The Potential of the Industrial Sector in Implementing ISO 14001: 2004 in Vientiane, Lao P.D.R.

ศักยภาพของโรงงานอุตสาหกรรมในนครหลวงเวียงจันทน์ ประเทศ ส.ปป.ลาว ในการประยุกต์ใช้ระบบมาตรฐานการจัดการสิ่งแวดล้อม ISO 14001: 2004

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Abstract

This research aims to study the potential of the industrial sector and factors affecting the implementation of ISO 14001:2004. The total number of representative samples which were selected through simple random sampling from 329 locations in the capital Vientiane. Most samples included senior executives, general managers or division heads. The data were drawn from the questionnaire survey, of which 320 or 97.27 percent were completed and returned. According to the study 9 indicators which are used to determine the factory's potential level. There are 5 indicators at the medium level that executive's demands for the ISO 14001:2004 system; technology for pollution control; budget allocation for environmental management; environmental problems prevention; and maintenance of machinery. Understanding ISO 14001:2004 ; potential of employees; environmental planning; and trainings for staff on ISO 14001:2004 are at a low level. It was found that the factors affecting the ISO 14001:2004 implementation were education level, other certificates and factory fuel utilization, which are related to factory potential level at the statistically significant 0.05.

Key words: factory potential / ISO 14001:2004 / Vientiane Lao P.D.R.

บทคัดย่อ

การศึกษาวิจัยครั้งนี้มีวัตถุประสงค์คือ เพื่อศึกษาศักยภาพของโรงงานอุตสาหกรรม และปัจจัยที่ส่งผลต่อ การประยุกต์ใช้ระบบมาตรฐาน การจัดการสิ่งแวดล้อม ISO 14001:2004 กลุ่มตัวอย่างคือ โรงงานอุตสาหกรรมในนครหลวงเวียงจันทน์ 329 แห่ง ซึ่งได้มาโดยวิธีการสุ่มตัวอย่างแบบง่าย (Simple Random Sampling) เก็บรวบรวมข้อมูลโดยใช้แบบสอบถาม กับผู้บริหารสูงสุด ผู้จัดการทั่วไป หรือหัวหน้าแผนก ได้แบบสอบถามที่สมบูรณ์คืนทั้งสิ้น 320 ชุด คิดเป็นร้อยละ 97.27 ผลการศึกษาวิจัยพบว่า จากตัวชี้วัด 9 ตัวที่เป็นตัวกำหนด ระดับศักยภาพของโรงงานอุตสาหกรรม มีตัวชี้วัด 5 ตัว ที่มีศักยภาพในระดับปานกลางได้แก่ ความต้องการของระบบมาตรฐาน ISO 14001:2004 ของผู้บริหาร ความพร้อมของเทคโนโลยีในการควบคุมมลพิษ งบประมาณในการจัดการสิ่งแวดล้อม การป้องกันปัญหาสิ่งแวดล้อม การปรับปรุงเครื่องจักร สำหรับระดับความเข้าใจในระบบมาตรฐาน ISO 14001:2004 ศักยภาพของพนักงาน การวางแผนจัดการสิ่งแวดล้อม การอบรมระบบมาตรฐาน ISO 14001:2004 และปัญหาสิ่งแวดล้อมสำหรับพนักงาน มีระดับศักยภาพต่ำ และปัจจัยที่มีผลต่อศักยภาพในการ

ประยุกต์ใช้ระบบมาตรฐาน ISO 14001:2004 ที่ระดับนัยสำคัญ .05 คือระดับการศึกษาของผู้บริหาร โรงงานได้รับมาตรฐานอื่นๆ การใช้เชื้อเพลิงในโรงงาน

คำสำคัญ : ศักยภาพของโรงงานอุตสาหกรรม / ระบบมาตรฐานการจัดการสิ่งแวดล้อม ISO 14001:2004 / นครหลวงเวียงจันทร์ ประเทศ ส.ปป.ลาว

1. Introduction

Lao people's Democratic Republic is governed by the People's democratic Republic system with only one political party which is people Revolution party to lead the country, having the highest authority since Laos adopted socialism on December 2nd 1975 based on social communism. The party had set up the policies and targets for developing the country. Economic development has been done together with National industrial development. Obviously, industrial sectors of the developed country and developing countries have grown rapidly in the state of globalization. In the similar situation, economic growth which emphasized on businesses for industrial sector has released industrial pollution and exploited raw materials and other natural resources in the production of numerous products and destroyed ecosystem equilibrium as well as lessening environmental quality. It is the result of lacking proper environmental management. Therefore, current environmental problems should be everyone's concern and responsibility to find better way to solve problems because many environmental problems caused by industrial careless production, including people's consumption without proper plan and effective management as well as lacking environmental awareness. These factors have caused environmental problems and water and air pollution, hazardous wastes which effected human life quality. Realizing the urgency to solve those problems, different organizations in both government and private sectors try to find problems prevention and correction continuously by practicing environmental management in own organization to accomplish the international standard practice. (Turk, 2008)

Presently, Lao People's Democratic Republic is facing problems in controlling and managing toxic and water because Laos has not established regulation in this area directly. Another problem is the entrepreneurs have failed to separate wastes and reused them incorrectly which in turn caused harm to health from using improper chemical containers or packages. These problems continue to increase without proper management. However in the past years, managing waste, toxic remain or hazardous waste have become so complicated because lacking modern equipments to treat these problems. These include lacking of qualified staffs, information on the amount of usage and volume of excess toxic chemical, lacking research tools and materials and procedures to control hazardous objects, inadequate funds for establishing the operational procedures, lacking manuals and other management methods. Presently, technology advancement has favored industrial sector as well as facilitating the use. At the same time it also created environmental impacts, causing pollution in soils, water, air and ecosystem

because these industries use chemical in the production. Without entrepreneurs' awareness in environmental impacts and finding measures to solve pollution problems, in the future, mankind has to face crisis in environmental toxic which should affect health and the living conditions. (Kulchan, 2002)

2. Methodology

1. Targeted Population Dimension

Populations selected for this study were top executives, managers and division heads of the industry as representatives of 1,851 factories in Vientiane.

2. Random Sampling

In this research, data were collected by interviewing top executives, managers or head of divisions. More data were obtained from the Ministry of Industry and Commerce which consisted of data from large, medium and small industries in Vientiane in the total of 1,851 factories.

Size of total 329 factories were calculated. Because of uneven size of factories, the researcher had used the following formula to calculate proportion of each factory:

$$\text{Sample size} = \frac{\text{Size of factories x } 329}{\text{Total factories size}}$$

No.	Size	Total	Sample Size
1.	Large	69	13
2.	Medium	280	50
3.	Small	1,502	267
	Grand Total	**1,851**	**329**

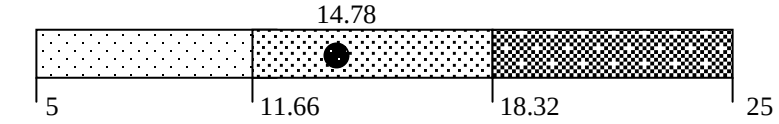
3. Data Analysis

- Descriptive Statistics such as Percentage, Mean, and Standard Deviation is being used for base data analysis.

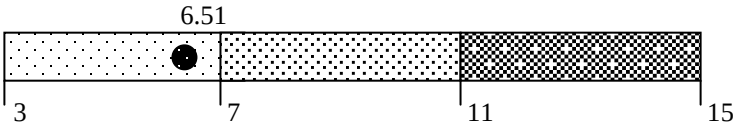
- Statistics Analysis such as Chi - Square test is being used together with statistical testing of Mean Comparison to explain the potential of industrial sector in Lao P.D.R. in implementation of ISO 14001:2004:2004.

-In the study of factory potential, a questionnaire was checked and scores for each number before taking total scores to distribute frequency and find the mean, then determine its level. Factory potential was divided into 3 levels calculated with the following formula (Sayam, 2006)

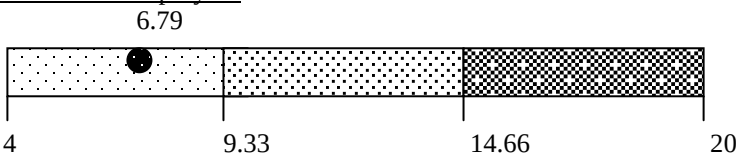
1. Executive needs for the system ISO 14001:2004



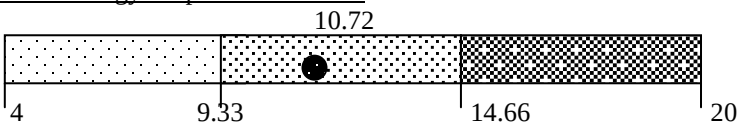
2. Understanding in system ISO 14001:2004



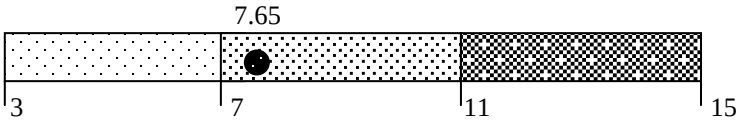
3. Potential of employees



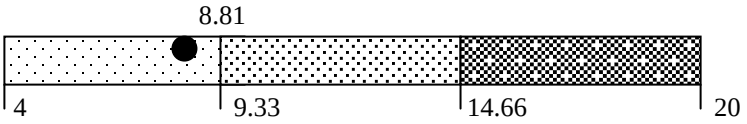
4. Technology for pollution control



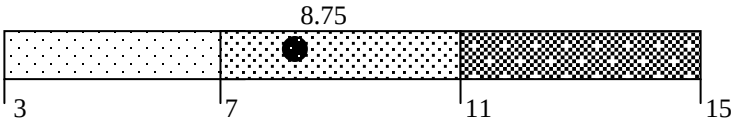
5. Budget allocation for environmental management



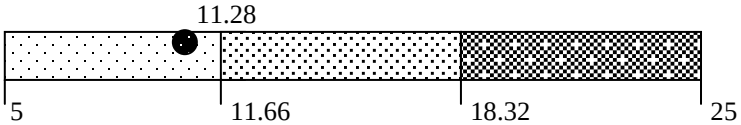
6. Environmental planning



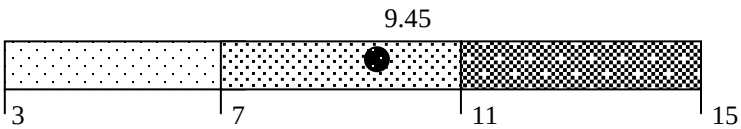
7. Environmental problems prevention



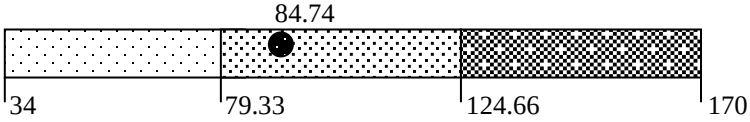
8. Training employees for staff on ISO 14001:2004



9. Maintenance of machineries



All factory potential level



3. Result and Discussions

3.1 Executive's fundamental factors

Based on table 1 revealed the executive's fundamental factors which were derived from 320 samples. The details are shown as below.

Table 1 Executive's fundamental factors

Executive's fundamental factors		Number (persons)	Percentage (%)
1. Gender			
	Male	222	69.4
	Female	98	30.6
2. Age			
	≤ 35 year	63	19.7
	36 – 46 year	147	45.9
	≥ 47 year	108	33.8
	Missing	2	0.6
3. Status			
	Single	36	11.3
	Married	278	86.9
	Divorce	6	1.9
4. Education			
	Lower than bachelor degree	85	26.6
	Bachelor degree	202	63.1
	Higher than bachelor degree	33	10.3
5. Position			
	Head of division	22	6.9
	Manager	150	46.9
	Executive	148	46.3
6. Worked at any other factories			
	Never worked	112	35.0
	Worked 5 months to 1 year	15	4.7
	Worked more than 1 year	192	60.0
	Missing	1	0.3
	Total	320	100

Table 1 (Cont.)

Executive's fundamental factors	Number (persons)	Percentage (%)
7. Experienced of executives working in their own factories		
From 3 months to 1 year	15	4.7
From 2 to 5 years	71	22.2
More than 5 years	234	73.1
Total	320	100

Male was more than female in number, ic., male 69.4% and female 30.6%. And the age in the range of 36-46 years or 45.9%, and more than or equaled of 47 years 33.8%, and less or equaled 35 years are 19.7%. And the status of the executive, most sampled groups are married 86.9%, and unmarried 11.3%, and divorced 1.9%. And the education level of executive, most sampled groups were graduates 63.1%, and undergraduates 26.6%, which higher than graduate 10.3%. Most sampled groups were general managers 46.9%, others executives 46.3%, and heads of division 6.9%. And the most of executive used to work other factories more than 1 year 60.0% and never worked other factories 35.0 %, used to work other factories between1 month to 1 year. And most of executive have experience in their own factory more than 5 years (73.1%), and had 2 to 5 years (22.2%), and had 3 months to 1 year.

3.2 Factory's fundamental factors

According to table 2, it revealed factory's fundamental factors which were derived from 320 questionnaires. This results show that most factories were near communities 74.4%, and 16.3 % of factories were far from communities and 15.6% of factories were near the riverbank, and 9.7% located near public water source and 3.1% were near flood prone area. Most of factories had operated 6-10 years or 56.3%, 25.6% had more than 10 years, and 18.1% had less than 5 years. The most of factories have had employees less than 50 persons 68.4%, 22.5% had 51-200 employees, 5.3% had 200-500 employees and other have had employees more than 500 persons (3.8%). For factory types, there were pure dinking water factories 25.0%, sewing factories15.9%, construction factories 12.2%, automobile parts 7.5%, process woods 6.6%, produced paper 4.4%, made plastic 4.1%, services industry-food condiments3.1%, electronic 2.5%, medicines 19% and other. And most of factories had never been certified by ISO 57.8%, 23.8% were certified by the government, and other certified by ISO.

Most sampled groups did not pollution treatment 34.7%, 33.4% had the garbage disposal, 23.1% had a water treatment, 3.4% had an incineration and 3.1% had the air pollution treatment. And most of the factory used electricity 95.3%, 3.8% used coal, 0.6% used cooking gas and 0.3 used oil. And the most of samples group to hired pickup truck to manage a garbage at the factories 88.4%, 5.3% manage by

incineration, 5.0% buried in own land, 0.9 sent to store at the garbage dump, and 0.3% sold as crap. Majority factory had not been complained by close customers 81.9%, 9.4% had a sewage problem, 9.4% had complained sewage, 5.0% had complained to the garbage problems, 0.9% had complained with the nearby neighbor and 0.6% had complained about odor –smoke.

Table 2 Factory's fundamental factors

Detail	Number (factories)	Percentage (%)
1. General area of factories		
The surrounding areas communities	238	74.4
No areas	82	25.6
- Factories with public water source nearby	31	9.7
No areas	289	90.3
- Riverbank or Klong connected to Mae Kong River	50	15.6
No areas	270	84.4
- Flood prone area	10	3.1
No areas	310	96.9
-Further away from the communities	52	16.3
No areas	268	83.8
2. Duration from starting operation		
Less than 5 years	58	18.1
For 6-10 years	180	56.3
More than 10 years	82	25.6
3. Number of workers		
Fewer employees than 50 persons	219	68.4
Employees from 51-200 persons	72	22.5
Employees from 200-500 persons	17	5.3
Employees over 500 persons	12	3.8
4. Type of factory		
Drinking water	80	25.0
Sewing	51	15.9
Construction	39	12.2
Making automobile parts	24	7.5
Process woods	21	6.6
Produced paper	14	4.4
Total	320	100

Table **2** (Cont.)

Detail		Number (factories)	Percentage (%)
	Made plastic	13	4.1
	Other food condiments	10	3.1
	Services	10	3.1
	Other	58	17.1
	Missing	60	18.8
5. Other Certified ISO			
	Never been certified ISO	185	57.8
	ISO 9000	15	4.7
	Received certification of government	76	23.8
	Certification from Science Department	1	0.3
	Standards Institute Ministry of Industry And commerce	7	2.2
	Certified by Foods and Drugs Administration	25	7.8
	Industrial and Environment Division	4	1.3
	Science and Environmental Standard of Lao P.D.R	3	0.9
	SA 8000	3	0.9
	ISO 14001:2004	1	0.3
6. Pollution treatment			
	Water treatment	74	23.1
	Garbage disposal	107	33.4
	Air pollution treatment	10	3.1
	Incineration	11	3.4
	No treatment	114	34.7
	Missing	4	1.3
7. Used fuel			
	Oil	1	0.3
	Electricity	305	95.3
	Coal	12	3.8
	Cooking gas	2	0.6
8. Manage garbage			
	Incineration	17	5.3
	Pickup truck to manage garbage	283	88.4
	Total	320	100

Table 2 (Cont.)

Detail	Number (factories)	Percentage (%)
Buried in own land	16	5.0
Sent to store at the garbage dump	3	0.9
Sold as scrap	1	0.3
9. General complaints concerned with factory operation mostly		
Garbage problems	16	5.0
Sewage problem	30	9.4
Odor	2	0.6
Problems with the nearby neighbor	3	0.9
Smoke	2	0.6
No complaints	262	81.9
10. Cash flow		
Less than 100,000 baht	37	11.6
Have 100,000 – 500,000 baht	139	43.4
Have 600,000 – 1,000,000 baht	65	20.3
Have 1,000,000 – 10 million baht	44	13.8
More than 10 million baht	33	10.3
Missing	2	0.6
11. Operational patterns among those factories		
Not done exporting	224	70.0
Exporting 1 – 25 %	23	7.2
Exporting 26 – 75 %	14	4.4
Exporting 76 – 99 %	16	5.0
Exporting 100 %	39	12.2
Missing	4	1.3
12. Executives had knowledge in ISO 14001:2004		
Don’t know	234	73.1
Trained	77	24.1
Implemented this system	8	2.5
Missing	1	0.3
13. Organizations readiness in implementing ISO 14001:2004		
Readiness	29	9.1
Not readiness	150	46.9
Not sure	141	44.1
Total	320	100

According of the study, most sample groups had cash flow 100,000-500,000 baht or 43.4%, 20.3% had cash flow 600,000-1,000,000 baht, 13.8% had cash flow1, 000,000 to 10 million baht, 11.6% had cash flow less than 100,000 baht, and 10.3% had cash flow more than 10 million. And most factories not had done exporting 70%, 12.2% had exporting 100 percent, 7.2% had exporting from 1-25 percent, 5.0% had exporting 76-99 percent and 4.4% had exporting 26-75 percent. Most of sample of executives do not had knowledge in ISO 14001:2004 , 24.1% had trained in ISO 14001:2004 , and 2.5% had implemented of ISO 14001:2004 system in organization. Organization had readiness to implementing ISO 14001:2004 , most of them were not readiness 46.9%, 44.1% had not sure and 9.1% had readiness to implementing in organization.

3.3 Other relevant factors

According to table 3 most sample groups were more competition rate in the market 79.1%, 17.2 were same competition rate, and 3.8% were decreasing competition rate. Most increased domestic competition rate 76.3%, 17.8% were same competition rate, 4.7% were not competition rate and 1.3% decreased competition rate. The factories had international competition rate. Most factories had no competition rate60%, 34.1% increased competition rate, 5.0 had same competition rate and 0.9% decreased competition rate. Most of factories supported from government sectors and other divisions to set up quality system or ISO for the environmental management 72.5%, 23.8% were not support, 3.8% were support, 3.4% supported trade industry department and environmental division, 0.3% supported training for employees in environment. Most of them never expressed their need for ISO 14001:2004 78.1%, 11.6% some concerned and 10.3% expressed their needs for ISO 14001:2004.

Table 3 other relevant factors

Detail	Number (factories)	Percentage (%)
1. Market competition rate		
Decreasing competition	12	3.8
Same competition	55	17.2
More competition	253	79.1
2. Domestic competition rate		
No competition	15	4.7
Decreasing competition rate	4	1.3
Same competition rate	57	17.8
Increased	244	76.3
3. International competition rate		
No competition	192	60.0
Decreasing competition rate	3	0.9
Same competition rate	16	5.0
Increased	109	34
Total	320	100

Table 3 (Cont.)

Detail	Number (factories)	Percentage (%)
4. The government sector or other work division involvement in setting up quality system or ISO		
Not have	76	23.8
Have	232	72.5
Some division	12	3.8
Employees received funds	1	0.3
Industry Department and environment	11	3.4
5. Demand of ISO from trade partners		
Expressed their needs for ISO 14001:2004	33	10.3
Never expressed their needs ISO 14001:2004	250	78.1
Some concerned	37	11.6
Total	320	100

3.4 Factory potential level.

According to the study 9 indicators which are used to determine the factory's potential level. There are 5 indicators at the medium level that executive's demands for the ISO 14001:2004 system; technology for pollution control; budget allocation for environmental management; environmental problems prevention; and maintenance of machinery. Understanding ISO 14001:2004; potential of employees; environmental planning; and trainings for staff on ISO 14001:2004 are at a low level. (Kaokhem, 2002)

Table 4 factory potential level

Variables	Sum	Mean	Potential level
1. Executive's demands for the ISO 14001:2004 system	4727	14.78	Medium
2. Understanding in system ISO 14001:2004	2083	6.51	Low
3. Potential of employees	2172	6.79	Low
4. Technology for pollution control	3429	10.72	Medium
5. Budget allocation for environmental management	2447	7.65	Medium
6. Environmental planning	2819	8.81	Low
7. Environmental problems prevention	2798	8.75	Medium
8. Training employees for staff on ISO 14001:2004	3596	11.28	Low
9. Maintenance of machineries	3021	9.45	Medium
Total	27092	84.74	Medium

3.5 Testing hypothesis to analyze relationship between an independent variable and factory potential level

3.5.1 Analysis of relationship between executive's fundamental factors and factory potential level. Results from the analysis of relationship between executive's fundamental factors (gender, age, and education level, current position, worked in other factories, experienced of executive working in their own factories) and factory potential level. It revealed that there was no relationship between other variables with factory potential level and except education level of the executive it was relation which statistical significant .05.

3.5.2 Analysis of relationship between factory's fundamental factors and factory potential level. The analysis of relationship between factory's fundamental factors was consisted (surrounding communities or urban communities, period starting operation, numbers of factory employees, factory type, other certified ISO, factory pollution treatment, factory fuel utilization, factory garbage management, factory received complaints, cash flow, operation model, executive's knowledge in ISO 14001:2004) and factory potential level. It was performed by Chi-square test. Most of them there were no relation and except other certified ISO, factory used fuel utilization there were relation which were statistical significant .05

3.5.3 Analysis of relationship between other relevant factors and factory potential level. The analysis of relationship between other relevant factors was consisted (current competition rate, domestic competition rate, international competition rate, government/other division support, demand of ISO from trade partners) and factory potential level. It was performed by Chi-square test. It revealed that there no relation with variables.

3.6 Executive's fundamental factors. Results from the analysis of relationship between executive's fundamental factors and factory potential level indicated that only education level had relation to factory potential level at statistical significant .05. Education level is very important to management in organization, which the most of executives had finished bachelor degree 63.1% and 10.3% finished higher than bachelor degree. It is supported idea system and environmental management of the organization. So the education had been related with potential of industrial sectors. This is consistent with the research of Kaokhem (2002) the adoption for ISO 14001:2004 of workers: A case study of international curity footwear Co.,Ltd. Research finding showed that: there was education an impact on ISO 14001:2004 adoption at the statistically significant level of .05 respectively. And corresponded with the research of Tawin (2001) conducted studies on work adjustment of supervisor to environmental management system ISO 14001:2004: case study of ECCO (Thailand) Co.,Ltd. The study revealed that there were significant among education levels and income levels in work adjustment at level .05

3.7 Factory's fundamental factors were revealed the analysis of relationship between factory's fundamental factors and factory potential level, which indicated no relationship to factory potential level with statistical significant .05. Excepts other certified ISO, factory fuel utilization were related to factory potential level at statistical significant .05, addition other certified ISO of factory sectors is basic to receive certify of ISO 14001:2004 to implementation. It is readiness of all factors to implementation in ISO 14001:2004. Factory fuel utilization had used in organization and used energy to conservation.

3.8 Other relevant factors of the potential of industrial sector were consisted current competition rate, domestic competition rate, and international competition rate, supported from government or other division promotion, demand of ISO from trade partners. Results from the analysis of relationship between other relevant factors and factory potential level was indicated no relationship with factory potential level, that statistical significant .05.

4. Conclusion

1. Executive's fundamental factors

According to research, 320 in Vientiane factory of executives were selected for samples in the study. It revealed the following data. Most sampled groups were males 69.4%, 45.9% aged from 36-46 years, 86.9% married, 63.1% graduated with bachelor degree or equivalence, 46.9% was of general manager, 60.0% worked at other factories more than 1 year and 73.1% experienced at executives working in their own factories more than 5 years.

2. Factory's fundamental factors

As for factory's fundamental factors, it revealed that most factories surrounded by communities or located in the city or 74.4%, 56.3% stared operation of factories in from 6-10 years, 68.4% hired less than 50 employees, 25.0% were water businesses besides construction and processed woods, 57.8% never certified ISO, 34.7% had no pollution treatment, 95.3% used electricity as the fuel, 88.4% hired the pickup truck to move garbage, 81.6% had never received any complaints. Most of factories had been cash flow from 100,000-500,000 baht 43.4%, 70.0% no exported. And 73.1% of executives were not known for the ISO 1400:2004.

3. Other relevant factors

Results were found other relevant factors. It revealed increasing competition rate 79.1%, 76.3% had more domestic competition rate. 60.0% had not international competition rate, 72.5% received government support and other divisions in ISO promotion, 78.1% never expressed their needs from trading partners.

4. Factory potential level

Results from the analysis revealed for executive's demands for the system ISO 14001:2004 with the mean scores of 14.78 which was in the medium level. And understanding system ISO 14001:2004 was arranged at 6.51 at low level. Potential of employees indicated the mean score 6.79 at low level. And the technology for pollution control had been the scored of mean 10.72 at medium level. And in the budget allocation for environmental management were scored of 7.65 at medium level. Environmental planning had been scored 8.81 at low level. And the environmental problems prevention were the mean scored 8.75 at medium level. As for training for staff on ISO 14001:2004 and environmental problems were scored to 11.28 at low level. And Maintenance of machineries were scored to 9.45 at medium levels. The factors to effect of system ISO 14001:2004 in implementing in the factories. The first factor is the education level; other certificate and factory fuel utilization. The criteria for measuring are variables of relation with factory potential level.

5. Results summarized from interviewing concerned government officials

Interviewing the government officials revealed executives general data. As for factory general data, the factories selected for the study at Lao P.D.R. mostly were small, followed by medium, only few large factories. For environmental pollution, the effects were not serious from operating as small or household enterprises with low cash flow and less labor. Few medium factories had produced goods for domestic consumption mainly and not enough to export. Even domestic consumption, certain products were inadequately produced in Lao P.D.R. Therefore, interviewing results were consistent with the set hypothesis and confirmed the relationship between the factories and the factory potential level. For other related variables. Interviewees mentioned high tendency for competition rate mostly in Lao P.D.R. and the government gave good support. Moreover, the trading partners paid no attention to getting ISO, because Lao partners. The findings were consistent with the set hypothesis that other factors related to factory potential level. Regarding international competition rate, most of them or 60.0 percent had not related with factory potential level.

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