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ICMIT2014

23 – 25 Sep 2014, Singapore

**2014 IEEE International Conference on
Management of Innovation and Technology**



Organized by:

IEEE TMC Singapore Chapter
IEEE Singapore Section

Division of Engineering and Technology Management, National University of Singapore

IEEE Catalog Number: CFP14795-ART
ISBN: 978-1-4799-5529-9

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The Effect of TQM Implementation towards Productivity of Employees Using Structural Equation Modeling (SEM) Analysis Method in PT XYZ

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Abstract - This paper analyzes influences of TQM's implementation on employees productivity in PT XYZ, analyze predominant factor in order to establish the success of TQM's implementation as well as predominant factors affecting employees productivity. The research method used the result of interview and questionnaire. Number of respondents is 100 and using analysis method of Structure Equation Modeling (SEM) by software Linear Structural Relationship (LISREL) 9.0. The results showed the influences of TQM's implementation on employees and to specify the predominant factor in the implementation of TQM's and employees productivity. This paper is useful for manufacture companies in Indonesia. Because the variables used in this research are based on the empirical research. TQM's was measured six indicators and the work productivity of employee is measured by four indicators.

Keywords - Quality improvement, Work productivity, SEM methods

I. INTRODUCTION

Manufacturing and service companies have implemented a system which aims to improve the quality either from aspect of product/service or management aspect. The system is known as Total Quality Management (TQM). An effective TQM's implementation is desired to give positive influences on company's productivity. PT XYZ has implemented TQM since 2000. TQM's implementation is a form of PT XYZ's commitment in order to create quality products and a proper management system. TQM is profiting-each-other cooperation from people in organization and related to business process to yield product and service' value which exceed consumers' needs and hopes [1]. Whereas, according to Juran in [2], TQM will be implemented whether following three managerial processes e.g. quality planning, quality control, and quality improvement. The process development by Juran himself is known as "Trilogy of Juran". In TQM's implementation in PT XYZ there is a problem, unachievable target as established target. Unachievable target depicts that there is a decreasing employees performance that causes on decreasing employees productivity. Improvement of employees productivity in a company could be done with one way, implement TQM. However, in order to implement TQM, it needs to identify predominant factors which take major roles in the success of TQM's implementation. Besides, predominant factors which determine successful TQM implementation also need to be known so that it is right on target to improve

employees productivity. Human resource is a major factor in order to establish the success or failure of product's quality improvement so that it is necessary to the company to pay attention to factors affecting employees productivity. There are many factors which can affect employees productivity either related to workforces or related to company's environment and the government policies as a whole.

This research aims to analyze the influence of TQM's implementation on employees productivity in PT XYZ. The success of the implementation is affected by indicators influencing TQM. According to Ibrahim [3], TQM's implementation is measured by six indicators e.g. human resources, standard, tools, organization, internal audit, and training & education. Whereas in Sinungan [4], employees productivity are measurable using four indicators e.g. employees work environment and work relations. The magnitude influence given to implementation of TQM in PT XYZ on employees productivity is measured using an analysis method of Structural Equation Modeling (SEM). These research indicators are referred to previous research, as seen on both **Table I** and **Table II**.

Structural Equation Modeling is a statistical method used to analyze relationship pattern between latent variable and its indicator, one latent variable with others, also direct measurement. Statistical analysis method in the research is done using Structural Equation Modeling (SEM) with software LISREL.

II. METHODOLOGY

Respondents in this research are employees of PT XYZ. Data collecting is conducting by two steps. First, questionnaires are spread out to 30 respondents. Then, validity and reliability tests are conducted. If data collected is invalid or not reliable so that the questionnaires have to be revised, then, step 2 questionnaires are spread out to obtain total number of 100 data.

Variables used in the research are latent variables and manifest variables. Latent variables are original variables that can't be measured directly, but through the variables indicator. In contrast, manifest variables are measurable variables. Both research model of latent variables and manifest variables are as seen on **Table III**.

Table I. Research Indicators Determination of Total Quality Management

Variables	No	Indicators	Attributes	Previous Research
Total Quality Management	1	Human Resources	Employees are able to understand the leader's needs and wants	Sugiharti (2005), Melissa (2009), Rendy (2009)
			Employees work together to yield quality products	Sugiharti (2005), Melissa (2009), Rendy (2009), Chairany (2011)
			Company considers work experience in employees recruitment	Sugiharti (2005), Melissa (2009), Rendy (2009)
			Employees understand the goals the company wants to achieve.	Sugiharti (2005), Melissa (2009), Rendy (2009), Chairany (2011)
			Employees are given a freedom in order to convey ideas and concepts concerned with quality control	Sugiharti (2005), Chairany (2011)
	2	Standard	The Standard establishment has been appropriate with consumers' needs	Sugiharti (2005), Melissa (2009), Chairany (2011)
			The standard used is appropriate with goals the company wants to achieve	Sugiharti (2005), Melissa (2009), Rendy (2009), Chairany (2011)
			The products produced have been appropriate with the standard established	Sugiharti (2005), Chairany (2011)
			Work procedure for each activity in the company is compatible with company's goals	Sugiharti (2005), Melissa (2009), Rendy (2009)
			Employees are involved in order to establish the standard.	Sugiharti (2005), Melissa (2009), Rendy (2009), Chairany (2011)
	3	Tools	The company has a certain division to conduct function of quality control.	Sugiharti (2005), Melissa (2009), Rendy (2009)
			There is a tool for consumers to convey their complaint.	Sugiharti (2005), Melissa (2009), Rendy (2009), Chairany (2011)
			Tools in company are supported in training and education.	Sugiharti (2005), Melissa (2009), Rendy (2009), Chairany (2011)
			Tools in company meet the aspects of security, comfort, health, and safety.	Sugiharti (2005), Melissa (2009), Rendy (2009)
			SOP about tools and equipments is clear.	Sugiharti (2005), Melissa (2009), Chairany(2011)
			Whether the transportation used in products distribution is satisfied	Sugiharti (2005), Chairany (2011)
			Whether the tools has supported to employees to convey their ideas and concepts	Sugiharti (2005), Rendy (2009), Chairany (2011)
	4	Organization	Organization's structure has been defined well	Sugiharti (2005), Melissa (2009), Chairany(2011)
			Company builds relationship with customers	Melissa (2009), Rendy (2009)
			Whether every employee understands tasks and authorities.	Sugiharti (2005), Rendy (2009), Chairany (2011)
			Employees are involved in company's decision making.	Sugiharti (2005), Melissa (2009), Chairany(2011)
			Task and responsibility have been defined clearly.	Sugiharti (2005), Melissa (2009), Rendy (2009)
	5	Internal Audit	Decision making is based on facts and information	Sugiharti (2005), Rendy (2009), Chairany (2011)
			Internal audit is conducted regularly.	Sugiharti (2005), Melissa (2009), Chairany(2011)
			Result of internal audit influences in quality control.	Sugiharti (2005), Melissa (2009), Rendy (2009)
			Implementation of internal audit is affected by consumers' complaint.	Sugiharti (2005), Melissa (2009), Rendy (2009), Chairany (2011)
	6	Training and education	Internal audit conducted is beneficial in order to achieve company's goals.	Sugiharti (2005), Melissa (2009), Rendy (2009), Chairany (2011)
			Training and education is often conducted by the company.	Sugiharti (2005), Melissa (2009), Rendy (2009), Chairany (2011)
Employees understand benefit of training and education.			Sugiharti (2005), Melissa (2009), Chairany(2011)	
Training and education given appropriate with job needed by employees.			Sugiharti (2005), Melissa (2009), Chairany(2011)	
		Whether there is a tied with other institution in conducting a training and ed	Sugiharti (2005), Rendy (2009)	

Hypothesis of the research is prepared based on desirable research objective. Research hypothesis formulation as follow:

- H₁: there is a positive relationship between implementation of Total Quality Management in PT XYZ and employees productivity.
- H₂: there is a positive relationship between human resources, tools, standard, organizing, internal auditing, a training & education on TQM's implementation.
- H₃: there is positive relationship between work willingness, work ability, work environment, and work relations with employees productivity in PT XYZ.

After variables of implementation used in the research, then the relationship between both latent variables can be made in mathematical notation form, in two types equation form:

1. Structural Model Mathematical Notation
 $PKK = \gamma' MKT + C$
2. Measurement Model Mathematical Notation
 - a. $SDM = \lambda SDM MKT + \delta$
 - b. $STD = \lambda STD MKT + \delta$
 - c. $SRN = \lambda SRN MKT + \delta$
 - d. $ORG = \lambda ORG MKT + \delta$
 - e. $AUI = \lambda AUI MKT + \delta$
 - f. $DIK = \lambda DIK MKT + \delta$
 - g. $KMK = \lambda KMK PKK + \epsilon$
 - h. $KPK = \lambda KPK PKK + \epsilon$

- i. $LJK = \lambda LJK PKK + \epsilon$
- j. $HBK = \lambda HBK PKK + \epsilon$

Table II. Research Indicators Determination of Employees Productivity

Variables	No	Indikator	Atribut	Penelitian Terdahulu
Employees Productivity	1	Empoyees willing to work	I am responsible on the job I do.	Melissa (2009), Indraswari (2007), Sugiharti (2005), Chairany (2011)
			I am always serious in conducting a work.	Melissa (2009), Indraswari (2007), Sugiharti (2005), Chairany (2011)
			I always obey the rules of work.	Melissa (2009), Indraswari (2007), Chairany (2011)
			I always follow activities conducted by the company.	Melissa (2009), Indraswari (2007), Sugiharti (2005), Chairany (2011)
			I always work seriously, even though there is no supervision from the boss.	Melissa (2009), Indraswari (2007), Sugiharti (2005)
	2	Employees ability	I can work properly.	Melissa (2009), Indraswari (2007), Chairany (2011)
			I can finish the task on time.	Melissa (2009), Sugiharti (2005), Chairany (2011)
			I can carry out task and responsibility as my job description.	Melissa (2009), Indraswari (2007), Chairany (2011)
			I always struggle to give the best effort to the company.	Melissa (2009), Sugiharti (2005), Chairany (2011)
			I often ask for advice to co-workers or boss about difficult work.	Melissa (2009), Indraswari (2007), Sugiharti (2005)
	3	lingkungan kerja karyawan	I am responsible on the job I do.	Melissa (2009), Indraswari (2007), Sugiharti (2005), Chairany (2011)
			I am always serious in conducting a work.	Melissa (2009), Indraswari (2007), Sugiharti (2005), Chairany (2011)
			I always obey the rules of work.	Melissa (2009), Indraswari (2007), Chairany (2011)
			I always follow activities conducted by the company.	Melissa (2009), Indraswari (2007), Sugiharti (2005), Chairany (2011)
			I always work seriously, even though there is no supervision from the boss.	Melissa (2009), Indraswari (2007), Sugiharti (2005)
	4	Employees work relation	I can cooperate with others.	Melissa (2009), Indraswari (2007), Sugiharti (2005)
			I often ask for help to finish my task.	Melissa (2009), Indraswari (2007), Chairany (2011)
			I am ready to give a grant to finish task which is not mine.	Melissa (2009), Indraswari (2007), Sugiharti (2005), Chairany (2011)
			I always report result of work as the truth.	Melissa (2009), Indraswari (2007), Sugiharti (2005), Chairany (2011)
			aya memiliki hubungan yang baik dengan rekan kerja. I have a good relationship with co-workers.	Melissa (2009), Sugiharti (2005), Chairany (2011)

Table III. Research Variables in PT XYZ

Latent Variables	Manifest Variables	Variables Code
Total Quality Management (MKT)	Human Resources (SDM)	X1
	Standard (STD)	X2
	Tools (SRN)	X3
	Organisasi (ORG)	X4
	Internal Auditing (AU)	X5
	Training and Education (DIK)	X6
Employees Productivity (PKK)	Willingness to Work (KMK)	Y1
	Employees ability to work (KPK)	Y2
	Employees work environment (LKK)	Y3
	Employees work relationship (HKK)	Y4

III. RESULTS

Result of the research can be begun from data processing result of preliminary questionnaires test using Microsoft Excel 2007 to make tabulation of descriptive data and data adequacy test, and SPSS 16.0 for Windows to test validity and reliability. The preliminary test aims to know whether questionnaires are feasible and accurate to spread out to consumers in an adequate amount. Validity and reliability tests are conducted on data collected from questionnaires dissemination on 100 employees of PT XYZ. Value of r-table to data n=100 and error rate 5% is about 0.195 [10]. If the result of validity test conducted to all first step questionnaires data are known that all data exist up to 0.195, so it can conclude that research questionnaires to the employees is valid and it can be used to gain second step data. Reliability testing questionnaires also uses software SPSS 16.0 with n=100. According to Sugiyono [11], question instrument are reliable whether value of alpha's coefficient (Cronbach's alpha) is not

lower than 0.60, so that the questionnaires are feasible to disseminated. As well as result of adequacy test of questionnaires that are known value $N > N'$. It can be concluded that the data is sufficient and able to represent population existing, so that next data processing can be conducted.

After conducting preliminary test on questionnaires data then it can continue by implementing analysis method of SEM, that is:

1. Model Specification

This step is related to preliminary forming of structural equation before estimation conducted. Steps of model specification can be shown as follow:

a. Determining Latent variables

Latent variables in the research as follow:

1. Total Quality Management (MKT)

These variables are independent latent variables because they are a kind of variables influencing another latent variable, namely PKK.

2. Employees Productivity (PKK)

These variables are dependent latent variables because being influenced by other variable, namely MKT

b. Determining Manifest Variables

Manifest variables are directly measurable variables. Manifest variables which are used in the research as shown in **Table IV**.

Table IV. Manifest Variables in the Research

No	Indicators of MKT (X)	Indicators of PKK (Y)
1	SDM (X)	KMK (Y1)
2	STD (X2)	KPK (Y2)
3	SRN (X3)	LKK (Y3)
4	ORG (X4)	HKK (Y4)
5	AUI (X5)	
6	DIK (X6)	

c. Determining Structural Model

Structural model in the research is $PKK = \gamma MKT + \epsilon$

d. Determining Measurement Equation Notation

Based on structural model and manifest variables' determination to the respective variable, it can determine measurement equation notation to variables of MKT and PKK. There are several equation notations in the research, as follow:

1. $SDM = \lambda_{SDM} MKT + \delta$
2. $STD = \lambda_{STD} MKT + \delta$
3. $SRN = \lambda_{SRN} MKT + \delta$
4. $ORG = \lambda_{ORG} MKT + \delta$
5. $AUI = \lambda_{AUI} MKT + \delta$
6. $DIK = \lambda_{DIK} MKT + \delta$
7. $KMK = \lambda_{KMK} PKK + \epsilon$
8. $KPK = \lambda_{KPK} PKK + \epsilon$
9. $LJK = \lambda_{LJK} PKK + \epsilon$
10. $HBK = \lambda_{HBK} PKK + \epsilon$

2. Model Estimation

Step of estimation is done to obtain value of factors existed in the model. Estimation method used is Maximum Likelihood. Result of SEM estimated is in the form of standardized solution, diagram of path. Processing result uses LISREL Student 9.0 to know level of closeness of relationship between variables existed in the model.

The model estimation is processing result of all questions in questionnaires which are manifest variables of each latent variable in the research. There are several questions in these research variables, as following in **Table V**.

Table V. Variables of Research

Research Variables	Indicators Measured	Number of Questions
Total Quality Management (MKT)	Human Resources (SDM)	1, 2, 3, 4, 5, 6
	Standard (STD)	7, 8, 9, 10, 11, 12
	Tools (SRN)	13, 14, 15, 16, 17, 18, 19, 20
	Organisasi (ORG)	21, 22, 23, 24
	Internal Auditing (AUI)	25, 26, 27
	Training and Education (DIK)	28, 29, 30, 31
Employees Productivity (PKK)	Employees Willingness to Work (KMK)	32, 33, 34, 35, 36
	Employees ability to work (KPK)	37, 38, 39, 40
	Employees work environment (LKK)	41, 42, 43, 44
	Employees work relationship (HKK)	45, 46, 47, 48, 49

Based on the questionnaires, data will be processed using software of LISREL Student 9.0, and then it will yield model estimation, as shown by **Figure 1**.

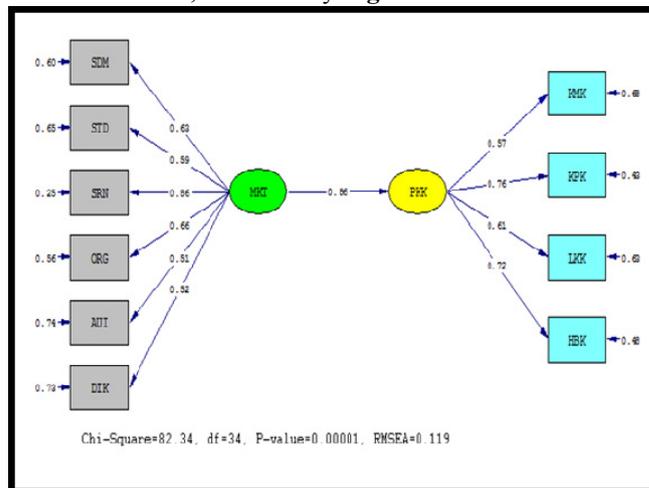


Figure 1 Structural Estimation Value

Value of loading factor and determination coefficient (R^2) can be obtained from estimation result. Loading factor is a coefficient showing the magnitude of indicator's variable contribution level in forming latent variable. Value of R^2 of every coefficient is determinant coefficient that is showing how the magnitude of indicator's variable is able to influence latent variable. Information about value of loading factor and R^2 from structural estimation can be seen on **Table VI**.

Table VI. Value of Factor Loading and R^2

The relationship between independent latent variables (MKT) and dependent latent variables (PKK) as well as manifest variables and its latent variables other than structural estimation value could be seen on test of t-value on diagram of path. Value of t-value could be seen on **Figure 2**.

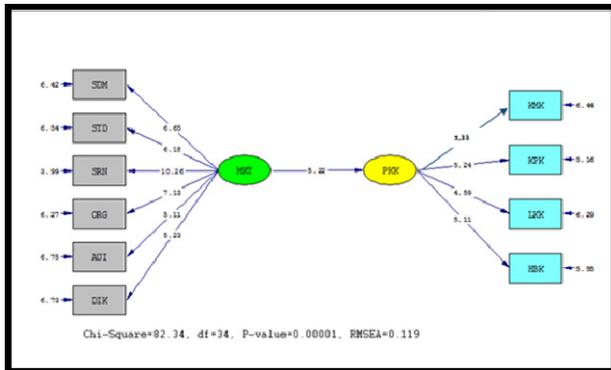


Figure 2 Value of T-value Test of Structural Model

It shows that all indicators forming latent variables is feasible ($t\text{-value} > 1.96$), so that the model doesn't need to be modified.

Based on structural estimation value, it is obtained structural mathematical notations and mathematical model notation of manifest variables measurement on latent variables as follow:

1. Structural mathematical notation of research
 $PKK = 0,86 MKT + 0,265$
 The notation explains that PKK is affected by MKT's implementation as magnitude of 0.86 in scale measurement error as 0.265 (26.5%). The result is feasible because relationship between MKT's independent latent variable and PKK's dependent variable, based on t-value, as magnitude of 5.22 in feasible degree 5% (> 1.96), therefore it yields fit model.
2. Mathematical model notations of manifest variable measurement on latent variable.
 - a. $SDM = 0,63 MKT + 0,60$
 - b. $STD = 0,59 MKT + 0,65$
 - c. $SRN = 0,86 MKT + 0,25$
 - d. $ORG = 0,66 MKT + 0,56$
 - e. $AUI = 0,51 MKT + 0,74$
 - f. $DIK = 0,52 MKT + 0,73$
 - g. $KMK = 0,57 PKK + 0,68$
 - h. $KPK = 0,76 PKK + 0,43$
 - i. $LJK = 0,61 PKK + 0,63$
 - j. $HBK = 0,72 PKK + 0,48$

3. Goodness Of fit statistic / GOF

After conducting model estimation, the next step is conducting fitness test to check compatibility level of data on the model, validity and reliability of measurement model and coefficient feasibility of structural model of the

Research Variables	Indicators Measured	Factor of Loading	R ²
MKT	Human Resources	0,63	0,396
	Standard	0,59	0,352
	Tools	0,86	0,748
	Organization	0,66	0,442
	Internal Audit	0,51	0,255
	Training and Education	0,52	0,266
PKK	Work Ability	0,57	0,321
	Work Willing	0,76	0,571
	Work Environment	0,61	0,367
	Work relations	0,72	0,518

research obtained. The summary of the test using SEM's analysis method can be seen on **Table VII**.

The next step is evaluation of measurement of fitness test, that is, validity and reliability evaluation. Validity evaluation is based on t-value of loading factor $\geq 1,96$ and value of loading factor of each indicator $\geq 0,5$. Based on path diagram on model estimation, it can be known that t-value of each indicator ≥ 1.96 and value of each research indicator ≥ 0.5 . Whereas reliability evaluation, it is based on value of construct reliability and variance extracted. A construct has a feasible reliability value if construct reliability ≥ 0.70 and variance extracted ≥ 0.5 . Construct reliability value of MKT's latent variable PKK's latent variable are as 0.801 and 0.821. Whereas value of construct variability of MKT's and PKK's latent variable are 0.629 and 0.676 respectively. Therefore it can be known that research model is feasible as a whole, and not necessary to re-specify, the model can directly be interpreted to path diagram, as shown on Figure 1.

Test of research hypothesis is viewed based on t-value. Based on the use of SEM's analysis method, it can mark the significance of research model statistic by verifying research hypothesis.

H₁: There is positive relationship between implementation of Total Quality Management and Employees Productivity in PT XYZ.

MKT's independent latent variables give positive influence on PKK's dependent latent variable as magnitude of 0.86. It means feasible because there is relationship between MKT's independent latent variable and PKK's dependent variable as 5.22 ($t\text{-value} > t\text{-table } 1,96$). Therefore, H1 is accepted.

H₂: There is positive relationship between human resources, standard, tools, organization, internal audit, as well as training and education on TQM's implementation.

Human resources, standard, tools, organization, internal audit, as well as training and education

give positive influence on MKT as latent variable, based on loading factor's value >0.5 and t-value which is owned by each indicator is greater than t-table (1.96). Therefore, H₂ is accepted.

Table VII. Fitness Test of Research Model

Measure of GOF	Level of Fitness	Estimation yield	Conclusion
Chi-square/df	≤ 3	2,4	Good
RMSEA	0,08 < RMSEA ≤ 0,1 (marginal fit)	0,119	Marginal
GFI	GFI ≥ 0,9 (good fit)	0,854	Marginal
AGFI	AGFI ≥ 0,8 (good fit)	0,764	Marginal
NFI	NFI ≥ 0,9 (good fit)	0,884	Marginal
NNFI	NNFI ≥ 0,9 (good fit)	0,904	Good
CFI	CFI ≥ 0,9 (good fit)	0,927	Good

H₃: There is a positive relationship between employees willing to work, employees ability, work environment, and work relationship on employees productivity (PKK) in PT XYZ.

Work willing, work ability, work environment, and work relations give positive influence on PKK as latent variable based on loading factor > 0.5 and value of t-value which is owned by each indicator is greater than value of t-table (1.96). In other words, H₃ is accepted.

V. CONCLUSION

Elements of TQM's implementation in PT XYZ, e.g. human resources, standard, organization, internal audit, and training & education, give positive influences on the success of TQM's implementation. Tool is the most predominant element in order to influence the success of TQM's implementation in PT XYZ, the better development and management of rubber's tool, so that TQM's implementation in PT XYZ will be more effective. It also has positive influences on employees productivity. They are obtained from structural model equation of research that is $PKK = 0,86 MKT + 0,265$. Whereas, improvement of employees productivity in PT XYZ is measured by indicator of employees willing to work, employees ability, work environment, and work relations. Based on SEM's analysis method, concluded that employees willing is the most predominant indicator in affecting employees productivity which indicates that the better employees willing then employees productivity will improve. Therefore, PT XYZ still has to improve the development and management on the tool which has been available to support an effective TQM's implementation.

ACKNOWLEDGMENT

The authors are would like to thank all respondents who participated in the study.

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Prepared for

Nilda Tri Putri
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Productivity of Employees Using Structural Equation Modeling (SEM)**

Analysis Method in PT XYZ
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Andalas University, Indonesia



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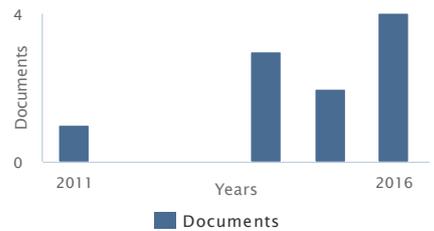
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