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AN APPROACH OF COST MANAGEMENT, QUALITY MANAGEMENT, AND TECHNOLOGICAL APPLICATIONS FOR FACTORY MANAGEMENT – A CASE OF DCT IN VIETNAM CONSTRUCTION MATERIAL INDUSTRY

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ABSTRACT

In emerging markets such as Vietnam, there are certain risks in construction material sector. For instance, competitive risk from Chinese competitors. Then quality risk (low quality) for products looking good at the beginning but through times, quality reduced. Another risk is that many construction material companies keep high inventories and burden losses.

This study will use OLS regression model to estimate determinants of cost of a typical construction material company, DCT in Dong Nai Province, Vietnam.

Then We will propose cost management solutions and total quality management for the company. For instance, firms can use video camera to monitor operation and apply ICT, AI and robots in production activities. More over, Video camera application can help labor safety.

Next, firms need to adapt to regulations in which The Ministry of Construction stimulate technical requirement and quality management of construction materials and products. Also we suggest project management board and consultants to supervise inspection, take samples of materials for testing, checking materials record. If the material profile is not satisfactory, the procedure is required to remove that material from the site. If successful, conduct material testing; materials with successful test results will be tested and accepted for input materials and put into construction.

Last but not least, we recognize that: Admin cost, net profit and R has negative corr. With COGS . And Lending rate and COGS has negative impact on Admin cost .

Key words: quality management, COGS, Admin cost, construction material, multi factors, econometric, cost management, risk management

JEL: M21, G30, G32, G38

1.Introduction

First, we recognize we need researches on technological applications for better factory management and as well as cost management for firm development.

Second, There are several kinds of risk on this material industry: competitive risk, for instance.

Imported material for construction from overseas such as China with various designs and cheap production cost that become a threat fro domestic materials.

Third, total quality management also needed to ensure quality of material products for construction and build proper processes for checking and monitoring construction materials products.

Therefore, In this paper we mainly focus on recommendations of using video camera for observing factory operation, and conduct an econometric model for better cost management and enhance business results.

We also select a case of Dong Nai Roofsheet And Construction Material JSC (DONAC) on stock exchange and do business in construction material sector for cost econometric model performance.

Research questions:

Question 1: What are technological applications such as video camera can help better factory monitoring?

Question 2: What are cost factors econometric model?

2. Literature review

First, Trivelas and Satouridis (2013) stated MIS performed well to help firm creativity and productivity..

Moreover, Sibanda et al (2020) mentioned digital technology has good role in this era.

Next, Huy, D.T.N (2015) stated risk management needed for management and business governance. And Kien, Le & Nguyen, M. (2021) mentioned contribution for education.

Then, We summarize previous studies as follows:

Table 1 – Summary of previous studies

Authors	**Year**	**Contents, results**
Cocca et al	2016	demonstrate the effectiveness of video technology at supporting the identification of the risks connected to unsafe behaviours of the work-force and critical conditions of the working environment. Video surveillance provides several benefits as opposed to in person observations, such as: non-biased and accurate accident data; in-depth analysis; observations possible not in real-time; observer not exposed to risks; undisturbed work activity; possi-bility of longer observation periods. The recorded videos can facilitate the identification of safe practices and the best risk management approaches as well as be used to improve training sessions. Further inves-tigation is required to assess the effectiveness of the system in the long term
Rai et al	2018	In broad terms, advanced video-based surveillance could be described as an intelligent video processing technique designed to assist security personnel's by providing reliable real-time alerts and to support efficient video analysis for forensic investigations. Author deals with the various requirements for designing a robust and reliable video surveillance system. Also, it is discussed the different types of cameras required in different environmental conditions such as indoor and outdoor surveillance.
Giebe et al	2019	Firms can achieve better service with "Big Data & Analytics".
Feitosa et al	2019	Disruptive technologies are triggers that transform the nature of work
Hoang Thanh Hanh, Dinh Tran Ngoc Huy	2021	Firms can build cost econometric model for better results
Nguyen Dinh Trung, Dinh Tran Ngoc Huy, Trung Hieu LE	2021	ML - Machine Learning and IoTs and AI together also has certain impacts in hospitals and medicine sector where public health data and patients information and diseases information are recorded and processed faster with Big Data
Nguyen Dinh Trung et al	2021	applying TQM will Gain performance commitment from members, staff, and the department. Build a new working style that is scientific and systematic, easy to monitor.

3. Methodology

Method and Data

First we use qualitative analysis and inductive and synthesis method for TQM solutions.

Second we use literature review for related studies.

Third we use econometric model with OLS for cost factors - econometric model.

Next we look at below figure:

- standard dev. of COGS higher than that of admin cost (fig 1 and fig 2)

- corr. Between COGS and lending rate higher than between COGS and sale cost (fig 3)

- on contrary, corr. Between admin cost and lending rate lower than between admin cost and sale cost (fig 4)

Figure 1 - Cost factors stats (COGS)

	COGS	CPI	G	NETPROFIT	R	RF	SALE_COST	TOTALREV...	VNINDEX
Mean	308.0000	0.053530	0.061090	-53.25000	0.115260	0.046905	4.350000	334.6000	696.4710
Median	298.0000	0.038150	0.064800	-47.50000	0.100000	0.053350	3.850000	309.0000	621.9500
Maximum	492.0000	0.181300	0.070800	32.00000	0.190000	0.065350	8.000000	531.0000	1067.500
Minimum	218.0000	0.006300	0.029100	-134.0000	0.080000	0.012200	0.600000	250.0000	351.5500
Std. Dev.	76.73475	0.048052	0.012441	57.89180	0.039225	0.018595	3.172889	81.17909	258.6604
Skewness	1.285510	2.051303	-1.843628	-0.033851	1.138882	-0.570545	0.030657	1.480882	0.170352
Kurtosis	4.522007	6.308044	5.524584	1.641501	2.705184	2.017240	1.347613	4.475602	1.511125
Jarque-Bera	3.719439	11.57272	8.320575	0.770876	2.197970	0.944960	1.139227	4.562270	0.972011
Probability	0.155716	0.003069	0.015603	0.680153	0.333209	0.623454	0.565744	0.102168	0.615078
Sum	3080.000	0.535300	0.610900	-532.5000	1.152600	0.469050	43.50000	3346.000	6964.710
Sum Sq. Dev.	52994.00	0.020781	0.001393	30163.15	0.013847	0.003112	90.60500	59310.40	602146.8

(source: author analysis)

Figure 2 - Cost factors stats (Admin cost)

	ADMIN_COST	CPI	G	NETPROFIT	R	RF	SALE_COST	TOTALREV...	VNINDEX
Mean	13.20000	0.053530	0.061090	-53.25000	0.115260	0.046905	4.350000	334.6000	696.4710
Median	13.00000	0.038150	0.064800	-47.50000	0.100000	0.053350	3.850000	309.0000	621.9500
Maximum	19.40000	0.181300	0.070800	32.00000	0.190000	0.065350	8.000000	531.0000	1067.500
Minimum	6.500000	0.006300	0.029100	-134.0000	0.080000	0.012200	0.600000	250.0000	351.5500
Std. Dev.	4.962302	0.048052	0.012441	57.89180	0.039225	0.018595	3.172889	81.17909	258.6604
Skewness	-0.035380	2.051303	-1.843628	-0.033851	1.138882	-0.570545	0.030657	1.480882	0.170352
Kurtosis	1.459184	6.308044	5.524584	1.641501	2.705184	2.017240	1.347613	4.475602	1.511125
Jarque-Bera	0.991300	11.57272	8.320575	0.770876	2.197970	0.944960	1.139227	4.562270	0.972011
Probability	0.609175	0.003069	0.015603	0.680153	0.333209	0.623454	0.565744	0.102168	0.615078
Sum	132.0000	0.535300	0.610900	-532.5000	1.152600	0.469050	43.50000	3346.000	6964.710
Sum Sq. Dev.	221.6200	0.020781	0.001393	30163.15	0.013847	0.003112	90.60500	59310.40	602146.8

(source: author analysis)

Figure 3 - Cost factors correlation (COGS)

Correlation Matrix									
	COGS	CPI	G	NETPROFIT	R	RF	SALE_COST	TOTALREV...	VNINDEX
COGS	1.000000	-0.199964	0.518992	-0.217287	0.341066	0.260006	0.323059	0.876955	-0.191565
CPI	-0.199964	1.000000	0.099628	0.434232	0.744833	0.509105	0.163795	0.049338	-0.583929
G	0.518992	0.099628	1.000000	0.112645	0.095911	0.426732	0.071087	0.508407	-0.220040
NETPROFIT	-0.217287	0.434232	0.112645	1.000000	0.143564	-0.072939	-0.585331	0.181918	0.074926
R	0.341066	0.744833	0.095911	0.143564	1.000000	0.678900	0.570010	0.475357	-0.808435
RF	0.260006	0.509105	0.426732	-0.072939	0.678900	1.000000	0.753013	0.199490	-0.929696
SALE_COST	0.323059	0.163795	0.071087	-0.585331	0.570010	0.753013	1.000000	0.129931	-0.830197
TOTALREV...	0.876955	0.049338	0.508407	0.181918	0.475357	0.199490	0.129931	1.000000	-0.192123
VNINDEX	-0.191565	-0.583929	-0.220040	0.074926	-0.808435	-0.929696	-0.830197	-0.192123	1.000000

(source: author analysis)

Figure 4 - Cost factors correlation (Admin cost)

Correlation Matrix									
	ADMIN_COST	CPI	G	NETPROFIT	R	RF	SALE_COST	TOTALREV...	VNINDEX
ADMIN_COST	1.000000	0.187573	0.137213	-0.496130	0.555471	0.803435	0.973935	0.126547	-0.869225
CPI	0.187573	1.000000	0.099628	0.434232	0.744833	0.509105	0.163795	0.049338	-0.583929
G	0.137213	0.099628	1.000000	0.112645	0.095911	0.426732	0.071087	0.508407	-0.220040
NETPROFIT	-0.496130	0.434232	0.112645	1.000000	0.143564	-0.072939	-0.585331	0.181918	0.074926
R	0.555471	0.744833	0.095911	0.143564	1.000000	0.678900	0.570010	0.475357	-0.808435
RF	0.803435	0.509105	0.426732	-0.072939	0.678900	1.000000	0.753013	0.199490	-0.929696
SALE_COST	0.973935	0.163795	0.071087	-0.585331	0.570010	0.753013	1.000000	0.129931	-0.830197
TOTALREV...	0.126547	0.049338	0.508407	0.181918	0.475357	0.199490	0.129931	1.000000	-0.192123
VNINDEX	-0.869225	-0.583929	-0.220040	0.074926	-0.808435	-0.929696	-0.830197	-0.192123	1.000000

(source: author analysis)

4.Main results

4.1 Technological and video camera applications for better factory monitoring

First of all, nowadays many factories has applied video cameras for monitoring factory operation. For instance:

Figure 1 - Video camera monitoring

(source: internet)

Using video camera can help to manage or observe working environment and prevent damages or dangers happening for workers.

Other technology applications:

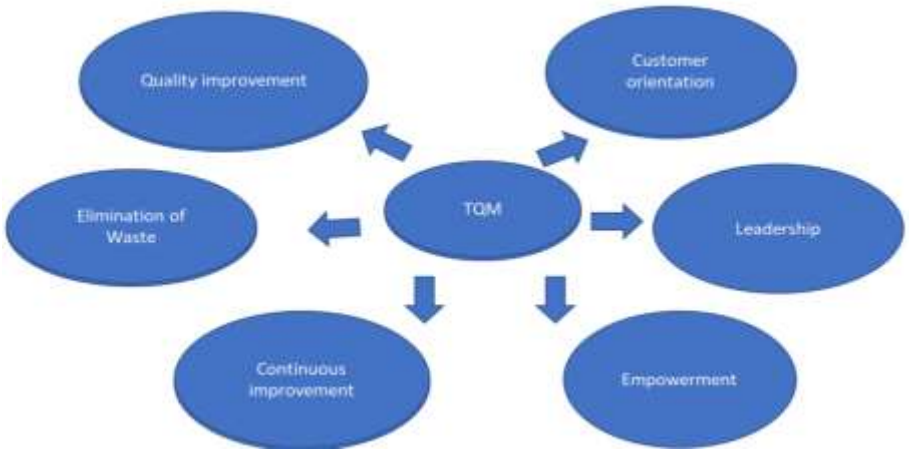
Next, Dinh Tran Ngoc Huy et al (2021) show us that ICT and AI and IoTs application will affect considerably on factory and industry. For instance, AI and robots can contribute to enhance productivity while IoTs can help to record and resolve Big Data for these industries together with data protection and security solutions.

Therefore, in term of ICT, digital technology , IoTs and AI combination can have good effects on firms and business will have more chance to enhance better communications channels via email, chatbox, e-meeting and video conference with cameras and speakers, etc.

4.2 Quality management solutions

First we look at below figure:

Figure 2 - TQM



***(source:** Slivestro, R, 1998. https://www.researchgate.net/figure/Manufacturing-model-ofTQM_fig1_2445265, access date 25/8/2021)*

Nguyen Dinh Trung et al (2021) said Every people and every aspects of organization should join TQM process. - Quality team activities. Through the quality team related problems are solved and suggestions for improvement are passed on to company management.

Other benefits of applying TQM will include:

- Higher productivity.
- Enhanced market image.
- Elimination of defects and waste.
- Reduced costs and better cost management.
- Higher profitability.

4.3 Cost management issues

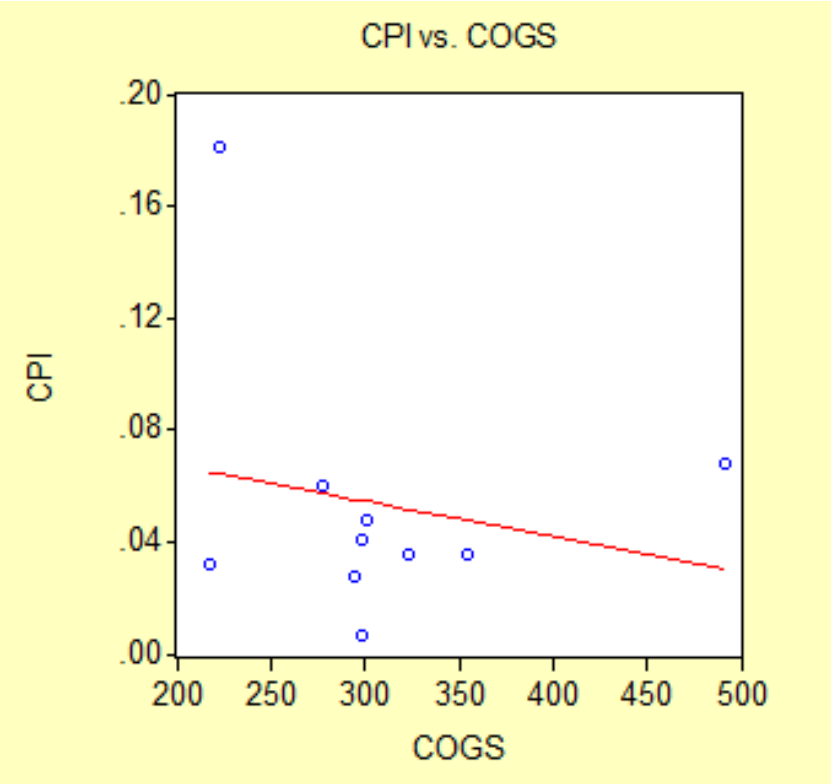
Overall data results

Next we look at below charts:

- CPI , net profit and COGS has negative corr. (chart 1 and chart 2)

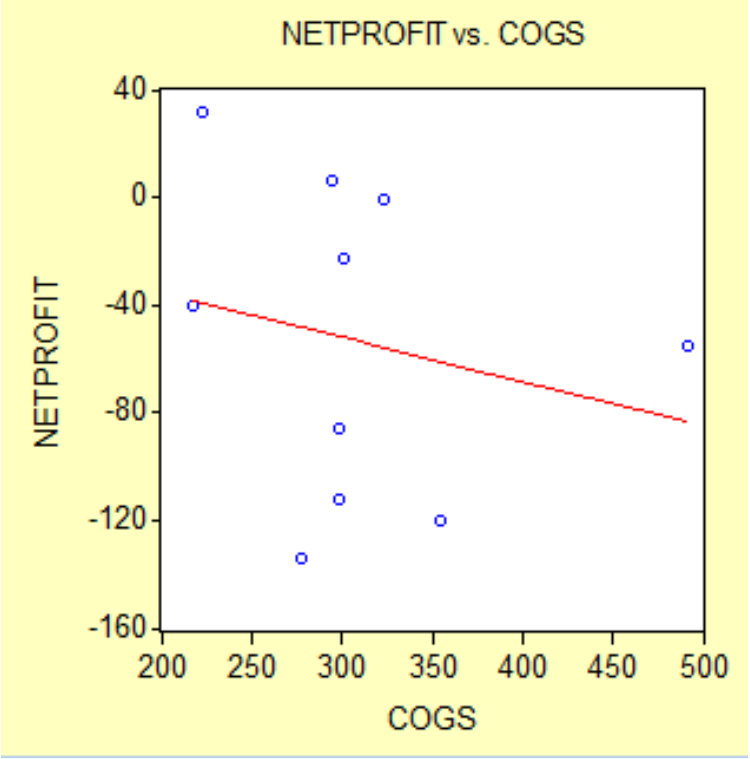
- lending rate, CPI and G and Admin cost has positive corr. (chart 4 and 5 and 6)

Chart 1 - CPI and COGS



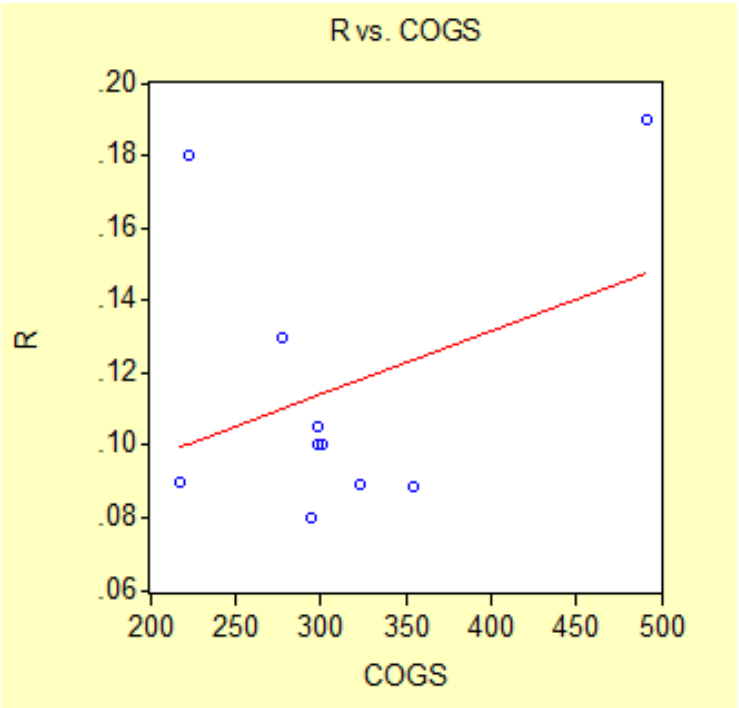
(source: author analysis)

Chart 2 - COGS and net profit



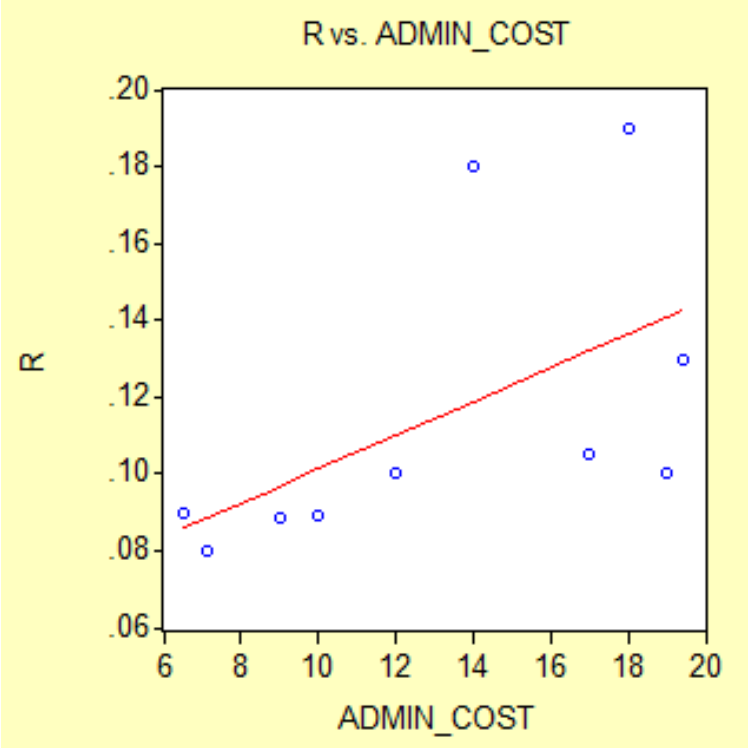
(source: author analysis)

Chart 3 - COGS and Lending rate



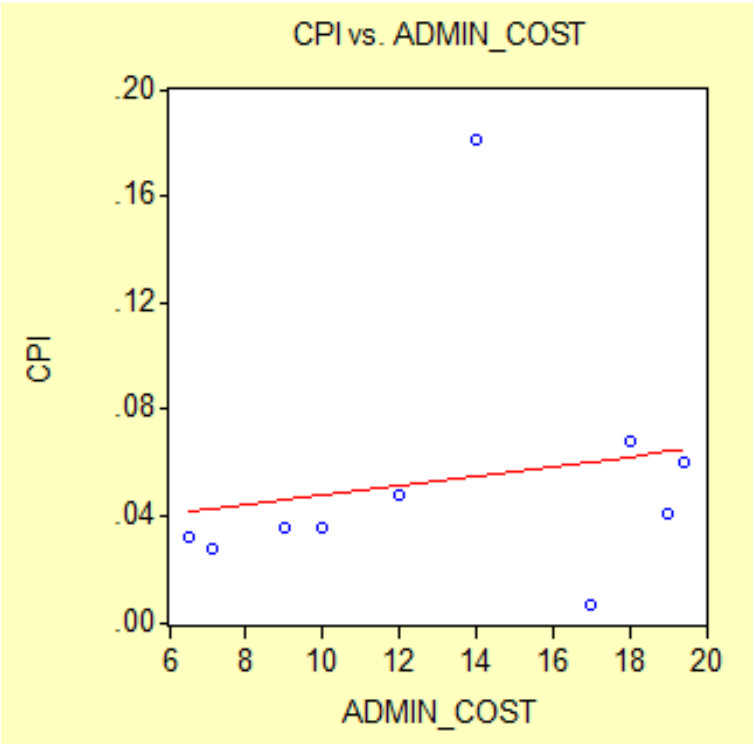
(source: author analysis)

Chart 4 - Admin cost and Lending rate



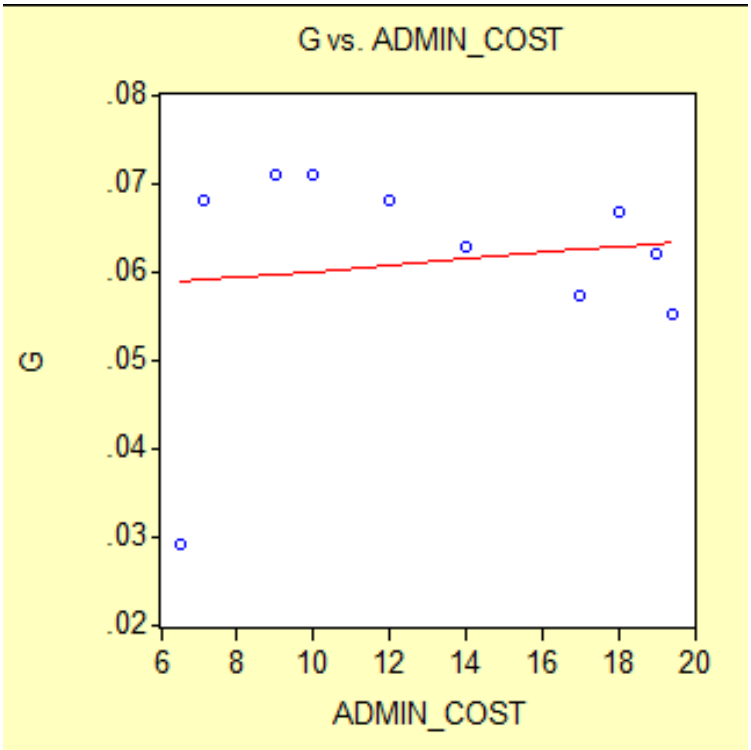
(source: author analysis)

Chart 5 - Admin cost and CPI



(source: author analysis)

Chart 6 - Admin cost and G



(source: author analysis)

4.4 OLS Regression results

Then we make analysis of below figures:

- Lending rate and Admin cost has positive corr. (fig 5)
- Lending rate and COGS has positive corr. (fig 6)
- CPI has negative corr. But G has positive corr. With COGS (Fig 7)
- CPI, G has positive cor. With Admin cost (Fig 8)

Figure 5 - OLS 1 factor for Admin cost

Dependent Variable: ADMIN_COST
Method: Least Squares
Date: 02/15/22 Time: 20:10
Sample: 1 10
Included observations: 10

Variable	Coefficient	Std. Error	t-Statistic	Prob.
R	70.27226	37.19273	1.889409	0.0955
C	5.100419	4.504713	1.132241	0.2903

R-squared	0.308549	Mean dependent var	13.20000
Adjusted R-squared	0.222117	S.D. dependent var	4.962302
S.E. of regression	4.376635	Akaike info criterion	5.967294
Sum squared resid	153.2395	Schwarz criterion	6.027811
Log likelihood	-27.83647	F-statistic	3.569865
Durbin-Watson stat	0.555278	Prob(F-statistic)	0.095513

(source: author analysis)

Figure 6 - OLS 1 factor for COGS

Dependent Variable: COGS
Method: Least Squares
Date: 02/15/22 Time: 20:10
Sample: 1 10
Included observations: 10

Variable	Coefficient	Std. Error	t-Statistic	Prob.
R	667.2211	650.1777	1.026213	0.3348
C	231.0961	78.74829	2.934617	0.0189

R-squared	0.116326	Mean dependent var	308.0000
Adjusted R-squared	0.005867	S.D. dependent var	76.73475
S.E. of regression	76.50932	Akaike info criterion	11.68956
Sum squared resid	46829.41	Schwarz criterion	11.75008
Log likelihood	-56.44779	F-statistic	1.053114
Durbin-Watson stat	2.423353	Prob(F-statistic)	0.334817

(source: author analysis)

Figure 7 - OLS 2 factors for COGS

Dependent Variable: COGS
Method: Least Squares
Date: 02/15/22 Time: 20:11
Sample: 1 10
Included observations: 10

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	-405.9236	495.2831	-0.819579	0.4395
G	3357.235	1912.953	1.755002	0.1227
C	124.6356	119.3610	1.044190	0.3311

R-squared	0.333325	Mean dependent var	308.0000
Adjusted R-squared	0.142847	S.D. dependent var	76.73475
S.E. of regression	71.04300	Akaike info criterion	11.60777
Sum squared resid	35329.75	Schwarz criterion	11.69855
Log likelihood	-55.03886	F-statistic	1.749938
Durbin-Watson stat	2.336132	Prob(F-statistic)	0.241935

(source: author analysis)

Figure 8 - OLS 2 factors for Admin cost

Dependent Variable: ADMIN_COST
Method: Least Squares
Date: 02/15/22 Time: 20:12
Sample: 1 10
Included observations: 10

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	18.13884	38.24660	0.474260	0.6498
G	47.74907	147.7214	0.323237	0.7560
C	9.312037	9.217260	1.010282	0.3460

R-squared	0.049373	Mean dependent var	13.20000
Adjusted R-squared	-0.222235	S.D. dependent var	4.962302
S.E. of regression	5.486060	Akaike info criterion	6.485623
Sum squared resid	210.6780	Schwarz criterion	6.576398
Log likelihood	-29.42811	F-statistic	0.181780
Durbin-Watson stat	0.461038	Prob(F-statistic)	0.837598

(source: author analysis)

Figure 9 - Multi factors affect Admin cost

Dependent Variable: ADMIN_COST
Method: Least Squares
Date: 02/15/22 Time: 20:05
Sample: 1 10
Included observations: 10

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NETPROFIT	0.018044	0.017202	1.048963	0.3534
R	-21.90829	22.61368	-0.968807	0.3875
SALE_COST	1.886274	0.312329	6.039380	0.0038
TOTALREVENUE	0.003929	0.020722	0.189614	0.8588
COGS	-0.003717	0.021137	-0.175875	0.8689
C	8.310976	2.380049	3.491935	0.0251

R-squared	0.965838	Mean dependent var	13.20000
Adjusted R-squared	0.923135	S.D. dependent var	4.962302
S.E. of regression	1.375779	Akaike info criterion	3.759626
Sum squared resid	7.571069	Schwarz criterion	3.941177
Log likelihood	-12.79813	F-statistic	22.61756
Durbin-Watson stat	2.831344	Prob(F-statistic)	0.004933

(source: author analysis with Eview)

(source: author analysis with Eview)

Figure 10 - External factors affect COGS

Dependent Variable: COGS
Method: Least Squares
Date: 02/15/22 Time: 20:08
Sample: 1 10
Included observations: 10

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	-754.5325	668.4986	-1.128697	0.3103
G	3727.309	2716.492	1.372104	0.2284
RF	-2077.635	4841.187	-0.429158	0.6857
VNINDEX	-0.238095	0.338399	-0.703592	0.5131
C	383.9666	394.6037	0.973043	0.3752

R-squared	0.430957	Mean dependent var	308.0000
Adjusted R-squared	-0.024277	S.D. dependent var	76.73475
S.E. of regression	77.66062	Akaike info criterion	11.84943
Sum squared resid	30155.86	Schwarz criterion	12.00072
Log likelihood	-54.24713	F-statistic	0.946671
Durbin-Watson stat	2.339178	Prob(F-statistic)	0.507436

Run OLS regression with Eviews gives below results:

Figure 11 - Multi factors affect COGS

Dependent Variable: COGS
Method: Least Squares
Date: 02/15/22 Time: 20:09
Sample: 1 10
Included observations: 10

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ADMIN_COST	-2.064253	11.73703	-0.175875	0.8689
NETPROFIT	-0.430555	0.403931	-1.065912	0.3465
R	-241.2756	579.6920	-0.416213	0.6986
SALE_COST	4.964409	23.27970	0.213251	0.8416
TOTALREVENUE	0.930976	0.154586	6.022364	0.0038
C	7.030725	112.7919	0.062334	0.9533

R-squared	0.920667	Mean dependent var	308.0000
Adjusted R-squared	0.821501	S.D. dependent var	76.73475
S.E. of regression	32.41975	Akaike info criterion	10.07912
Sum squared resid	4204.161	Schwarz criterion	10.26067
Log likelihood	-44.39561	F-statistic	9.284104
Durbin-Watson stat	1.876071	Prob(F-statistic)	0.025383

(source: author analysis with Eview)

4. Discussion

During period 2011-2020:

Impacts on COGS:

Admin cost, net profit and R has negative corr. With COGS (see fig 11)

Impacts on Admin cost:

R and COGS has negative impact on Admin cost (see figure 8)

5. Conclusion

Management implications:

Because sale cost and revenue has positive effects on COGS (see fig 11), management need to control sale cost and increase revenue properly.

Beside, we need to use ICT, AI and video camera for monitoring factory operation.

Next, we consider to apply TQM as it will be A continual process of improving and enhancing customer satisfaction through a comprehensive approach of management by ensuring the participation of all the employees to deliver superior quality of product or service for long-term success.

Last but not least, firms need to adapt to regulations in which The Ministry of Construction stimulate technical requirement and quality management of construction materials and products. Also we suggest project management board and consultants to supervise inspection, take samples of materials for testing, checking materials record. If the material profile is not satisfactory, the procedure is required to remove that material from the site. If successful, conduct material testing; materials with successful test results will be tested and accepted for input materials and put into construction.

Policy implications:

Because CPI has negative impact on COGS (fig 10), we suggest not decreasing CPI (targeted) too much.

Risk Management Information System (RMIS) implications

Management can build above cost factor econometric model to assess factors affecting COGS and admin cost.

Limitation of research

We can expand our research model for other industries and other markets.

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