Estorilio, C., & Posso, R. K. (2010). The reduction of irregularities in the use of “process FMEA.” *International Journal of Quality & Reliability Management*, 27(6), 721–733. <http://doi.org/10.1108/02656711011054579>
- Feili, H. R., Akar, N., Lotfizadeh, H., Bairampour, M., & Nasiri, S. (2013). Risk analysis of geothermal power plants using Failure Modes and Effects Analysis (FMEA) technique. *Energy Conversion and Management*, 72, 69–76. <http://doi.org/10.1016/j.enconman.2012.10.027>
- Jensen, F., Morris, A. S., Levin, M. A., Kalal, T. T., Pascoe, N., & Carlson, C. (n.d.). *Effective FMEAs*.
- Kolich, M. (2014). Using failure mode and effects analysis to design a comfortable automotive driver seat. *Applied Ergonomics*, 45(4), 1087–1096. <http://doi.org/10.1016/j.apergo.2014.01.007>
- Margineanu, L., Prostean, G., & Popa, S. (2015). Conceptual Model of Management in Automotive Projects. *Procedia - Social and Behavioral Sciences*, 197(February), 1399–1402. <http://doi.org/10.1016/j.sbspro.2015.07.085>
- Mikulak, R., McDermott, R., & Beauregard, M. (2011). *The basics of FMEA. Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki*. Retrieved from <http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:No+Title#0> [http://books.google.com/books?hl=en&lr=&id=rM5Vi\\_0K9bUC&oi=fnd&pg=PP1&dq=the+basics+of+FMEA&ots=TK0TsBDT\\_2&sig=xoUVOuaFhx1Hz-KkwHNI50igzko](http://books.google.com/books?hl=en&lr=&id=rM5Vi_0K9bUC&oi=fnd&pg=PP1&dq=the+basics+of+FMEA&ots=TK0TsBDT_2&sig=xoUVOuaFhx1Hz-KkwHNI50igzko) <http://books.google.com/books?hl=en&lr=&i>
- Namdari, M., Sh, R., & Jafari, A. (2011). Using the FMEA method to Optimize fuel consumption in Tillage by Moldboard Plow 1 Introduction, 1(4), 734–742.
- Paciarotti, C., Mazzuto, G., & D'Ettorre, D. (2014). A revised FMEA application to the quality control management. *The International Journal of Quality &*

*Reliability Management*, 31(7), 788. <http://doi.org/10.1108/IJQRM-02-2013-0028>

Pandian, A., & Ali, A. (2014). Performance measurement of an automotive BIW robotic assembly, 2–21. <http://doi.org/10.1108/13683041311311338>

Shafiee, M., & Dinmohammadi, F. (2014). An FMEA-based risk assessment approach for wind turbine systems: A comparative study of onshore and offshore. *Energies*, 7(2), 619–642. <http://doi.org/10.3390/en7020619>

Shebl, N., Franklin, B., & Barber, N. (2012). Failure mode and effects analysis outputs: are they valid? *BMC Health Services Research*, 12(1), 150. <http://doi.org/10.1186/1472-6963-12-150>

Vinodh, S., & Santhosh, D. (2012). Application of FMEA to an automotive leaf spring manufacturing organization. *The TQM Journal*, 24(3), 260–274. <http://doi.org/10.1108/17542731211226772>

Ford Motor Company, C. C. (1995). Potential Failure Mode and Effect Analysis (FMEA) Reference Manual (1st ed., Vol. 1, Ser. 2). General Motor Corporation.

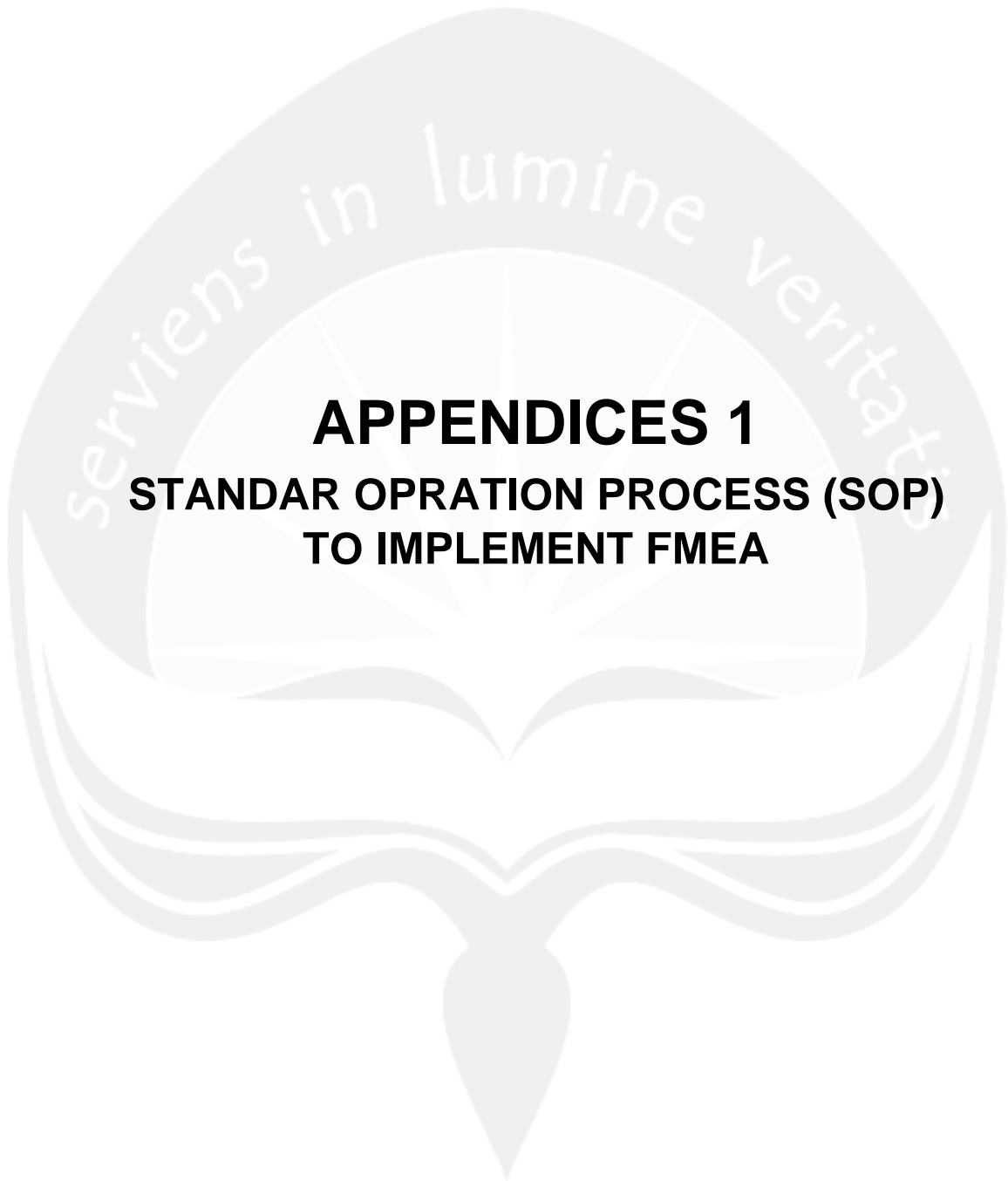
Saputra, H. R. (2007). Kinds of Sample Size. *Probablistic and Statistic*, 54(4), 81-82. doi:10.1353/dss.2007.0111

Stamatis, D. H. (2003). *Failure mode and effect analysis: FMEA from theory to execution*.

Gay, L.R. dan Diehl, P.L. (1992), *Research Methods for Business and Management*, MacMillan Publishing Company, New York

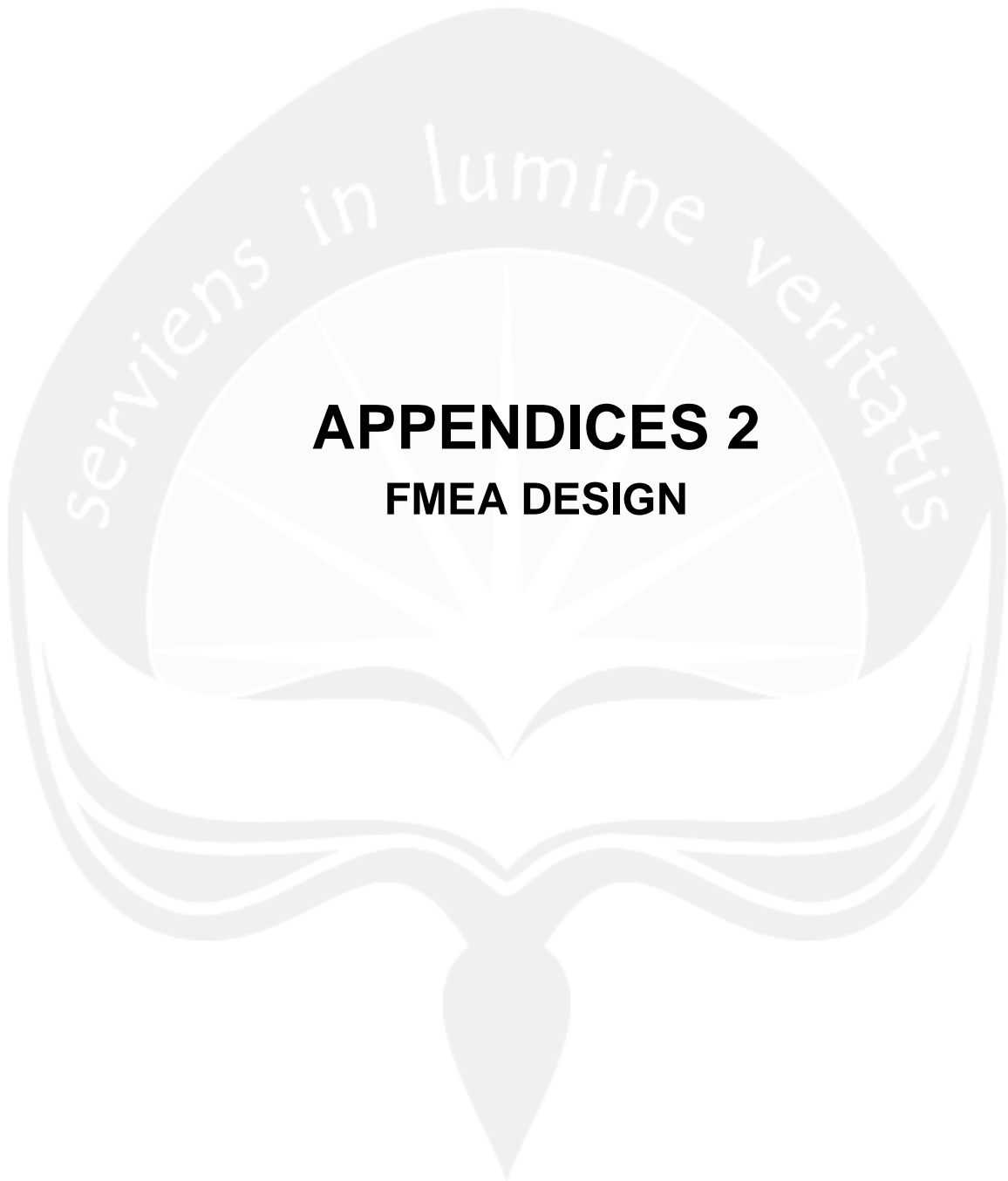
Arikunto Suharsimi. (2005). *Manajemen Penelitian*. Jakarta : Rineka Cipta

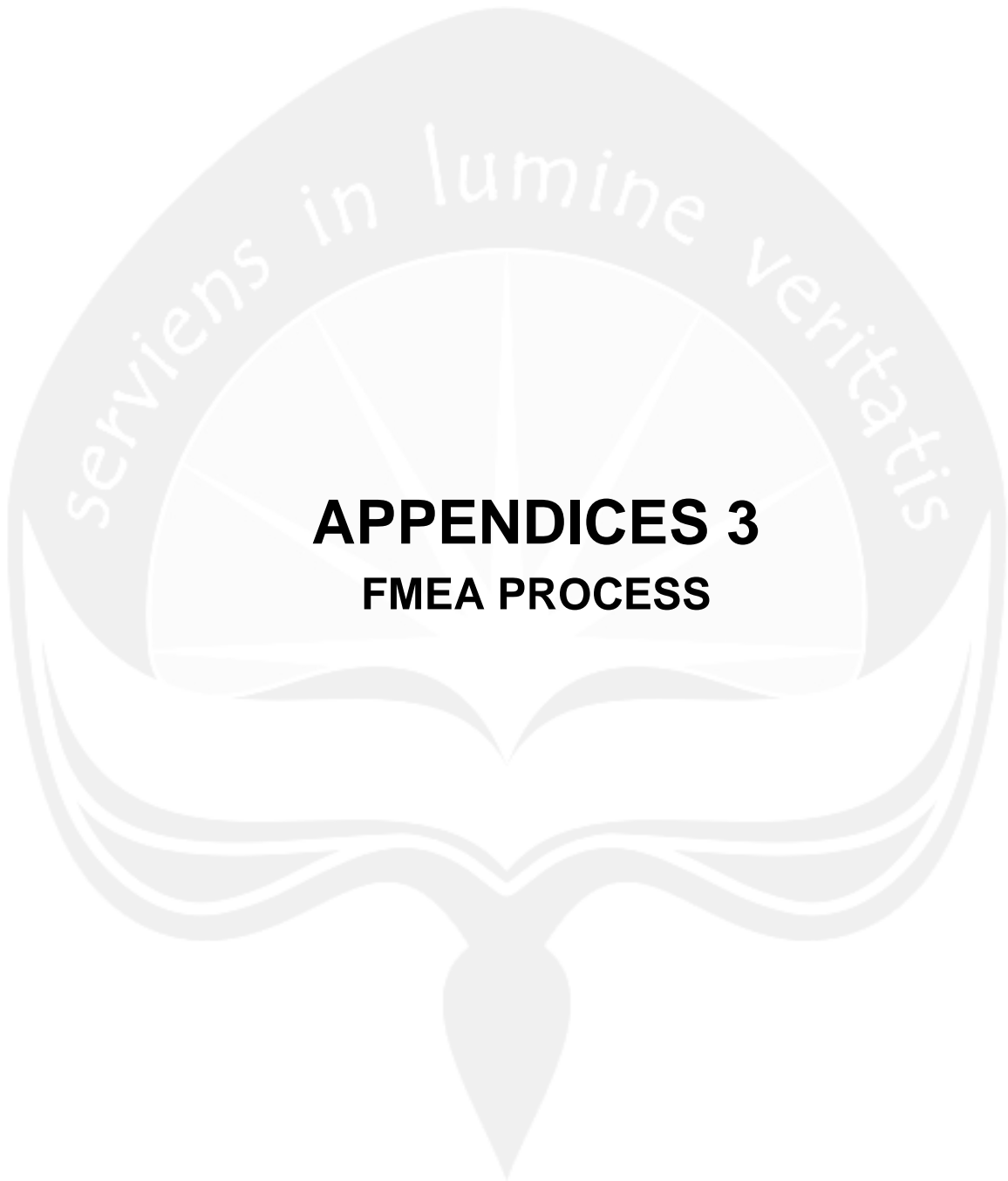
AIAG , 2008 , Potential Failure Mode and Effects Analysis (FMEA) 4th Edition , Reprinted from Potential Failure Mode and Effects Analysis (FMEA) 4th Edition, 2008 Manual with permission of Chrysler, Ford and GM Supplier Quality Requirements Task Force.



# **APPENDICES 1**

## **STANDAR OPRATION PROCESS (SOP) TO IMPLEMENT FMEA**

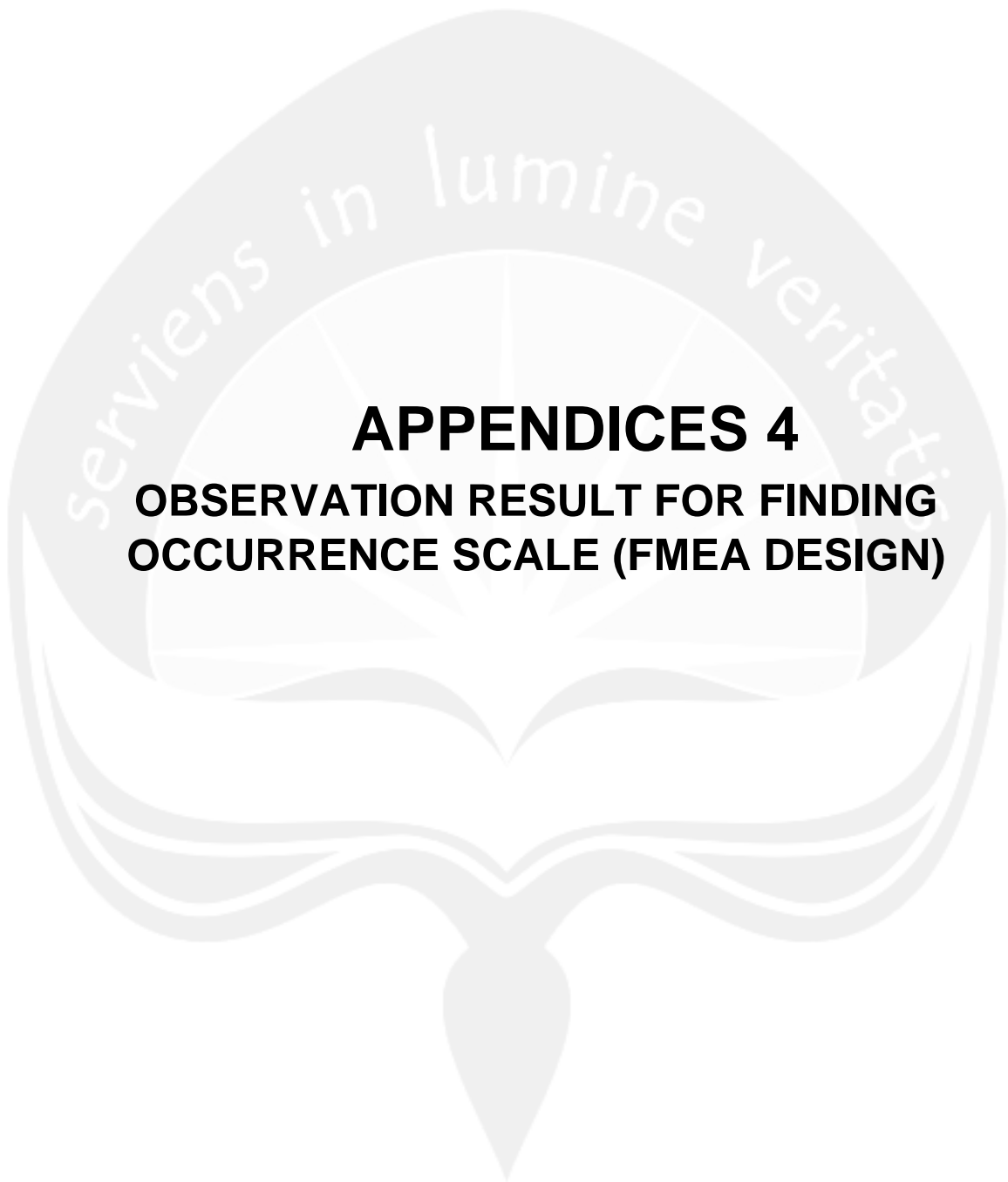




## **APPENDICES 3**

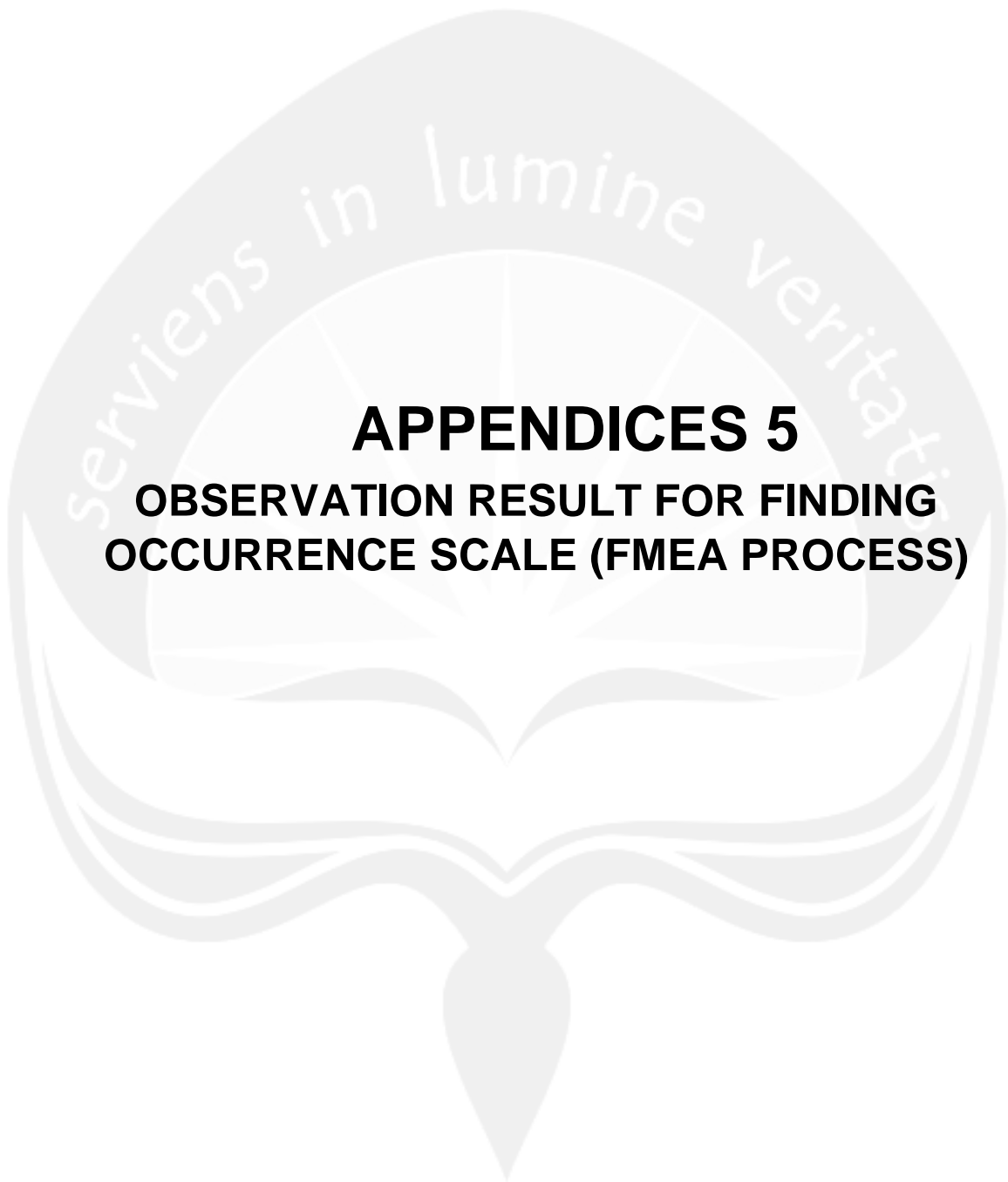
### **FMEA PROCESS**





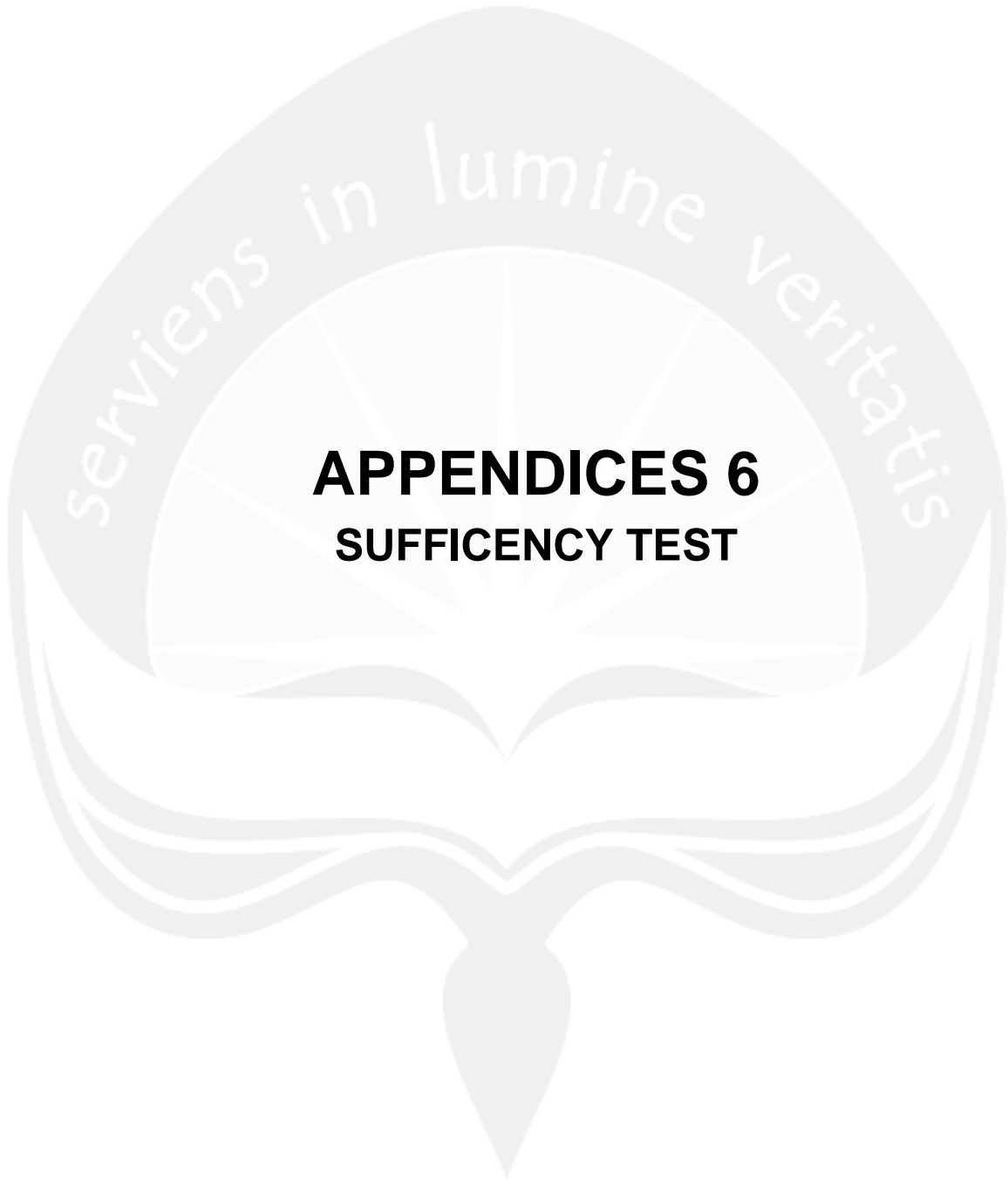
# **APPENDICES 4**

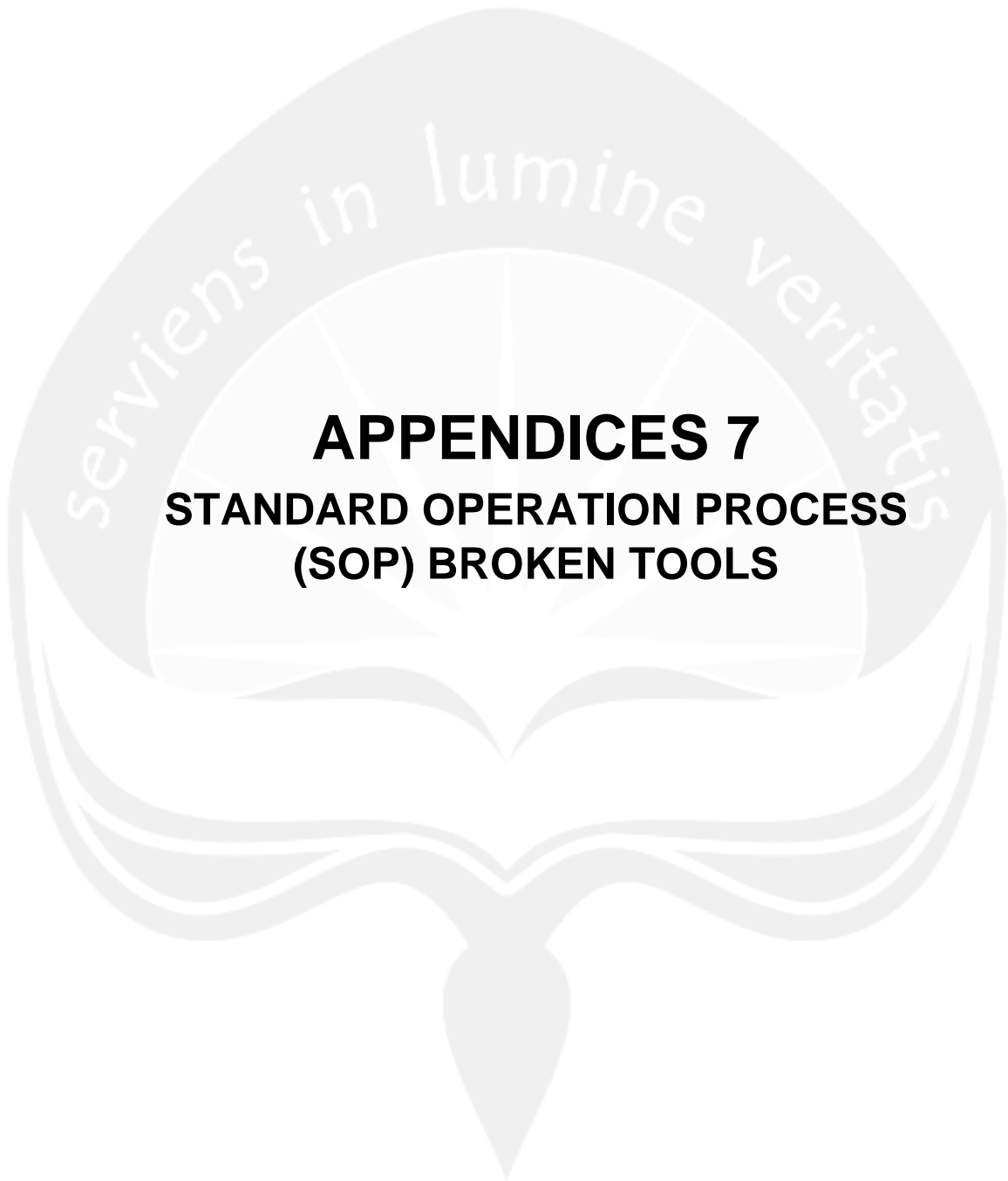
## **OBSERVATION RESULT FOR FINDING OCCURRENCE SCALE (FMEA DESIGN)**



# **APPENDICES 5**

## **OBSERVATION RESULT FOR FINDING OCCURRENCE SCALE (FMEA PROCESS)**





# **APPENDICES 7**

## **STANDARD OPERATION PROCESS (SOP) BROKEN TOOLS**