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# A Strategic of Labour Productivity to Support Shipyard Competitiveness in Partial Least Square (PLS) Path Analysis: PLS Algorithm and Bootstrapping \*

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## **Abstract**

*As a developing country, Indonesia has been able to deliver vessels to foreign ship owners which are completed by one of the Indonesian shipyard. This condition that way needs strength of international competitiveness, where each a shipyard will reduce cost of material and labour. Therefore, the acceleration shipyard will conduct a measurement for the rationalization increase of labour productivity*

*The study proposes the path modeling with a partial least square (PLS) approach. PLS is a second-generation multivariate statistical method [14] for the analysis of indirectly measured cause and effect in complex behavioral systems. The mentioned model includes inner model with 6 latent variables (2 endogenous construct and 4 exogenous construct) and outer model with 25 indicator variables (10 indicators in endogenous construct and 15 indicators in exogenous construct).*

*The SmartPLS Path Modeling Software with PLS Algorithm and Bootstrapping show that the inner model (formative indicators) included 2 endogenous construct and 3 exogenous construct. Furthermore, the outer model (reflective indicators) included 9 endogenous construct and 10 indicators in exogenous construct. As its consequence, the shipbuilding system would be oriented to the equilibrium of interaction between shipyard competitiveness, labour productivity, and strategic policy.*

**Keywords:** PLS path analysis, shipyard competitiveness, labour productivity, reflective indicators, formative indicators.

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## **1. Introduction**

The economic globalization and free trade place Indonesia to part of this system, both in the competition in the ASEAN and the world. The Indonesian Statistical Data in 2008 show that the number of Indonesian population more than 227 million people is a big potential market share, which one will spring up a form of new business by domestic and foreign capital investment. The global market and the competition create a very big change. The strategy must be applied to gain the success through the utilisation of available opportunities in the fastly business environment and increasingly competitive [20].

The productivity is the determining root of the level of competitiveness, both in the level of the individual, the company, the industry and in the level of the country. The productivity is the source of the standard of the life and the source of the individual income

and per capita, whereas competitiveness basically is the capacity to create a level of prosperity [29]. The definition of competitiveness is a level of capacity from the country product goods and services that in accordance with the demand of international market, and the same time ability create a continuous welfare for the citizen. So there are relationship between the productivity and competitiveness [28].

As the framework of the strength of international competitiveness, then each shipyard will reduce costs to connect with the shipbuilding development. Since that time, each shipyard in a manner the acceleration does measurement for rationalisation to the side of increase productivity, i.e.: automation and computerisation. The Japanese shipyard and South Korean significantly carry out the reduction in cost to the shipbuilding material and labour cost [27].

In this paper, a structural equation modeling with partial least square (SEM-PLS) approach is presented to support a path modeling analysis. SEM-PLS is a nonparametric multivariate statistical technique for used at prediction of variable relations between the labour productivity and Indonesian shipyard competitiveness. To understand state of the art of research, these methods are briefly reviewed in Section 2. The implementation of SEM-PLS in a SmartPLS Path Modeling is presented in Section 3. Finally, a conclusions of wok described in this paper is presented in Section 4.

## 2. Method

Figure 1 shows that the conceptual framework of research is included tree steps: problem, design, and interpretation.

### 2.1. First step – problem identification

Critical review that is carry out in (1) the level of industrial competitiveness and the shipyard, and (2) the definition, level, and measurement productivity: [1] [5] [12] [15] [19] [22] [25] [26] [27] [33] [35] [38] [41] [44].

The basic support of the theory in (1) the cultural factor that influence in the activity of the business, (2) the work condition factor as human relations with the Indonesian environment, (3) the labour productivity factor as one of the important variables in the superiority of competition, and (4) the strategic policy of labour productivity and shipyard competitiveness [2] [3] [4] [9] [10] [11] [15] [18] [19] [24] [28] [30] [31] [32] [34] [38] [40] [42] [43] [46].

### 2.2. Second steps – statistical model design

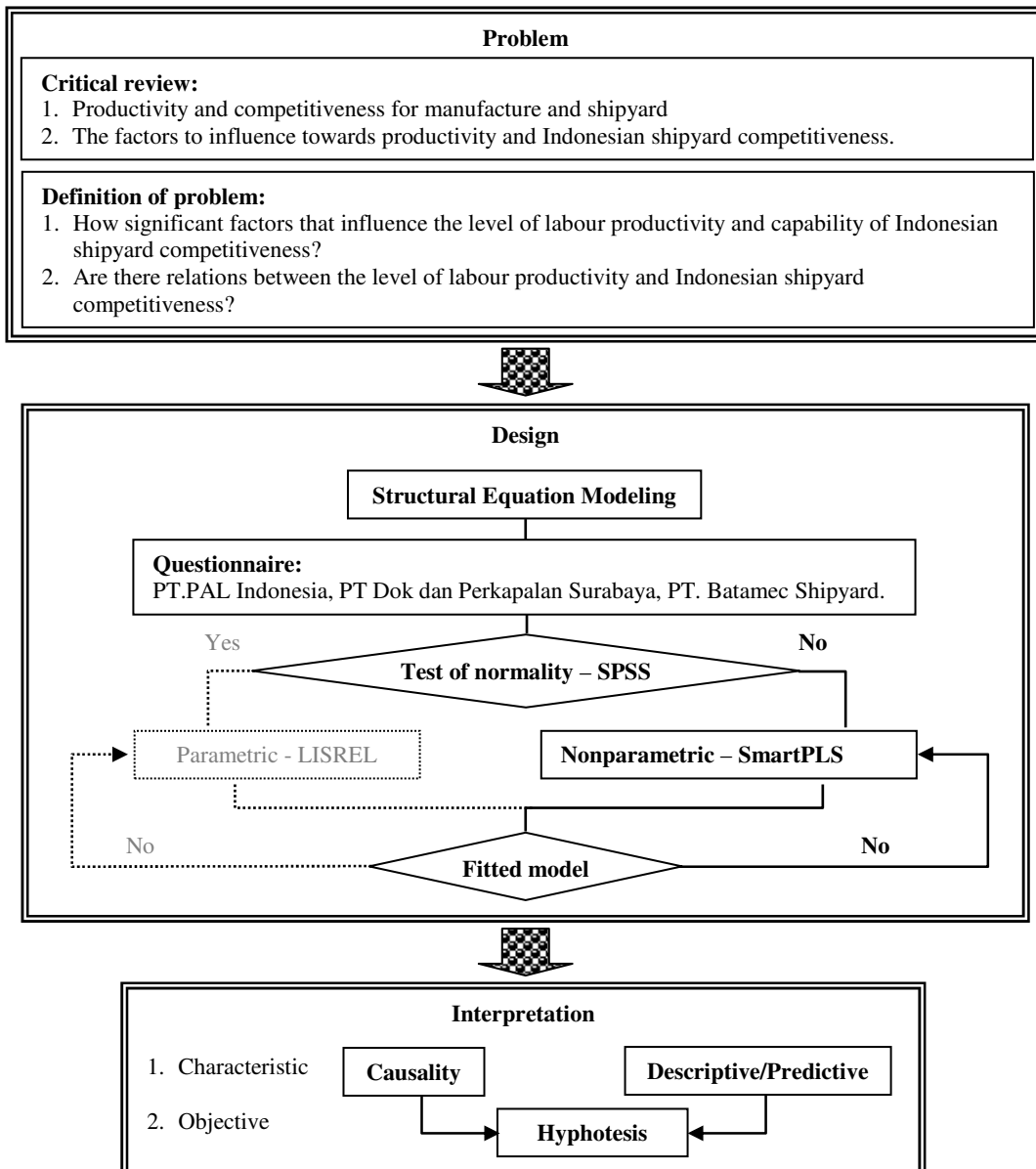
In researching relations between the variable that more than 2 (two) could use multivariate statistical technique [17]. Whereas the design of the model that it is proposed in this research is structural equation modelling (SEM).

The SEM technique is the statistical method for the evaluation of various hypotheses in the development research had three aims [45], that is :

1. This research determining the profit in the use of the analytical method for the apply research. All of analysis of the book that is published in Child Development between 1993 up to 1997 identify that 41 articles (6%) us the method SEM.
2. This research decisive how the method SEM is used in Child Development. The summary of the report showing that the researcher need information communication that is enough to the reader about the modelling strategy and the rationalisation for the evaluation of an appropriate model.
3. This research test whether something that is normal is use “rule signs” (as the compatibility index  $> 0.90$ ) concerning fitted model from the global model that in accordance with the empirical justification which agreed by under conditions of which is usually found in the development research.

Technical taking of the sample is chosen based on the purposive sampling method or the sample from the population target [6], that is the individual respondent who it is thought had adequate competence in the development field of the shipbuilding. The respondents are

the supervisors and the managers who are considered as middle level in company management.



**Figure 1.** Conceptual Framework

The sample scale to fulfill assumption SEM is 100 respondents and hereinafter applies comparison of 5 observations for every estimation of parameter [13]. The determine influence every the parameter is used metric measurement [17], so the design of questionnaire is the form of semantic differential scale by using the interval scale from Likert in the range thought 1 to 5 [23]. The validation of the contents of the questionnaire is carried out with logical validity and face validity through the expert discussions and the questionnaire test at some prospective respondents [13].

### 2.3. Third step – model interpretation

The nonparametric multivariate statistics as one of tool analysis implements in the research with the data has not normal distribution. [36]. The ratio skewness and kurtosis could be made the guidance whether a data distribution normal or not [21, 39]. Whereas as the guidance, when the ratio skewness and kurtosis are between -2 as far as +2, then the distribution of data is normal [37].

**Table 1.** Goodness of fit index – SmartPLS

| Goodness of Fit Index              | Cut-off Value                            | Interpretation                     |
|------------------------------------|------------------------------------------|------------------------------------|
| ▪ Average variance extracted - AVE | ▪ > 0,5                                  | ▪ Discriminant validity [14]       |
| ▪ Composite reliability - $\rho_c$ |                                          |                                    |
| ▪ Crobach alpha - $\alpha$         | ▪ > 0,5 (fine)<br>▪ 0,3 – 0,5 (adequate) | ▪ Function of Prediction [8]       |
| ▪ $R^2$                            | ▪ Value is expected large                | ▪ The substantive influence [16]   |
| ▪ Convergent validity - $\lambda$  | ▪ > 0,7 (fine)<br>▪ 0,5 – 0,6 (adequate) | ▪ Correlation between variable [7] |
| ▪ t-statistic                      | ▪ > 1,96                                 | ▪ Estimation of variable [7]       |

### 3. Result and discussion

Descriptive of 145 respondents from three medium sized Indonesian shipyards, covered: 52% respondent of PT. PAL Indonesia, 21% respondent of PT. Dok & Perkapalan Surabaya, and 28% respondent of PT. Batamec shipyard. It is tabulated in Table 2.

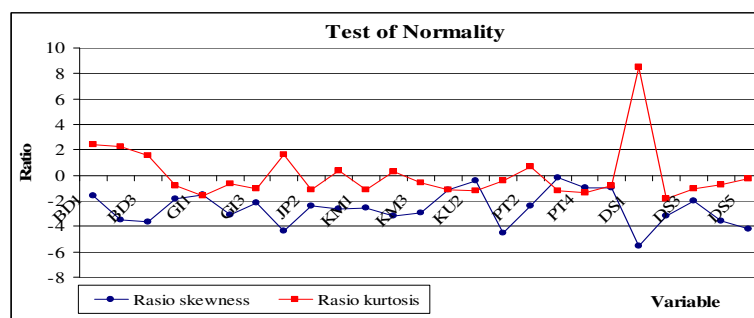
**Table 2.** Descriptive data

| No |                | DESCRIPTIVE                                                                                                                                | People              | %                   |
|----|----------------|--------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------|
| 1  | Institution    | 1. PT. PAL Indonesia<br>2. PT. Dok & Perkapalan Surabaya<br>3. PT. Batamec Shipyard                                                        | 75<br>30<br>40      | 52<br>21<br>28      |
| 2  | Gender         | 1. Male<br>2. Female                                                                                                                       | 135<br>10           | 93<br>7             |
| 3  | Age            | 1. age < 20 years<br>2. $20 \leq$ age < 30 years<br>3. $30 \leq$ age < 40 years<br>4. age $\geq$ 40 years                                  | 0<br>8<br>66<br>71  | 0<br>6<br>46<br>49  |
| 4  | Occupation     | 1. Manager or assistant<br>2. Chief or assistant of project<br>3. Chief or assistant of department<br>4. Coordinator/planner/engineer, etc | 24<br>5<br>4<br>112 | 17<br>3<br>3<br>77  |
| 5  | Education      | 1. High school<br>2. Diploma or polytechnic<br>3. Undergraduate<br>4. Graduate                                                             | 39<br>36<br>63<br>7 | 27<br>25<br>43<br>5 |
| 6  | Period of work | 1. work < 2 years<br>2. $2 \leq$ work < 5 years<br>3. $5 \leq$ work < 10 years<br>4. work $\geq$ 10 years                                  | 4<br>5<br>19<br>117 | 3<br>3<br>13<br>81  |

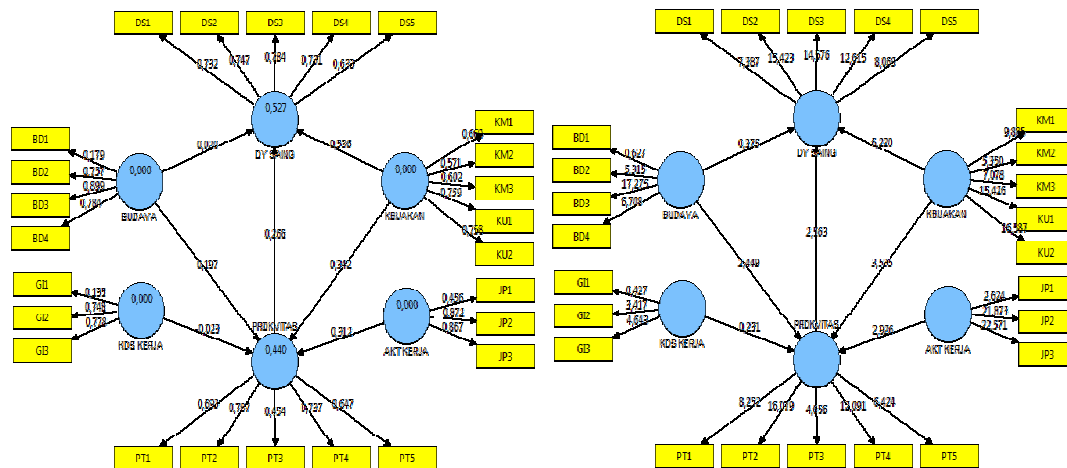
Source: questionnaire

It can be seen from table that manpower gender is dominated by the men of 93% and most ages of manpower more than 30 years. The level composition of manpower education, covered: 43% undergraduate, 27% high school, 25% diploma/polytechnic, and 5% graduate with the period of work that more than 10 years reach 81%.

The test normality the data is carry out with SPSS software for each research variable, where the data normal distribution will have the value of the ratio skewness and kurtosis is among -2 as far as 2. Figure 2 shows some value skewness and kurtosis is outside between -2 and 2, so as the statistics analysis could be used nonparametric multivariate statistical technique.

**Figure 2.** Ratio skewness and kurtosis from questionnaire

The nonparametric multivariate statistical technique used in the research is the SmartPLS Version 2.0 M3 next generation path modeling software.



**Figure 3.** Initial path modeling – PLS Algorithm and Bootstrapping

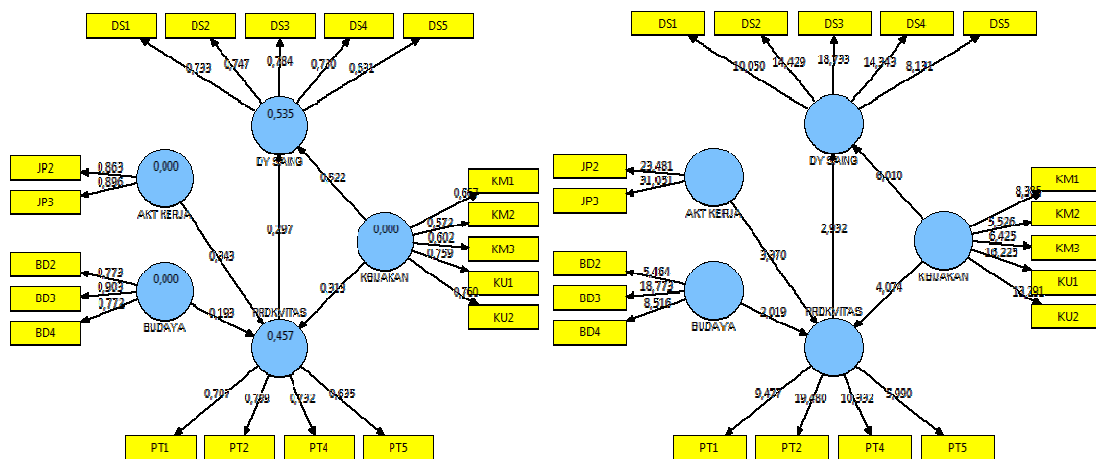
PLS algorithm and bootstrapping analysis for initial path modeling, shown in Figure 3, Table 2, and Table 3.

**Table 2.** PLS algorithm analysis for initial path modeling

| 1. Structural Model Specification:                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Parameter Value                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Cut-off Value                                                                                                                                   | Interpretation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Average variance extracted<br>0,394097 – 0,573300                                                                                                                                                                                                                                                                                                                                                                                                                  | AVE > 0,5                                                                                                                                       | 3 latent variables have discriminant validity: work activity (akt kerja), corporate culture (budaya), and shipyard competitiveness (dy saing).                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Composite reliability<br>0,602577 – 0,847891                                                                                                                                                                                                                                                                                                                                                                                                                       | $\rho_c > 0,5$                                                                                                                                  | 6 latent variables have discriminant validity: work activity (akt kerja), corporate culture (budaya), shipyard competitiveness (dy saing), strategic policy (kbijakan), work condition (kds kerja), and labour productivity (prdkvitas).                                                                                                                                                                                                                                                                                                                                                                          |
| Cronbach alpha<br>0,349565 – 0,573300                                                                                                                                                                                                                                                                                                                                                                                                                              | <ul style="list-style-type: none"> <li>▪ <math>\alpha &gt; 0,5</math> (fine)</li> <li>▪ <math>\alpha = 0,3 - 0,5</math> (adequate)</li> </ul>   | <ul style="list-style-type: none"> <li>▪ 5 latent variables have a fine prediction: work activity (akt kerja), corporate culture (budaya), shipyard competitiveness (dy saing), strategic policy (kbijakan), and labour productivity (prdkvitas).</li> <li>▪ 1 latent variable has an adequate prediction: work condition (kds kerja).</li> </ul>                                                                                                                                                                                                                                                                 |
| <ul style="list-style-type: none"> <li>▪ <math>R^2 = 0,526872</math> (dy saing)</li> <li>▪ <math>R^2 = 0,439812</math> (prdkvitas)</li> </ul>                                                                                                                                                                                                                                                                                                                      | Value is expected large                                                                                                                         | <ul style="list-style-type: none"> <li>▪ 52,69% the substantive influence from corporate culture (budaya), startegic policy (kbijakan), labour productivity (prdkvitas) towards shipyard competitiveness (dy saing)</li> <li>▪ 43,98% the substantive influence from corporate culture (budaya), work condition (kds kerja), work activity (akt kerja), strategic policy (kbijakan) towards labour productivity (prdkvitas)</li> </ul>                                                                                                                                                                            |
| 2. Outer Loading:                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Parameter Value                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Cut-off Value                                                                                                                                   | Interpretation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Convergent validity:<br><ul style="list-style-type: none"> <li>▪ Budaya (corporate culture)<br/>0,178632 – 0,899255</li> <li>▪ Kds kerja (work condition)<br/>0,134530 – 0,778046</li> <li>▪ Akt kerja (work activity)<br/>0,456069 – 0,871762</li> <li>▪ Kbijakan (strategic policy)<br/>0,571032 – 0,759234</li> <li>▪ Prdkvitas (labour productivity)<br/>0,454222 – 0,796679</li> <li>▪ Dy saing (shipyard competitiveness)<br/>0,632607 – 0,783693</li> </ul> | <ul style="list-style-type: none"> <li>▪ <math>\lambda &gt; 0,7</math> (fine)</li> <li>▪ <math>\lambda = 0,5 - 0,6</math> (adequate)</li> </ul> | <ul style="list-style-type: none"> <li>▪ Corporate culture:<br/>BUDAYA = BD2 BD3 BD4 (fine correlation)</li> <li>▪ Work condition:<br/>KDS KERJA = GI2 GI3 (fine correlation)</li> <li>▪ Work activity:<br/>AKT KERJA = JP2 JP3 (fine correlation)</li> <li>▪ Strategic policy:<br/>KBIJAKAN = KU1 KU2 (fine correlation), dan KM1 KM2 KM3 (adequate correlation)</li> <li>▪ Labour productivity:<br/>PRDKVITAS = PT2 PT4 (fine correlation), dan PT1 PT5 (adequate correlation)</li> <li>▪ Shipyard competitiveness<br/>DY SAING = DS1 DS2 DS3 DS4 (fine correlation), dan DS5 (adequate correlation)</li> </ul> |

**Table 3.** Bootstrapping analysis for initial path modeling

| 1. Outer Model T-Statistic:                                                                                                                                                                                                                                                                                                                                                                                                                     |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Parameter Value                                                                                                                                                                                                                                                                                                                                                                                                                                 | Cut-off Value         | Interpretation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <ul style="list-style-type: none"> <li>▪ Budaya (corporate culture)<br/>0,627195 – 17,274633</li> <li>▪ Kds kerja (work condition)<br/>0,427255 – 4,643214</li> <li>▪ Akt kerja (work activity)<br/>2,624189 – 22,570932</li> <li>▪ Kbijakan (strategic policy)<br/>5,349782 – 16,586950</li> <li>▪ Prdkvitas (labour productivity)<br/>4,656208 – 16,078681</li> <li>▪ Dy saing (shipyard competitiveness)<br/>7,386693 – 15,422930</li> </ul> | t-statistic ><br>1,96 | <ul style="list-style-type: none"> <li>▪ Corporate culture:<br/>BUDAYA = BD2 BD3 BD4</li> <li>▪ Work condition:<br/>KDS KERJA = GI2 GI3</li> <li>▪ Work activity:<br/>AKT KERJA = JP1 JP2 JP3</li> <li>▪ Strategic policy:<br/>KBIJAKAN = KM1 KM2 KM3 KU1 KU2</li> <li>▪ Labour productivity:<br/>PRDKVITAS = PT1 PT2 PT3 PT4 PT5</li> <li>▪ Shipyard competitiveness:<br/>DY SAING = DS1 DS2 DS3 DS4 DS5</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 2. Path Coefficient:                                                                                                                                                                                                                                                                                                                                                                                                                            |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Parameter Value                                                                                                                                                                                                                                                                                                                                                                                                                                 | Cut-off Value         | Interpretation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 0,374842 – 6,220040                                                                                                                                                                                                                                                                                                                                                                                                                             | t-statistic ><br>1,96 | <ul style="list-style-type: none"> <li>▪ The construct correlation is significant:                             <ol style="list-style-type: none"> <li>1. Work activity → Labour productivity (AKT KERJA → PRDKVITAS)</li> <li>2. Corporate culture → Labour productivity (BUDAYA → PRDKVITAS)</li> <li>3. Strategic policy → shipyard competitiveness (KBIJAKAN → DY SAING)</li> <li>4. Strategic policy → Labour productivity (KBIJAKAN → PRDKVITAS)</li> <li>5. Labour productivity → shipyard competitiveness (PRDKVITAS → DY SAING)</li> </ol> </li> <li>▪ The construct correlation is not significant:                             <ol style="list-style-type: none"> <li>a. Corporate culture → shipyard competitiveness (BUDAYA → DY SAING)</li> <li>b. Work condition → Labour productivity (KDS KERJA → PRDKVITAS)</li> </ol> </li> </ul> |



**Figure 4.** Three-step final path modeling – PLS Algorithm and Bootstrapping  
PLS algorithm and bootstrapping analysis for three-steps final path modeling, show in Figure 4, Table 4, and Table 5.

**Table 4.** PLS algorithm analysis for three-steps final path modeling

| <b>1. Structural Model Specification:</b>                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Parameter Value                                                                                                                                                                                                                                                                                                                                                                                       | Cut-off Value                                                                                                                                   | Interpretation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Average variance extracted<br>0,457514 – 0,773878                                                                                                                                                                                                                                                                                                                                                     | AVE > 0,5                                                                                                                                       | 5 latent variables have discriminant validity: work activity (akt kerja), corporate culture (budaya), shipyard competitiveness (dy saing), work condition (kds kerja), and labour productivity (prdktivitas).                                                                                                                                                                                                                                                                                                                               |
| Composite reliability<br>0,806242 – 0,872489                                                                                                                                                                                                                                                                                                                                                          | $\rho_c > 0,5$                                                                                                                                  | 6 latent variables have discriminant validity: work activity (akt kerja), corporate culture (budaya), shipyard competitiveness (dy saing), strategic policy (kbijakan), work condition (kds kerja), and labour productivity (prdktivitas).                                                                                                                                                                                                                                                                                                  |
| Cronbach alpha<br>0,693856 – 0,776029                                                                                                                                                                                                                                                                                                                                                                 | <ul style="list-style-type: none"> <li>▪ <math>\alpha &gt; 0,5</math> (fine)</li> <li>▪ <math>\alpha = 0,3 - 0,5</math> (adequate)</li> </ul>   | <ul style="list-style-type: none"> <li>▪ 5 latent variables have a fine prediction: work activity (akt kerja), corporate culture (budaya), shipyard competitiveness (dy saing), strategic policy (kbijakan), and labour productivity (prdktivitas).</li> </ul>                                                                                                                                                                                                                                                                              |
| <ul style="list-style-type: none"> <li>▪ <math>R^2 = 0,534838</math> (dy saing)</li> <li>▪ <math>R^2 = 0,456609</math> (prdkvistas)</li> </ul>                                                                                                                                                                                                                                                        | Value is expected large                                                                                                                         | <ul style="list-style-type: none"> <li>▪ 53,71% the substantive influence from startegic policy (kbijakan), labour productivity (prdkvistas) towards shipyard competitiveness (dy saing)</li> <li>▪ 43,97% the substantive influence from corporate culture (budaya), work activity (akt kerja), strategic policy (kbijakan) towards labour productivity (prdkvistas)</li> </ul>                                                                                                                                                            |
| <b>2. Outer Loading:</b>                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Parameter Value                                                                                                                                                                                                                                                                                                                                                                                       | Cut-off Value                                                                                                                                   | Interpretation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Convergent validity:<br><ul style="list-style-type: none"> <li>▪ Budaya (corporate culture)<br/>0,772395 – 0,903074</li> <li>▪ Akt kerja (work activity)<br/>0,863268 – 0,895838</li> <li>▪ Kbijakan (strategic policy)<br/>0,571881 – 0,759661</li> <li>▪ Prdkvistas (labour productivity)<br/>0,634597 – 0,799333</li> <li>▪ Dy saing (shipyard competitiveness)<br/>0,631191 – 0,783967</li> </ul> | <ul style="list-style-type: none"> <li>▪ <math>\lambda &gt; 0,7</math> (fine)</li> <li>▪ <math>\lambda = 0,5 - 0,6</math> (adequate)</li> </ul> | <ul style="list-style-type: none"> <li>▪ Corporate culture:<br/>BUDAYA = BD2 BD3 BD4 (fine correlation)</li> <li>▪ Work activity:<br/>AKT KERJA = JP2 JP3 (fine correlation)</li> <li>▪ Strategic policy:<br/>KBIJAKAN = KU1 KU2 (fine correlation), dan KM1 KM2 KM3 (adequate correlation)</li> <li>▪ Labour productivity:<br/>PRDKVITAS = PT1 PT2 PT4 (fine correlation), dan PT5 (adequate correlation)</li> <li>▪ Shipyard competitiveness<br/>DY SAING = DS1 DS2 DS3 DS4 (fine correlation), dan DS5 (adequate correlation)</li> </ul> |

**Table 5.** Bootstrapping analysis for three-steps final path modeling

| <b>1. Outer Model T-Statistic:</b>                                                                                                                                                                                                                                                                                                                                                  |                    |                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Parameter Value                                                                                                                                                                                                                                                                                                                                                                     | Cut-off Value      | Interpretation                                                                                                                                                                                                                                                                                                                                            |
| <ul style="list-style-type: none"> <li>▪ Budaya (corporate culture)<br/>5,464101 – 18,773224</li> <li>▪ Akt kerja (work activity)<br/>23,480701 – 31,051469</li> <li>▪ Kbijakan (strategic policy)<br/>5,526021 – 16,225038</li> <li>▪ Prdkvistas (labour productivity)<br/>5,990301 – 19,479721</li> <li>▪ Dy saing (shipyard competitiveness)<br/>8,130888 – 18,732745</li> </ul> | t-statistic > 1,96 | <ul style="list-style-type: none"> <li>▪ Corporate culture:<br/>BUDAYA = BD2 BD3 BD4</li> <li>▪ Work activity:<br/>AKT KERJA = JP2 JP3</li> <li>▪ Strategic policy:<br/>KBIJAKAN = KM1 KM2 KM3 KU1 KU2</li> <li>▪ Labour productivity:<br/>PRDKVITAS = PT1 PT2 PT4 PT5</li> <li>▪ Shipyard competitiveness:<br/>DY SAING = DS1 DS2 DS3 DS4 DS5</li> </ul> |

Continued

| 2. Path Coefficient: |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------------|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Parameter Value      | Cut-off Value      | Interpretation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 2,018738 – 6,010129  | t-statistic > 1,96 | <ul style="list-style-type: none"> <li>▪ The construct correlation is significant:               <ol style="list-style-type: none"> <li>1. Work activity → Labour productivity (AKT KERJA → PRDKVITAS)</li> <li>2. Corporate culture → Labour productivity (BUDAYA → PRDKVITAS)</li> <li>3. Strategic policy → shipyard competitiveness (KBIJAKAN → DY SAING)</li> <li>4. Strategic policy → Labour productivity (KBIJAKAN → PRDKVITAS)</li> <li>5. Labour productivity → shipyard competitiveness (PRDKVITAS → DY SAING)</li> </ol> </li> </ul> |

## 4. Conclusion

The study of shipyard competitiveness, labour productivity, and structural equation modeling were received by results as follows:

1. The aspect of labour productivity as centre of balance from the production process moving was giving the significant influence towards increasing at shipyard competitiveness.
2. The aspect of corporate culture is used as the capital of the business competition was giving the significant influence towards increasing at the labour productivity.
3. The aspect of work condition as the human relations with environmental was not giving the significant influence towards increasing at the labour productivity.
4. The aspect of work activity as the utility of facility and work procedure was giving the significant influence towards increasing at the labour productivity.
5. The aspect of strategic policy as the government and company commitment to support at the production process activity was giving the significant influence towards increasing at the labour productivity and shipyard competitiveness.

## 5. Acknowledgement

I would like to thank the following people for their help with the SmartPLS Version 2.0 M3 next generation path modeling, i.e.: Dr. Christian Ringle, Swen Wende, and Alexander Will from University of Hamburg - Germany.

## 6. Reference

- [1] APO (2004), *Achieving Higher Productivity Through Green Productivity*, Asian Productivity Organization, Training Manual-Participants Handbook.
- [2] Bashiruddin, J. (2002). Pengaruh Bising dan Getaran pada Kesimbangan dan Pendengaran, Disertasi, Universitas Indonesia, Jakarta.
- [3] Bennet, M. (1993), Toward Ethnorelativism: A Development Model of Intercultural Sensitivity. In R.M. Paige, *Education for The Intercultural Experience*, Maine, Intercultural Press. Inc, pp. 21 – 71.
- [4] Bhawuk, D.P.S., and Brislin, R. (1992), The Measurement of Intercultural Sensitivity Using The Concepts of Individualism and Collectivism, *International Journal of Intercultural Relations*, Vol. 16, pp. 413 – 436.
- [5] Bruce, G.J., and Garrard, I. (1999), *The Business of Shipbuilding*, LLP Reference Publishing, London.
- [6] Creswell, J.W. (2002), *Education Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research*, Pearson Education, Inc. New Jersey.
- [7] Chin, W.W. (1998), The Partial Least Squares Approach for Structural Equation Modeling, In Marcoulides, G.A. (Ed), *Modern Method for Business Resaearch*, Mahwah. NJ. Erlbaum.
- [8] Cronbach, L. J. (1951), Coefficient Alpha and Internal Structure of Test, *Psychometrika*, Vol. 16, pp. 297 – 334.
- [9] Deal, E. T. & Keneedy A.A. (1999), *The New Corporate Culture*, Perseus Publishing, New York.
- [10] Dinges, N., & Baldwin (1996), *Interculture Competence: A Research Perspective*. In D Landis & R. Brislin, Handbook of Interculture Training, Sage Publication, London, pp. 106 – 123.
- [11] Eddy, F. (2004). *Pengaruh Pengkondisian Udara, Pencahayaan, Dan Pengendalian Kebisingan Pada Perancangan Ruang Dan Bangunan*, Prodi Arsitektur, Fakultas Teknik, Universitas Sumatera Utara.
- [12] European Commission and Lloyd's Register – Fairplay (2002), *On The Situation in World Shipbuilding*, Fifth Report from The Commission to The Council, Brussel.

- [13] Ferdinand, A. (2005), *Structural Equation Modeling Dalam Penelitian Manajemen: Aplikasi Model-Model Rumit Dalam Penelitian Untuk Tesis Magister Dan Disertasi Doktor*, Edisi 3, Badan Penerbit Universitas Diponegoro, Semarang.
- [14] Fornell, C. and Bookstein, F. (1982), Two Structural Equation Models: LISREL and PLS Applied to Consumer Exit-Voice Theory, *Journal of Marketing Research*, Vol. 19, pp. 440-452.
- [15] Gebhardt, L.P., and Jarvis R.G. (2003), Productivity Improvement at the SENESCO Shipyard, *Journal of Ship Production*, Vol. 19, No. 3, pp. 187 – 193.
- [16] Geisser, S. (1975), The Predictive Samples Reuse Method with Application, *Journal of The American Statistical Association*, Vol. 70, pp. 320 – 328.
- [17] Hair, J.F., Anderson, R.E., Tatham, R.L. dan Black, W.C. (1998), *Multivariate Data Analysis*, 5th Edition, Prentice Hall, New Jersey.
- [18] Indrawati and Liewelyn R.V. (1999), Pengujian Model Regresi untuk Pengukuran Produktivitas Tenaga Kerja: Kasus Industri Kecil di Jawa Tengah, *Jurnal Manajemen dan Kewirausahaan*, Vol. 1, No.3:1.
- [19] Joseph, S. (2005), *Pengembangan Jejaring Produktivitas*, APINDO, Departemen Tenaga Kerja dan Transmigrasi.
- [20] Kotter, P.J. and Haskett, J.L. (1992), *Corporate Culture and Performance*, Free Press, Macmillan Press USA.
- [21] Kuncoro, M. (2007), *Metode Kuantitatif: Teori dan Aplikasi untuk Bisnis dan Ekonomi*, Edisi Ketiga, STIM YKPN, Yogyakarta.
- [22] Lamb, T. and Hellesoy, A. (2002), A Shipbuilding Productivity Predictor, *Journal of Ship Production*, Vol. 18, No. 2, pp.79 – 85.
- [23] Levin, R.I. dan Rubin, D.S. (1998), *Statistics for Management*, 7th edition, Prentice Hall, Englewood Cliffs, NJ.
- [24] Masyuri (1999), Produktivitas Tenaga Kerja Sektor Aneka Industri: Perspektif Sosial, *Jurnal Studi Indonesia*, Vol. 9, No.1:5.
- [25] Matsushita, K. (1998), *Shipbuilding Productivity and Competitiveness: Japanese and American Business Competition*, National Shipbuilding Research Program (NSRP).
- [26] Mulyatno, I.P. (2004), Optimizing Based Sensitivity for Shipyard Productivity on Indonesia, *Majalah Kapal*, 8 Edisi 3, Vol. 1, pp. 62 – 66.
- [27] Nagatsuka, S. (2000), *Study of the Productivity of Japan and South Korea's Shipbuilding Yards Based on Statistical Data*, Japan Maritime Research Institute (JAMRI), The Manufacturing Technology (MANTECH) Program and National Shipbuilding Research Program (NSRP).
- [28] Pilat D. (1996), *Labour Productivity Levels in OECD Countries: Estimates for Manufacturing and Selected Service Sector*, Organization for Economic Co-Operation and Development, Paris.
- [29] Porter, M. (1998), *Competitive Advantage Creating and Sustaining Superior Performance*, SimonSays.com.
- [30] Sedarmayanti (1996). *Tata Kerja dan Produktivitas Kerja: Suatu Tinjauan dari Aspek Ergonomi atau Kaitan Antara Manusia dengan Lingkungan Kerjanya*, Cetakan I, Penerbit Mandar Maju, Bandung.
- [31] Setiawan, I. 2002, Aliansi, Efisiensi dan Daya Saing, *Majalah Angkasa*, No. 11, Tahun XII.
- [32] Soesastro, H. (2004), Kebijakan Persaingan, Daya Saing, Liberalisasi, Globalisasi, Regionalisasi dan Semua Itu, *CSIS Working Paper Series*, WPE 082.
- [33] Sinungan, M. (2005), *Produktivitas: Apa dan Bagaimana*, Bumi Aksara, Jakarta.
- [34] SNI (2003). *Nilai Ambang Batas Iklim Kerja (Panas), Kebisingan, Getaran Tangan-Lengan dan Radiasi Sinar Ultra Ungu di Tempat Kerja*, Subpanitia Teknis K3, Badan Standardisasi Nasional, Indonesia.
- [35] Storch, R., Clark, J., and Lamb, T. (1995), *Requirement and Assessments for Global Shipbuilding Competitiveness*, National Shipbuilding Research Program (NSRP).
- [36] Sugiyono (2008), *Metode Penelitian Kuantitatif, Kualitatif dan R & D*, Cetakan keempat, Penerbit Alfabeta, Bandung.
- [37] Santoso, S. (2000), *Buku Latihan SPSS Statistik Parametrik*, PT. Elex Media Komputindo, Jakarta.
- [38] Sumanth, D. J. (1985), *Productivity Engineering and Management*, McGraw-Hill, Inc., USA.
- [39] Tabachnick, B. G., dan Fidell, L. S. (1996), *Using multivariate statistics*, 3rd ed., Harper Collins, New York.
- [40] UNIDO (2000), *Indonesia: Strategy for Manufacturing Competitiveness*, United Nations Industrial Development Organization, Project No. NC/INS/99/004, Jakarta.
- [41] UNCTAD and Llyod's Register – Fairplay (2004), *Review of Maritime Transport 2004*, United Nations Conference on Trade and Development, Geneva, Switzerland.
- [42] Widiyanto, B. (2004), Bappenas: Daya Saing Perusahaan Indonesia Menurun, *Tempo Interaktif*, 28 Juli.
- [43] Wie, T.K. (1995), *Pengembangan Kemampuan Teknologi di Indonesia*. Jakarta: PEP-LIPI.
- [44] Wignaraja G., and Joiner D. (2004), *Measuring Competitiveness in the World's Smallest Economies: Introducing the SSMECI*, Asian Development Bank.
- [45] Willoughby M. T., dan Curran, P.J. (1999), *Alternative Methods for Assessing the Fit of Structural Equation Models in Development research*, Duke University.
- [46] Yumarma, A. (1996), Unity in Diversity: A Philosophical and Ethical Studi of The Javanese Concept of Keselarasan, Dissertation, Rome Centre "Culture and Religions" – Pontifical Gregorian University.