GROSTLOG 2019
Global Research on Sustainable Transport & Logistics

ISSN: 2622-5778 (online)
Advances in Transportation and Logistics Research
http://proceedings.itltrisakti.ac.id/index.php/altr

The Effect of Container Receiving/Delivery to the Efficiency of RTGC's Performance with the Case Study in TPS 223X Terminal Support Division PT IPC Terminal Petikemas

Resque Cantias[1*], Riyanti[2], Darmawan Apriyadi[3], David P Sirait[4], Cokorda Bagus Purnama Dwisa[5]
[1,2,3] Institut Transportasi dan Logistik Trisakti, Jakarta, Indonesia
[*]Corresponding author: rr.grost2019@gmail.com

Abstract. RTGC (Rubber Tyred Gantry Crane) is one of the lifting equipments used in container terminal for loading and unloading activities, as from the trailer's chassis to stacking yard or vice versa. The purpose of this study is to analyze the effect of container receiving/delivery toward the performance of RTGC. The research method used survey method with quantitative analysis of simple linear regression analysis based on weekly historical data from 1 January 2018 until 31 March 2019 (65 weeks). The expected result is to have a positive direct effect of receiving/delivery container activities on the performance of RTGC.

Keywords*:* rubber tyred gantry crane, delivery, container, yard

1. Introduction

Ports have a role in sea transportation as a meeting point between land and sea transportation, the role of ports becomes very vital in encouraging economic growth, especially the hinterland area it is becoming a place for the transfer of goods and people in large quantities.

PT IPC Terminal Petikemas as a subsidiary of PT Pelabuhan Indonesia II (Persero), is a State-Owned Enterprise engaged in port and one of the largest ports in Indonesia located in Tanjung Priok, North Jakarta.

In order to improve service for handling containers at the port, PT IPC Terminal Petikemas in the Area Terminal Support uses 6 RTGC (Rubber Tyred Gantry Crane) units, one of which is in TPS 223X. RTGC (Rubber Tyred Gantry Crane) is one of the lifting equipment used for container loading and unloading activities from trailers to stacking yards or vice versa. This equipment can lift the load of containers with a maximum capacity of 41 tons and is able to stack containers higher up to 6 tiers. With this equipment, it is expected to increase the receiving/delivery container activities in TPS 223X Yard.

The yard for stacking imported containers must be close to the transfer point to reduce traffic congestion caused by trucks from outside [1]. Transfer of stacking for import container operations to temporary storage areas, where the containers are stacked to be claimed by the owner of the goods. By using loading and unloading equipment (RTGC) which is used for receiving, delivery and shifting [2]. There are two types of gantry cranes namely RMGC and RTGC. RTGC can move from block one to another block (row and tier) [3]. The storage yard in the container terminal serves as a temporary buffer for incoming and outgoing containers. Rubber Tyred Gantry Cranes (RTGCs) are the equipment most often used in the yard for container handling. The efficiency of yard operations is very dependent on the productivity of this RTGC. The workload of distribution in this yard changes over time, dynamic deployment of RTGC between storage blocks (container stacking areas) is an important problem of terminal operations management [4]. The effective distribution of material handling equipment in container terminals is very important in improving the efficiency and overall handling performance of containers, both import, export and container transhipment [5]. Maximum

ISSN: 2622-5778 (online)
Advances in Transportation and Logistics Research
http://proceedings.itltrisakti.ac.id/index.php/altr

efficiency can be achieved if yard planning and control functions, such as crane development, container grounding, crane shipping, vehicle traffic control, container rearrangement, are all well designed and coordinated [6]. There are many ways to measure port performance / productivity, namely by using physical indicators, factor productivity indicators, and financial indicators [7].

In the journal of Transportation Research Procedia 3 (2014: 592-601). The results of the analysis concluded; the journal was tested empirically the claim that the OS (Operating System) terminal was influenced by the business environment where CTs (Container Terminals) were built. On the basis of a sample of 65 European CTs, there are several determinants identified in the literature, such as labor costs or CT size, having a large influence on CT structures. In particular the increase in labor costs of SC (Straddle Carriers) CTs operated for RMG, RTG and semi-automatic CTs. Even SC systems are operated less labor-intensive than RTG or RMG CTs [8].

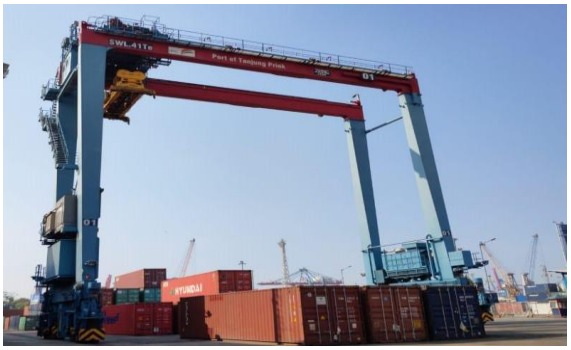

Figure 1. RTGC 01 equipment used in TPS 223X yard has specifications and capacity: Stacking height 1 over 6 capability with a maximum of 41 tons. But in its implementation, it is only able to stack as high as 4 tiers. This is because the stacking structure is still inadequate, there are still many uneven or wavy surface areas.

2. Method

This study used a quantitative method with simple linear regression analysis to find the relationship or influence of receiving/delivery container activities on the efficiency of the performance of RTGC equipment in TPS 223X Terminal Support Division of PT IPC Terminal Petikemas [9].

The data used was based on the weekly report of RTGC 01 equipment at TPS 223X from 1 January 2018 to 31 March 2019 or for 65 weeks.The researcher identified that variable X was receiving/delivery and variable Y was the performance of RTGC equipment. This study explains how variable X affects the variable Y.

Table 1. Simple Linear Regression Test

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		Correlations		
		B	Std. Error	Beta	T	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part
1	(Constant)	30.216	8.307		3.638	.001	13.612	46.821			
	RECEIVING/DELIVERY	1.286	.039	.973	33.105	.000	1.209	1.364	.973	.973	.973

a. Dependent Variable: PERFORMANCE RTGC

ISSN: 2622-5778 (online)
Advances in Transportation and Logistics Research
http://proceedings.itltrisakti.ac.id/index.php/altr

From the results of table 1, the regression equation form is:
$Y = a + bX$
$Y = 30.216 + 1.286X$
The interpretation of the regression line equation is:
A constant value of 30.216 means that if receiving/delivery (X) is 0, then the performance of RTGC (Y) equipment is 30.216.
Simple receiving/delivery (X) regression coefficient of 1.286 means that each receiving/delivery (X) increases by one unit so the performance of RTGC (Y) equipment will increase by 1,286 units. The coefficient is positive, meaning that the higher receiving/delivery (X) then it will increase the performance of RTGC equipment (Y).

3. Discussion and Result

This study was conducted at TPS 223X in the Terminal Support Division of PT IPC Terminal Petikemas for 65 weeks from January 1, 2018 to March 31, 2019. Primary data that is very important here was done by recording the performance of RTGC equipment in the activities of Lift On, Lift Off and Shifting. TPS 223X yard began to be operated in late 2013. Beginning with the operation of this yard, using reach stacker in handling receiving/delivery container activities in the yard. At the beginning of 2015, TPS 223X yard used RTGC to handle receiving/delivery container activities in the yard. The RTGC used in TPS 223X yard was RTGC ZPMC in 2014 assembly year.

RTGC (Rubber Tyred Gantry Crane) is a loading and unloading equipment that operates in a yard that has a function to move the container from the truck to the stacking yard or vice versa from the stacking yard to the truck. RTGC has characteristics such as fast mobility, high stacking, area efficiency, high lifting power, and easy maintenance. The development of RTGC generation is inseparable from the development of sea freight transportation technology, especially those using containers, the more capacity it has, the more it has to be served both in terms of speed of service and the readiness of loading and unloading equipment on the dock.

From the table below, it can be seen where the average RTGC utilization in TPS 223X Yard based on the operational hours of the equipment.

Table 2. Utilization and Availability of RTGC 01 TPS 223X 1 January 2018 until 31 March 2019

Week	Engine hour utilized	Available hours	Downtime (maintenance, breakdown, accident) (%)	Utilization (%)	Availability (%)
1	51	84	1%	61%	99%
2	53	84	3%	63%	97%
3	63	84	3%	75%	97%
4	63	84	2%	75%	98%
5	45	84	1%	54%	99%
6	59	84	2%	70%	98%
7	37	84	0%	44%	100%
8	56	84	0%	66%	100%
9	51	84	0%	61%	100%
10	55	84	0%	65%	100%
11	48	84	0%	57%	100%
12	43	84	1%	52%	99%
13	49	84	0%	58%	100%
14	61	84	0%	72%	100%

ISSN: 2622-5778 (online)
Advances in Transportation and Logistics Research
http://proceedings.itltrisakti.ac.id/index.php/altr

15	34	84	0%	40%	100%
16	58	84	0%	69%	100%
17	51	84	1%	61%	99%
18	61	84	1%	73%	99%
19	54	84	3%	64%	97%
20	62	84	0%	73%	100%
21	65	84	0%	78%	100%
22	48	79	0%	61%	100%
23	56	84	4%	66%	96%
24	0	84	0%	0%	100%
25	32	84	5%	38%	95%
26	50	84	1%	60%	99%
27	58	84	0%	69%	100%
28	54	84	0%	64%	100%
29	55	84	2%	65%	98%
30	60	84	0%	71%	100%
31	61	84	0%	73%	100%
32	48	84	0%	57%	100%
33	42	84	2%	50%	98%
34	57	84	0%	68%	100%
35	54	84	0%	65%	100%
36	61	84	0%	72%	100%
37	52	84	1%	62%	99%
38	59	84	5%	70%	95%
39	64	84	3%	76%	97%
40	59	84	4%	70%	96%
41	54	84	0%	64%	100%
42	61	84	4%	73%	96%
43	55	74	0%	74%	100%
44	63	84	0%	75%	100%
45	54	84	0%	64%	100%
46	48	84	0%	58%	100%
47	56	84	0%	66%	100%
48	45	84	0%	54%	100%
49	56	84	0%	67%	100%
50	79	84	0%	94%	100%
51	75	84	18%	89%	82%
52	41	84	0%	49%	100%
53	53	84	0%	63%	100%
54	60	84	0%	71%	100%
55	50	84	0%	60%	100%
56	45	84	4%	53%	96%
57	33	84	0%	40%	100%
58	60	84	2%	71%	98%

ISSN: 2622-5778 (online)
Advances in Transportation and Logistics Research
http://proceedings.itltrisakti.ac.id/index.php/altr

59	45	84	0%	54%	100%
60	51	84	0%	60%	100%
61	55	84	2%	66%	98%
62	59	84	1%	70%	99%
63	48	84	0%	57%	100%
64	68	84	0%	81%	100%
65	61	84	2%	73%	98%
Average	**53**	**84**	**1%**	**64%**	**99%**

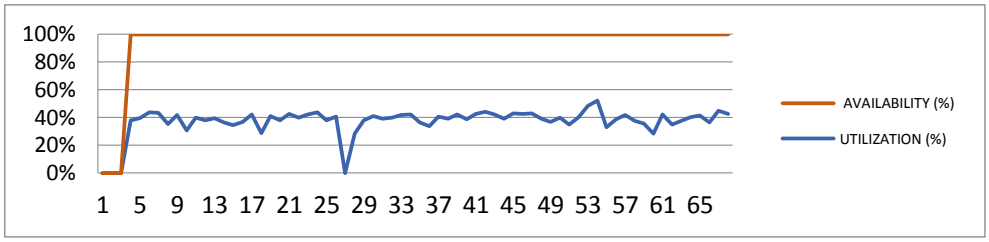

Figure 2. Utilization and Availability of RTGC 01 January 1 2018 to 31 March 2019

Data source: Equipment of Terminal Support Division PT IPC Terminal Petikemas, based on the operational hours of the RTGC equipment

From the table and graph above it can be seen where the average RTGC utilization in TPS 223X Yard is based on the operational hours of the equipment, which is enough where the margin is 64%. While availability on average per week at 99%. In the 24th week utilization has a value of 0%, this is due to the Eid Al-Fitr. The RTGC in TPS 223X Yard is capable of producing 17,681 periods from January 1 to 2018 until March 31, 2019 in the box count.

Table 3. Data Production of RTGC 01 Equipment and Recapitulation of Receiving/Delivery Container of TPS 223X January 1 2018 to March 31, 2019

Week	Lift off		Lift on		Shifting		Total Production (box)	Receiving		Delivery		Total Receiving/Delivery (box)
	20"	40'	20"	40"	20"	40"		20"	40'	20"	40"	
1	27	14	95	49	68	21	274	27	14	95	49	185
2	36	80	76	62	57	59	370	36	80	76	62	254
3	27	66	60	102	22	132	409	27	66	60	102	255
4	111	70	48	64	35	69	397	111	70	48	64	293
5	1	1	20	6	23	1	52	1	1	20	6	28
6	66	38	59	34	62	23	282	66	38	59	34	197
7	75	5	69	29	69	19	266	75	5	69	29	178
8	47	67	89	43	68	38	352	47	67	89	43	246
9	79	51	26	44	13	36	249	79	51	26	44	200
10	97	162	34	94	30	109	526	97	162	34	94	387
11	30	6	84	62	69	42	293	30	6	84	62	182
12	59	50	53	43	28	24	257	59	50	53	43	205
13	21	54	52	43	40	37	247	21	54	52	43	170
14	73	73	82	88	57	70	443	73	73	82	88	316
15	50	61	23	59	23	45	261	50	61	23	59	193
16	77	68	72	96	58	122	493	77	68	72	96	313
17	61	60	60	46	38	12	277	61	60	60	46	227

ISSN: 2622-5778 (online)
Advances in Transportation and Logistics Research
http://proceedings.itltrisakti.ac.id/index.php/altr

18	105	75	50	52	29	20	331	105	75	50	52	282
19	29	43	65	53	51	43	284	29	43	65	53	190
20	32	70	52	139	19	136	448	32	70	52	139	293
21	53	87	37	96	23	54	350	53	87	37	96	273
22	2	3	6	19	19	2	51	2	3	6	19	30
23	50	38	85	102	54	69	398	50	38	85	102	275
24	-	-	-	-	-	-	-	-	-	-	-	-
25	47	63	5	15	6	12	148	47	63	5	15	130
26	68	79	79	87	82	61	456	68	79	79	87	313
27	110	67	35	59	41	36	348	110	67	35	59	271
28	44	16	55	26	53	20	214	44	16	55	26	141
29	83	95	94	50	78	72	472	83	95	94	50	322
30	123	57	73	83	62	91	489	123	57	73	83	336
31	63	129	62	62	43	64	423	63	129	62	62	316
32	121	49	97	91	102	90	550	121	49	97	91	358
33	29	43	106	80	95	43	396	29	43	106	80	258
34	43	56	47	69	30	23	268	43	56	47	69	215
35	28	46	48	71	71	65	329	28	46	48	71	193
36	47	10	31	43	38	34	203	47	10	31	43	131
37	23	36	62	61	76	20	278	23	36	62	61	182
38	6	3	61	37	44	13	164	6	3	61	37	107
39	108	82	77	30	64	41	402	108	82	77	30	297
40	-	4	64	34	39	27	168	-	4	64	34	102
41	63	29	24	33	28	19	196	63	29	24	33	149
42	17	62	17	44	12	44	196	17	62	17	44	140
43	6	3	61	37	44	13	164	6	3	61	37	107
44	108	82	77	30	64	41	402	108	82	77	30	297
45	-	4	64	34	39	27	168	-	4	64	34	102
46	63	29	24	33	28	19	196	63	29	24	33	149
47	17	62	17	44	12	44	196	17	62	17	44	140
48	-	-	22	14	5	8	49	-	-	22	14	36
49	35	55	33	46	22	38	229	35	55	33	46	169
50	109	146	69	103	23	50	500	109	146	69	103	427
51	52	99	83	63	39	31	367	52	99	83	63	297
52	28	11	22	55	14	35	165	28	11	22	55	116
53	-	-	35	33	45	20	133	-	-	35	33	68
54	-	-	43	109	24	115	291	-	-	43	109	152
55	-	-	35	68	27	42	172	-	-	35	68	103
56	-	-	46	47	27	28	148	-	-	46	47	93
57	-	-	6	11	7	11	35	-	-	6	11	17
58	-	-	47	40	49	32	168	-	-	47	40	87
59	-	-	27	64	22	47	160	-	-	27	64	91

ISSN: 2622-5778 (online)
Advances in Transportation and Logistics Research
http://proceedings.itltrisakti.ac.id/index.php/altr

60	-	-	43	24	35	17	119	-	-	43	24	67
61	-	-	71	70	59	35	235	-	-	71	70	141
62	-	-	42	50	27	57	176	-	-	42	50	92
63	-	-	57	75	44	59	235	-	-	57	75	132
64	-	-	52	79	33	36	200	-	-	52	79	131
65	-	-	38	56	26	43	163	-	-	38	56	94
Average	**41**	**41**	**52**	**55**	**41**	**43**	**272**	**52**	**55**	**41**	**41**	**188**

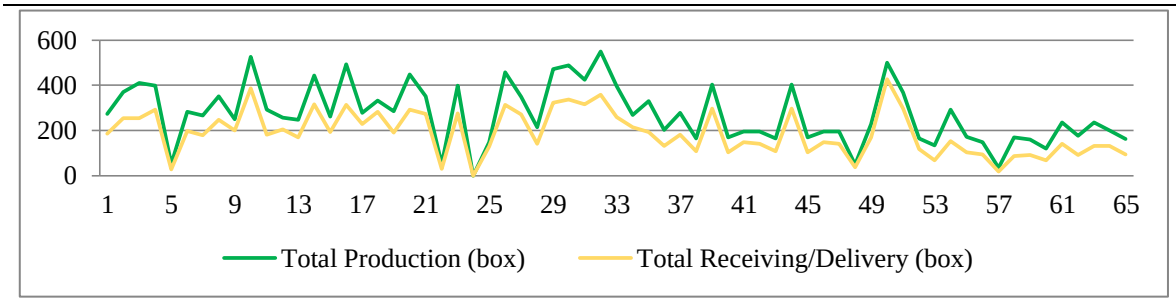

Figure 3. Production of RTGC 01 Equipment and Receiving/delivery Container TPS 223X 1 January 2018 until 31 March 2019

From the tables and graphs above, it can be seen that the number of RTGC production in TPS 223X yard has experienced an increase where the average is 272 boxes per week. The highest production is at week 32, 550 boxes, and does not produce at week 24, due to the Idul Fitri holiday.

The receiving/delivery activities in TPS 223X yard averaged from January 1, 2018 to March 31, 2019 as many as 188 boxes. Where the highest activity occurs at week 50 as many as 427 boxes and the lowest at week 57 is only 17 boxes.

Receiving / Delivery Container Activities at TPS 223X Yard in the Terminal Support Division PT IPC Terminal Petikemas

TPS 223X yard is a container stacking yard that serves to back up the stacking yard in Line I (origin terminal), inside the Tanjung Priok port (JICT, TPK Koja, MAL, NPCT1 and Tanjung Priok Area 2). The container that enters TPS 223X yard is an abundance from the origin terminal with the permission and approval of the Customs and Excise, in accordance with applicable regulations. At this time the Terminal Support Division handles more containers originating from the Operation Terminal 3. Where the working pattern in TPS 223X Terminal Support Division yard uses a 12 hour work pattern.

Receiving container is activity of container movement from hinterland / outside through gate in to container yard (CY) / stacking yard to stack.

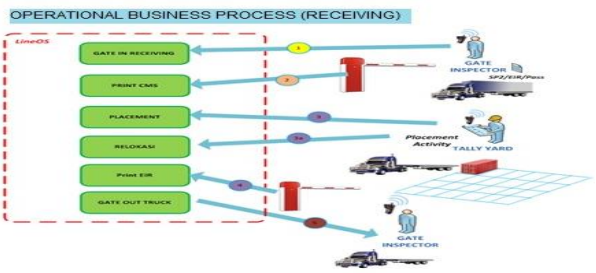

Figure 4. Process of Receiving Operational Business

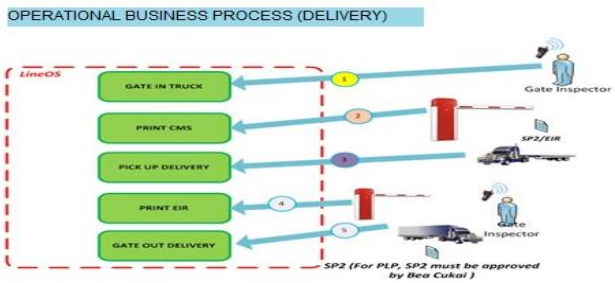

Figure 5. Operational Business Process Delivery

ISSN: 2622-5778 (online)
Advances in Transportation and Logistics Research
http://proceedings.itltrisakti.ac.id/index.php/altr

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.973[a]	.946	.946	29.67409	.946	1095.954	1	62	.000

a. Predictors: (Constant), RECEIVING/DELIVERY
b. Dependent Variable: PERFORMANCE RTGC

The following are the results of the relationship between receiving/delivery containers (variable X) with the variable-bound performance of the RTGC equipment (variable Y) is positive at 0.973 or 97.3% which means there is a relationship that is "very strong".

The coefficient of determination indicates that the influence of the receiving/delivery of the activity container on the performance efficiency of RTGC in TPS 223X in the Terminal Support Division of PT IPC Terminal Petikemas has a strong effect of 94.6%.

4. Conclusion

The results of the analysis and discussion of the influence of receiving/delivery container on the performance efficiency of the case study RTGC equipment at TPS 223X in the Terminal Support Division of PT IPC Terminal Petikemas within 65 weeks (January 1, 2018 to March 31, 2019), can be concluded: Averagely, RTGC utilization in TPS 223X Yard is based on the operating hours of the top equipment of 64%. Readiness and availability of RTGC averaging 99% per week. From the available utilization and availability RTGC in TPS 223X Yard is capable of producing 17,681 periods January 1 2018 to March 31, 2019 in a matter of boxes. Receiving/delivery activities in TPS 223X yard averaged 188 boxes per week.

The coefficient of correlation shows that the influence of receiving/delivery container activities on the performance efficiency of RTGC have a positive and very strong influence with equal is 97.3%. The coefficient of determination indicates that the influence of the receiving/delivery of the activity container on the performance efficiency of RTGC in TPS 223X in the Terminal Support Division of PT IPC Terminal Petikemas has a strong effect of 94.6% meanwhile 5.4% influenced by the other factors.

References

[1] C. Güven and D. T. Eliiyi, "Trip allocation and stacking policies at a container terminal," *Transp. Res. Procedia*, vol. 3, no. July, pp. 565–573, 2014.

[2] B. De Castilho and C. F. Daganzo, "Handling Strategies for Import Containers at Marine Terminals Bemardo De Castilho Carlos F . Daganzo Reprint UCTC No . 345 The University of California Transportation Center University of California," *Transp. Res.*, vol. 27B, no. 345, pp. 151–166, 1993.

[3] W. Yue, J. Sun, F. Liu, P. Yang, M. Han, and M. Feng, "A novel multi-RTGC scheduling problem based on genetic algorithm," *2010 7th Int. Conf. Serv. Syst. Serv. Manag. Proc. ICSSSM' 10*, pp. 226–231, 2010.

[4] C. Zhang, Y. wah Wan, J. Liu, and R. J. Linn, "Dynamic crane deployment in container storage yards," *Transp. Res. Part B Methodol.*, vol. 36, no. 6, pp. 537–555, 2002.

[5] H. Y. K. Lau and Y. Zhao, "Integrated scheduling of handling equipment at automated container terminals," *Int. J. Prod. Econ.*, vol. 112, no. 2, pp. 665–682, 2008.

ISSN: 2622-5778 (online)
Advances in Transportation and Logistics Research
http://proceedings.itltrisakti.ac.id/index.php/altr

[6] R. Linn, J. Y. Liu, Y. W. Wan, C. Zhang, and K. G. Murty, "Rubber tired gantry crane deployment for container yard operation," *Comput. Ind. Eng.*, vol. 45, no. 3, pp. 429–442, 2003.

[7] K. Bichou and R. Gray, "A logistics and supply chain approach to seaport efficiency-An inquiry based on action research methodology," *Res. Methodol. Supply Chain Manag. Collab. with Magnus Westhaus*, pp. 413–428, 2005.

[8] A. Michele and P. Serra, "Strategic determinants of terminal operating system choice: An empirical approach using multinomial analysis," *Transp. Res. Procedia*, vol. 3, no. July, pp. 592–601, 2014.

[9] D. B. Santoso *et al.*, "Hubungan Antara Komunikasi Interpersonal Lengkap," vol. 4, no. 2, pp. 45–51, 2013.