

## CHAPTER IV

### DATA SYNTHESIS AND ANALYSIS

This chapter will explain the data synthesis and data analysis that have been explained in chapter 2. The explanation about data synthesis and analysis will repeated briefly.

#### 4.1 Data Synthesis

55 research articles are suitable with the selection criteria. The research articles are referred to expert system, fuzzy logic and artificial neural network applications. Then the research articles are classified into service and manufacturing industry. Figure 4.1 below shows the percentage of expert system, fuzzy logic and artificial neural network research articles in this research.

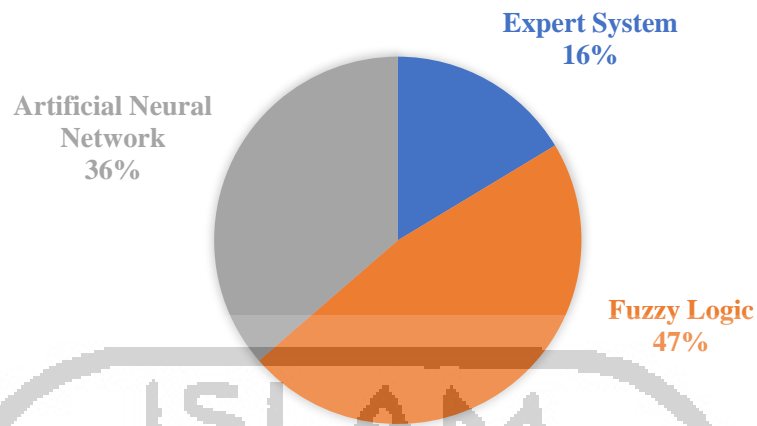


Figure 4. 1 Expert system, fuzzy logic and artificial neural network research article distribution

In Figure 4.1 shows the percentage of expert system, fuzzy logic and artificial neural network application fields from total 55 research articles. Fuzzy logic distributes most of the research articles with 47%, then artificial neural network with 36% and expert system with 16%. After findings the research articles based on expert system, fuzzy logic and artificial neural network, then the research articles are classified into their type of industry, service or manufacturing industry. Figure 4.2 below will show the application field of the research articles.

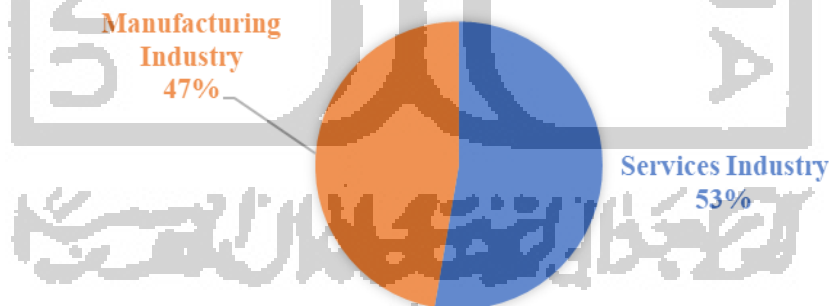


Figure 4. 2 Application field research article distribution

Figure 4.2 above shows the percentage of expert system, fuzzy logic and artificial neural network application fields from the total 55 research articles. Manufacturing industry with 47% and service industry 53%.

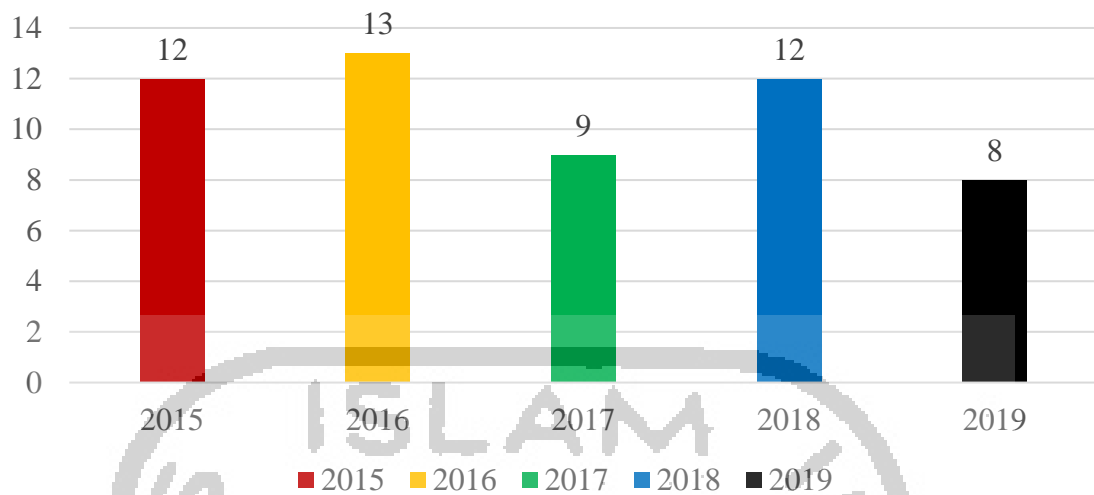


Figure 4. 3 Publication Year Distribution

The research articles are derived from the 2015 until 2019. Publication year of the research articles are illustrated on the figure 4.3 above. From year 2015 with 12 research articles, 13 research articles from 2016, 9 research articles from year 2017, 12 research articles from year 2018 and 8 research articles from 2019. Then, figure 4.4 below shows the publication journal distribution on this research.

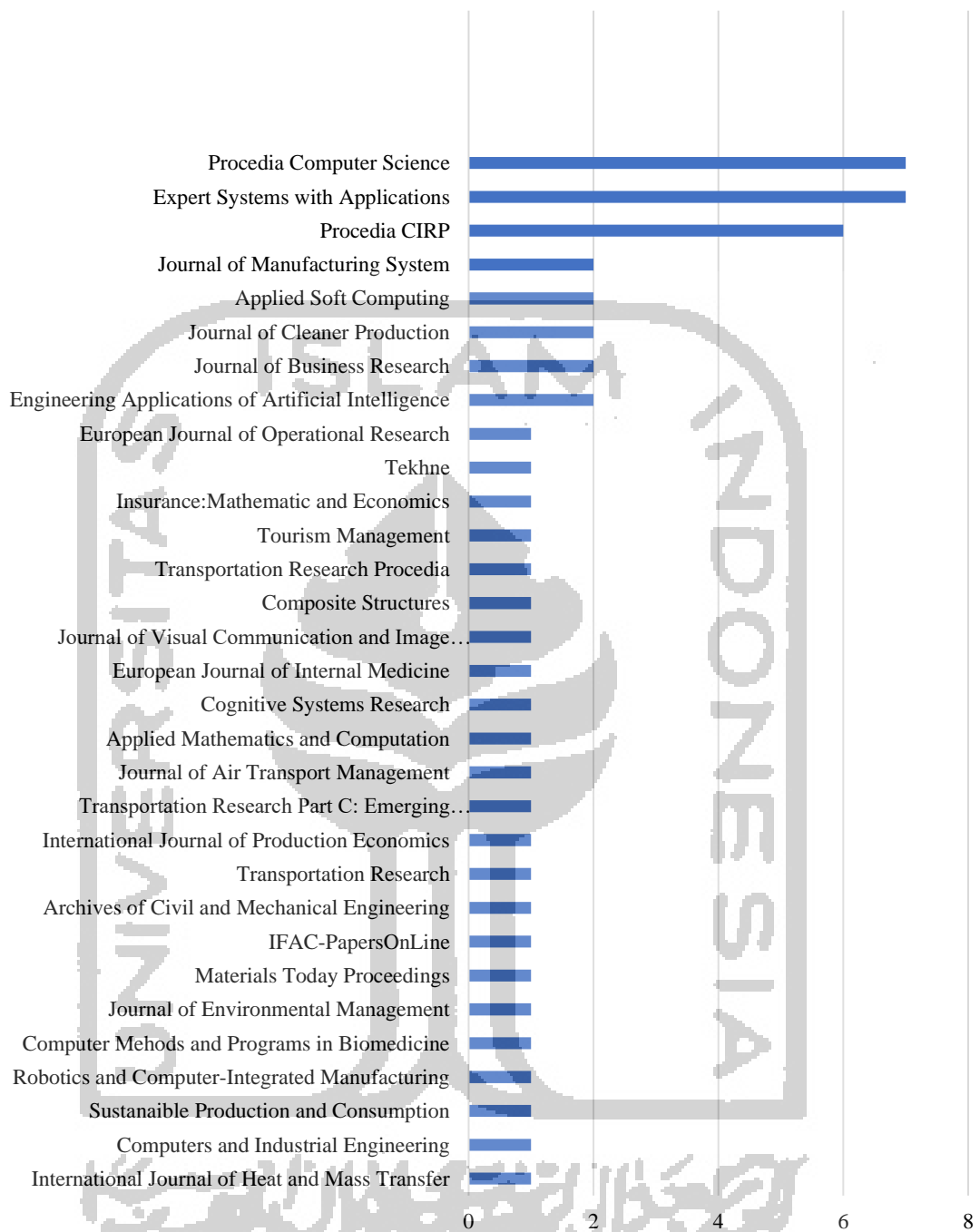


Figure 4. 4 Publication Journal Distribution

Figure 4.2 above shows the publication of research articles that applied. Procedia Computer Science and Expert System with Application contribute 7 research articles, 6 research articles from Procedia CIRP, 2 research articles from Journal of Business Research, Journal of Manufacturing System, Applied Soft Computing and Journal of Cleaner Production. Then, other publications have 1 research article distribution.

## 4.2 Data Analysis

From total number of 55 research articles that selected with selected criteria, the research articles are classified into each application of expert system, fuzzy logic and artificial neural network. Then, these 55 research articles will be analysed based on their artificial intelligence rule, artificial intelligence main tool and additional tool on each research article. Each research article will be analysed briefly below,

Table 4. 1 Artificial Intelligent Application

No	Issue	AI Rule	AI Main Tool	AI Additional Tool
1	Development a recommended suitable travel schedule that satisfies the tourist's interest	proper time, budget and preferences of required tourist places	backward chaining inference tool	expert system
2	Forecasting the success of a newly launched service in tourism	questionnaire that concerns the variables of developing a new service in tourism.	neural network	fuzzy logic.
3	Model and forecast the tourism demand for Mozambique	A set of independent variables namely: Consumer Price Index, Gross Domestic Product and Exchange Rates, of the outbound tourism markets	artificial neural networks	
4	Put of Esplan system in practice to gain	interviews on the expert	fuzzy expert system	inference engine

No	Issue	AI Rule	AI Main Tool	AI Additional Tool
	information about flights and system of ticket services			
5	Probability theory as mathematical framework for modelling giga-investment profitability	pay-out distribution for the giga-investment project insurance contract	mathematical optimization	fuzzy logic.
6	Analyse financial condition of company and make decision need more professionalism and good economic and financial background from managers	knowledge base from the experienced specialist	expert system	inference engine
7	Contributes theoretically to the tourism performance literature by validating a new approach to examining the determinants of hotel performance	ten input variables to investigate the relationships among user generated online reviews, hotel characteristics, and Revpar	artificial neural network	

No	Issue	AI Rule	AI Main Tool	AI Additional Tool
8	Integrated quality of service	applicable industry standards, specifications, economic and financial conditions.	expert system	
9	How environmental characteristics regarding restaurant location and individual characteristics of customers influenced customers' emotional responses to service attitudes, and how these emotions, in turn, influenced customer satisfaction and stickiness	182 customers from a fusion café chain restaurant	fuzzy logic	
10	Variety of fuzzy signals, analyses the uncertainties classification and their influence, constructs a three-	selects target region of interest (ROI), extracts some multidimensional and effective characteristics of targets on ROI, and builds a	simulation	fuzzy logic.

No	Issue	AI Rule	AI Main Tool	AI Additional Tool
11	<p>tier processing mode framework that can eliminate fuzziness processing, repair processing, dynamic combination processing, and presents some methods and algorithms for fuzzy signal processing</p> <p>Weak distinction between small targets and backgrounds and of less extractable features of targets</p> <p>have always been a technical bottleneck for accurate detection of dim and small targets</p>	<p>fuzzy recognition algorithm for targets</p> <p>higher-dimensional space mapping of the features low-dimension dim and small target blocks</p>	<p>deep neural network</p> <p>servqual</p>	<p>spindle network structure</p> <p>fuzzy AHP</p>
12	<p>Exhibit the importance of services quality in a hotel,</p>	<p>customer expectation from expected service and arising from needs</p>	<p>fuzzy SERVQUAL</p>	<p>fuzzy AHP</p>



No	Issue	AI Rule	AI Main Tool	AI Additional Tool
	considering the perception versus the expectation			
13	Develop screening tools to identify older inpatients at risk of prolonged LHS	patient medical record	novel analysis method	artificial neural network
14	Rationalization of the train routes on the railway network	the formation of train routes	neuro-fuzzy modelling	genetic algorithm
15	Daily box office prediction to avoiding the risks on film industry	end-to-end deep learning model for daily box office prediction	deep neural networks	
16	The pricing and retailers' service decisions in a supply chain where two retailers buy a product from one monopolistic manufacturer, and in turn sell it to the end consumers	demand-enhancing effort, including customer service before and after the sale, product advertising, on-time product delivery and product placement, and the overall quality of the shopping experience	game-theoretic approach	fuzzy logic
17	Deepen the scientific debate	sample of 551 passengers flying from	fuzzy logic approach	

No	Issue	AI Rule	AI Main Tool	AI Additional Tool
	on service quality of airport's food and beverage retailers	Olbia-Costa Smeralda Airport (Sardinia Region, Italy) with the aim of determining how they perceive the SQ delivered by F&B		
18	Is personalized service level improving the service quality of library	the necessity of personalized service library, the necessity of personalized service library and evaluation index system	fuzzy logic	analytical hierarchy process
19	Genetic programming system for predicting review scores based on a subset of existing reviews	customer's review on new purchases, repeat purchases	expert system	
20	Cash flow models for non-life insurance expert systems	recent statistical cash flow for asset-liability hedging, capital allocation and management decision tool	expert system	
21	Framework with fuzzy ontology based sentiment analysis of transportation and	real-time congestion mapping and city feature opinion map	fuzzy ontology-based sentiment analysis	semantic web rule language

No	Issue	AI Rule	AI Main Tool	AI Additional Tool
	city feature reviews to facilitate its and travellers			
22	Traveling salesman problem size reduction to minimize the cost	traveling salesman problem instances from the ranging from 131 to 2924 cities	fuzzy logic classifier	
23	The company for shorty throughput times, high schedule reliability, and low costs as three central objectives in logistics-network management	real-world simulation scenario based on the Hamburg Harbor Car Terminal, a logistic site faced with managing approximately 46,500 car-routing decisions on a yearly basis	agent-based neural-network modelling.	
24	Music genre recognition	Local Binary Patterns, Local Phase Quantization, and Gabor filters	convolutional neural network	spectrogram
25	Proposes a real-time method for predicting bike renting and returning in different areas of a city	historical data, weather data, and time data	deep long short-term memory model	recurrent neural network

No	Issue	AI Rule	AI Main Tool	AI Additional Tool
26	What combinations of factors can generate the kind of competitive advantage that consulting firms can benefit from	consulting-client satisfaction and consulting fees	fuzzy-set qualitative comparative analysis	
27	Estimate taxi times and their uncertainties on the traffic outside the airport as the airport ground movement	simulated taxi movements at Manchester Airport	fuzzy uncertainty	
28	The acceptable optimized schedule for employees	assigning employees to shifts determined by types, length, and the number of breaks	integer programming model integrated	fuzzy logic
29	Proposed a novel for failure mode and effect analysis on the risk management for improving the process reliability in manufacturing and service sector	the proposed previous research about failure of internet banking program	fuzzy TOPSIS	
30	Maintenance of belt conveyor as	real time measurements and the long-term	artificial neural network	fuzzy logic

No	Issue	AI Rule	AI Main Tool	AI Additional Tool
31	the mainly operated in aggressive condition machine Control the coal-grinding operations in a cement manufacturing plant	analysis of historic data that makes up the conveyor belt loop operation status	fuzzy logic	expert knowledge
32	Problem of distinguishing proper and defective operations in connector assembly tasks in an automotive company	experiments were conducted with 17 subjects to obtain force and vibration signals	artificial neural network.	
33	Intelligent optimization of the cutting process parameters based on the cutting process cases and the green cutting process technology	experimental data of machining tool manufacturing enterprise	expert system	response surface methodology

No	Issue	AI Rule	AI Main Tool	AI Additional Tool
34	Achieve sustainable development in the manufacturing sector,	sixteen metrics on the characteristics of SMEs	fuzzy logic	expert system
35	Evaluate the wear characteristics of selective inhibition sintering (SUS) made high density polyethylene (HDPE)	Experiments of using pin-on-disc wear testing apparatus to examine the wear rate	fuzzy logic	
36	Die designing for any component with highly skilled manpower.	knowledge of die design experts (industries, academics and professionals)	expert system	
37	Increase the knowledge of the adaptation and usability of augmented reality for the training of operators	operator an enhanced view of reality optimized for his/her individual need	augmented reality	expert system
38	Recognition of the worker's activity can be used for quantification and	high-level feature vector	convolutional neural network	

No	Issue	AI Rule	AI Main Tool	AI Additional Tool
	evaluation of the worker's performance			
39	Assembly of deformable components due to complex assembly movement and uncertain component geometry	assembly of geometrically complex shaped wheel arch liners, impedance-controlled robot and assembly motion data set	artificial neural network	
40	Detecting the control points of signals of smart fabric	number of signal measurements in the pattern, location of control points in the pattern and the number of patterns in the training data set	artificial neural network	
41	Reactive Red 195 azo dyestuff as textile industry waste water must be removed by advanced treatment methods	Sono-Fenton colour removal function and results of the 46 experimental sets generated by the Box-Behnken design	artificial neural network genetic algorithm	response surface methodology
42	Simulation model for casting metal substructure of a	CAD modelling of the simulation model for casting, fast modelling	expert system with AI additional tool	

No	Issue	AI Rule	AI Main Tool	AI Additional Tool
	metal-crown design to reduce manufacturing time	of gate design, CAD eligibility and cast ability check of the model, estimation and running of the program code for the casting machine	Zeiss Contura G2 and GOM inspect software	
43	Automated driving for individualized sheet metal part production as the most important issues in industrial sheet metal working	method for training data generation, training sessions, and strategy computer by trained networks	artificial neural network architecture.	
44	Accuracy of quality monitoring and prediction on work in progress product	manual feature extraction, and noise	artificial neural network	
45	Potential strategic determinants of firm performance with an emphasis on R&D investment and operational efficiency in	Ordinary Least Square Multiple Regression (OLSMR)	back propagation neural network	



No	Issue	AI Rule	AI Main Tool	AI Additional Tool
	leading U.S manufacturing firms			
46	Identifying critical attributes affecting resilience in supply chain	strategic, tactical, and operational risk assessment of the company and resilience level from the expert	Resilient Fuzzy Index (RFI) and Performance Fuzzy Index (PFI)	
47	Measurement of the observations in monitoring manufacturing process	is manufacturing process flow	Fuzzy nonlinear programming	
48	Predict the pores on carbon fibre reinforced plastics (CFRP) as a manufacturing defect	mechanical properties of CFRP parts with the characteristics of defects as derived from NDT techniques or with the manufacturing parameters	artificial neural network	X-ray Computed Tomography (CT)
49	Performance evaluation of social sustainability on Indian automotive component manufacturing	appropriate social sustainability indicator	fuzzy logic	

No	Issue	AI Rule	AI Main Tool	AI Additional Tool
50	Predict the values of cutting energy as a sustainable performance characteristic	classical parameters accuracy, performance, cost and reliability	artificial neural network	
51	Resolve a strong coupling between temperature and relative humidity in meat drying room control systems	are temperature and relative humidity	fuzzy inference	neural network
52	Intelligent monitoring and fault diagnosis on gearbox	machine fault types and severities	deep convolutional neural network	layer-wise relevance propagation
53	Selecting appropriate maintenance strategies can contribute to increase production efficiency	historical data from production lines	fuzzy logic	
54	The demand for a high quality of plate has made engineers aware of the precise cooling for finish	dimensions of plate, chemistry, start cooling temperature, air cooling time, water cooling time	artificial neural network backpropagation	

No	Issue	AI Rule	AI Main Tool	AI Additional Tool
55	cooling temperature and cooling rate Proper integrated approach is necessary to be adopted in order to select the best supplier	i.e., qualitative) from the experts of the case company	Fuzzy	

