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"Strategic Planning for Civil Engineering Education to Serve Sustainable Development of Lao PDR, A Case Study: Faculty of Engineering NUOL"

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Abstract

1. This paper deals with strategic planning for civil engineering education to serve the sustainable development, a case study: National University of Lao (NUOL). The country profile had been reviewed using existing documents and interviews i.e. geographic, economics, policy, National Economic and Social Development (NESD) plan, education system and needs of civil engineering study. The results show that basic infrastructures and compulsory education are urgently needed in attempt to edge over the poorness. Difficulties and drawbacks in education development are: quantity and quality of students, lacking of media and ICT-Based teaching and learning, insufficient qualified lecturers and instructors, lacking of research, technology, budgeting, financing and management. Economic profile shows slightly decreasing of agricultural sector, rapidly increasing of industry to certain limits while the service sector has become the same portion as the agriculture which indicate proper trend of balanced and sustainable development and needs for readjustment of civil engineering education strategies. Currently, three Bachelor programs in Construction, Transportation and Water Resource Engineering considerably conform to the NESD plan but the one plus four year period of study should be shortened to increase the expected numbers of graduate. In short term, international collaboration, cooperation or support can be alternatives for the higher degrees but curricula and faculty development are utmost necessary. Concerned authorities in engineering professional practice and control should have necessary plan and actions to deal with future sub-region or globalized agreements.

Keywords: Engineering education, Lao PDR, strategic planning, construction & development.

1. Introduction and Lao's Profile

Lao People Democracy Republic (Lao PDR), a member of ASEAN is a land-locked country situated in Southeast Asia, Latitude 14-23°N and Longitude 100-108°E, the 236,800 km^2 area is bounded by China and Myanmar (North and Northwest, 505 and 236 km, respectively), Thailand (West, 1,835 km), Vietnam (East, 2,069 km) and Cambodia (South, 535 km), respectively [1, 2], Fig 1

Figure 1 Map of Loa PDR.

(source: http://photobucket.com)

Topology of Lao PDR is 250 km wide (East to West) and 1,700 km in length (North to South), proximity, more than 70% of area along the East from the North to the South is the high land or mountainous, numbers of the river then, originate and flow through the rather flat plane of mainland to the low-land in the West prior join the Mekong river, which advantage for hydro-electric power (63 potential sites, capacity 28,000 Mega Watt) and rich of natural resources i.e. valued forest, wild life, minerals (Ferrous, gold, copper, granite, lead, gypsum, tin and fossil fuels). The monsoon climate has rain fall intensity 1,715 mm per year, 22.5°C - 33°C and 7–80% humidity. Important products are glutinous rice, corn, coffee, sweet potatoes, soybean and peanuts, sugarcane, tea, tobacco, sesame, rubber, cotton, vegetables, cow, water buffalo, pigs, sheep, goat, cattle poultry and fishes. Famous natural, historical, art and culture places that beneficial to tourism are: Wat Phu sanctuary, Luang Prabang world heritage, Khon Pha Peng, Li Phi and Si Phan Don in the lower Mekong river. The politic administration area consists of 16 provinces and one Special Administrative Region (SAR) which are divided into 139 Districts and 11,047 Villages [3-5], Table 1 and Table 2, respectively.

Table 1 Lao's Administrative Area and Population

Province or SAR	Area, km^2	District	Village	Population x1,000
Vientiane Capital	3,920	9	500	712
Vientiane	22,554	12	614	430
Savannakhet	21,774	15	1,288	842
Luangprabang	16,875	11	840	415
Huaphanh	16,500	8	751	288
Xayaburi	16,389	10	474	346
Xiengkhuang	16,358	8	566	246
Khammuane	16,315	9	803	345
Phongsaly	16,270	7	589	168
Champasack	15,415	10	847	617
Oudomxay	15,370	7	553	272
Bolikhamxay	14,863	6	326	233
Saravane	10,691	8	715	333
Attapeu	10,320	5	198	115
Luangnamtha	9,325	5	380	149
Sekong	7,665	4	248	87
Bokeo	6,196	5	335	149
Total	236,800	139	10,027	5,748

In 2009 Lao's population is 6.83 Million, or 28.9 persons per km^2, life expectancy is 65 years and growth rate is 1.7% per year. The population consists of three major groups and 68 different ethnic groups that can be categorized into five linguistic ethnic families (Tai-Kadai, 6 ethnic groups - 66.2%; Austro-Asiatic or Mon-Khmer and Viet-Muong, 30 ethnic groups - 22.8%; Hmong-Yao, two ethnic groups -7.4%; Tibeto-Burman, eight ethnic groups - 2.7%; and other ethnic groups including Vietnamese and Chinese - 0.9%, accordingly). About 60% of population is Buddhist while 1.5% is Christian and the remaining of unspecified. About 56% of population in low land lives in the Mekong river plain (Cultivate, horticulture and fishing), the 34% of population in the upland, lives and survives by cultivating in the area at 700-1,200 m from MSE and the remaining about 10% is the population in highland.

Table 2 Lao's Population in 2009

Age	Male	Female	Total
0-14	1,400,126 (20.48%)	1,386,480 (20.29%)	2,786,606 (40.77%)
15-64	1,898,995 (27.78%)	1,936,892 (28.34%)	3,835,887 (56.12%)
> 65	92,070 (1.35%)	120,379 (1.76%)	212,449 (3.11%)
Total	3,391,191 (49.62%)	3,443,751 (50.38%)	6,834,942 (100%)

3. Research Methodology

The research has been accomplished by reviewing the existing documents from primary and secondary sources to identify the importance and performing of Lao's development and education. Country profiles were reviewed i.e. geographic, economics, social, political, education and the NESD plans in conjunction to the needs and implementation of civil engineering education. Keyed statistics, indices and important issues were discussed consequently, conclusions and recommendations were made.

4. Physical Factors and Development Plans

About 32,260 km highway (3,390 km main highway, 1,620 km provincial linked and remaining of rural highway in districts or villages) is available for motor transportation specially, in the mountainous topology, The major routes are: No. 13 (North-South; Luangnamtha–Champasack-Cambodia, 1400 km); extension of No.3 (Boekeo–Luangnamtha-Bo Ten-Thailand-China, 247 km); No.8, (Khammuane-Bolikhamxay-Vietnam, 130 km); No.9 (Part of East-West Economic Corridor; EWEC and Ayeyawady-Chao Phraya-Mekong Economic Cooperation Strategy; ACMECS) and links to Savan-Seno Special Economic Zone (SSEZ); No. 2 and 4 (Xiyaburi–Oudoumxay–Phongsaly-Vietnam); and No.18B (Uttapue–Vietnam, 113 km). Water transportation can make uses of only about 1,330 km of 1,898 km of the Mekong river while three international airports (Wattay, Luang Prabang and Pakxe). Only the Lao's National Airlines serve domestic and international air transportation cover the GMS. The Government plans to extend the highway network and construct numbers of railway and high speed train system from North to South and East to West.

Following the establishment of new political structure in 1975, the Lao People's Revolutionary Party (LPRP) and the Government

(Directed by the Prime Minister, works under the National Council) have been functioned with full authority on the administration, justice, policy, planning and budgeting. The New Economic Mechanism (NEM) and the NESD plan has been launched since 1981 (Table 3).

Table 3 Summary of Lao's NESD Plans.

Stage	Context
I (1981 – 1985)	Recovers from the War, problems of poorness, improves infrastructures, agricultural products, economics, small industry, services, health, welfare and education for the better quality life.
II (1986 – 1990)	Establishment of regulations, policies, administration and management, increases hydro-power electric generation and agricultural products for export, sustainable consumption and reservation of forest.
II (1991 - 1995)	Diversifies natural-based agriculture to market-based, increases products, small industries and mining, launches regulations and policies for investment, improves transportations and existing infrastructures.
IV (1996 – 2000)	Economics crisis, inflation, increases irrigation system and products, rural development, integrates academic institutions to form the NUOL, improves human development, higher education, infrastructures, finance, trade, management and services
V (2001 – 2005)	Recovers from crisis, improves regulations, political and social structure, provides chance and accessibility to the education in poverty area, promotes international cooperation
VI (2006 – 2010)	Improves economic structures, provide infrastructure, increase quantity and quality of domestic and export products, prepares to competitiveness, cooperate with international organizations (ASEAN, WTO), strengthen basic economic factors, aims to be a center of services in sub-region, conserves the forest, resolves the poorness, maintains human moral and ethics to conform development and globalization.

According to the plans, the remaining 47% of forest area has been reserved, 24,695 irrigation projects have been developed to cover 3,150 km^2 of agricultural area, the uncertainty of "battery of Asia" plan has been caused by the numbers of hydro-power and multi-purpose dams in the upper and along the Mae Khong river in China, Lao, Thailand and Cambodia, the SSEZ has been in competition with industrial zone in Vietnam, less than two percent of population can access the telecommunication. Keyed economic indices in 2008 are: GDP U$5.5 billion, per capita income U$765 with growth rate at 7.5 and 5.5%, respectively and inflation rate 5.2% (varied from 4.5-15.5% after the crisis in 1998-2000). During 1981-2010, the economic structure which consists of three main sectors has changed significantly, implied needs in maintaining or increasing of the agriculture, careful promoting the industry and opportunities in services [6-10], Fig 2.

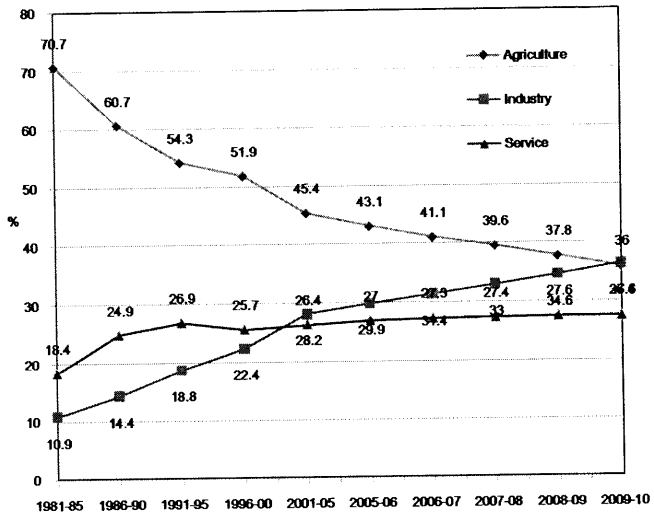

Figure 2 Lao's Economic Sectors (1981-2010).

5. Higher Education in Lao PDR

Lao's education system consists of three levels: Primary (Preparation to upper secondary; Vocational (Technical and higher technical certificate) and college or University (Table 4). College and University consist of three Programs: Academic (Bachelor - Doctoral); Professional

(Higher Graduate and Graduate Diploma); and Technology. The first two recruits student who completes general upper secondary education while the technical recruits student who completes the general vocational upper secondary education.

Table 4 Institutions in Lao PDR (2006).

Level (Period of study, year)	Institution	Student	Teacher or lecturer: Student
Preparation (3)	1,087	49,197	17.1
Primary (5)	8,654	891,881	32.1
Secondary (3)	642	243,131	24.1
Upper secondary (3)	28	147,510	28.9
Technical	47	26,337	17.1
Higher technical	12	2,953	20.8
College	38	30,048	26.2
University	3	30,574	22.1

(Source: National Statistical Center of Lao PDR, June 2007

The Ministry of Education (MOE, consists of 12 Departments) is responsible for studying, directing, managing, implementing, improving staff training, monitoring, evaluating and reporting for the macroscopic education of Lao PDR, the NUOL and Souphanouvong and Champsack University (founded in 2003 and 2004, respectively). The concerned departments in higher education are Department of Private Education Management, Organization and Personnel, Technical & Vocational Education, Higher Education, Planning and Co-operation, Finance), supporting units, Provincial and District Education Offices. There are four campuses of the NUOL (Dongdok, Sokpaluang Phiawat and Nabong), 11 faculties and units [11], Table 5, the faculty of Engineering has been integrated from the National Poly-technique Institute, Higher Technical College of Electronics and Electrics, School of Communication Vientiane, School of Irrigation, Vientiane MOE, under the MOE and in cooperated with the Ministry of Communication, Transport, Post and Construction, Ministry of Agriculture and Forestry, curricula and graduate are shown in Table 6 and 7, respectively [12-14]. During 1995-2001, Lao's investment in higher education varied from 5.3-12.5% of total investment or 0.5-1.4% GDP or 3.94-11.11% of total investment in education.

Table 5 The NUOL's Enrolled Students in 2007.

Faculty, School or Unit	Female	Male	Total	%
School of Foundation Studies	1,194	1,572	2,766	10.37
Sciences	348	541	889	3.33
Engineering	742	4,242	4,984	18.69
Agriculture	277	683	960	3.60
Medical Sciences	794	527	1,321	4.95
Letters	1,460	1,866	3,326	12.47
Education	1,684	1,952	3,636	13.63
Economics & Business Administration	1,425	1,870	3,295	12.35
Architecture	94	698	792	2.97
Laws &Political Sciences	625	1,648	2,273	8.52
Forestry	290	1,091	1,381	5.18
Social Sciences	349	424	773	2.90
Environment Development Center	133	144	277	1.04
Total	9,415	17,258	26,673	100

Table 6 The NUOL's Bachelor Degree Curricula.

Description, Time & Credits	Civil Eng.	Road & Bridge Eng.	Water Resource
Year update	2003-08	2003-08	2007–12
Study period	1+4 years	1+4 years	1+4 years
General Education	36	46	44
Basic Engineering	63	57	51
Specific Course (Core + Elective)	68 + 6	73 + 3	79
Free elective	9	3	3
Training	2	2	2
Project	4	-	-
Total	188	184	179

Table 7 The NUOL's Civil Engineering Graduate.

Year	Civil (+/-)	Transport (+/-)	Water Resource (+/-)	Total (+/-)	% to all graduate
1999-2000	171	87	76	334	
	51.2	26.0	22.8	100	64.0
2000-2001	275	148	124	547	-
	50.3	27.1	22.7	100	67.8
2001-2002	194	80	74	348	-
	55.7	23.0	21.3	100	67.1
2002-2003	234	101	98	433	-
	54.0	23.3	22.6	100	65.2
2003-2004	352	148	132	632	-
	55.7	23.4	20.9	100	60.8
2004-2005	475	150	131	756	-
	62.8	19.8	17.3	100	64.8
2005-2006	513	166	139	818	-
	62.7	20.3	17.0	100	66.3
2006-2007	480	207	105	792	-
	60.6	26.1	13.3	100	62.1
2007-2008	193	348	89	630	-
	30.6	55.2	14.1	100	51.9
2008-2009	254	413	155	822	-
	30.9	50.2	18.9	100	44.6

During 1999-2009, numbers of the NUOL's engineering graduate increased by four times with considerably positive trend, graduates from the three fields of civil engineering varied from 60.8-67.8% during 1999-2007 with significant changes in 2007 (during the NESD-VI) i.e. decreased to 51.9% (2007-2008) and 44.6% (2008-2009). Accordingly, the graduates in building field decreased significantly in related to the less demand in construction since 2007, the graduates in transportation field increased rapidly since 2007, conformed the urgently demand in transportation system development as NESD plan and the graduates in water resources field increased slightly to certain limits, cope with balanced and sustainable development in hydro-power and irrigation projects. In 2009, the 218 keyed staff in the faculty of Engineering, NUOL consists of 13 Doctoral, 108 Master and 81+18 Bachelor or Certificate. (Faculty: Student ratio is 1: 35). In addition, registration and controlling of professional practices in Lao are performed by the professional engineering association, under the Office of Prime minister. The association consists of the president, consultant, and administrative board with five panels (membership, rules, training, social and funding affair and advertisement).

6. Conclusion and Recommendation

Conclusions and recommendations can be drawn as follows.

2. Development of Lao PDR has it positive progress, brought the evolution of education system, all the levels of academic institutions, NUOL and Civil Engineering programs.

3. Difficulties and drawbacks in country development are: variety of people, topography, unity and political situation, fundamental needs of people and country (Food, health, welfare and education), conservation of natural resources and value asset (art and culture), policies, budgeting and financing, efficiency in administration and management. Difficulties and drawbacks in education development are: quantity and quality of enrolled students (affected by 10-20% of repletion and retirement in primary and secondary); lacks of learning and teaching media, including ICT-Based teaching and learning; insufficient qualified lecturers and instructors (1:35 when compared to the overall ratio of three Universities at 1: 22); and lack of researching, technology and management.

4. Economic profile shows slightly decreasing of agricultural sector, rapidly increasing of industry to certain limits while the service sector has become the same portion as the agriculture. These indicate proper trend of Lao's balanced and sustainable development, demand of civil engineers and needs for readjustment of civil engineering education strategies.

5. So far, numbers of engineering graduate in three fields of civil engineering and all the fields, compared to total population seems not adequate i.e. 1: 1,117 and 1: 664, respectively. Attempts to readjust the studying period for the primary to the University to 5: 7: 5 have not been done while the one plus four years with not less than 180 credits for the civil engineering programs should be readjusted to increase expected graduate for future demand, in Government offices and private industries. Combination of the three fields' graduates should be reconsidered or readjusted carefully according to significant situations or changes.

6. In short term, international collaboration, cooperation or support for the higher degrees education (Master and Doctoral) can be alternatives but continuing curricula and staff development in order to strengthen both quantity and quality are utmost necessary.

7. The strategies should also be supported by the professional engineering association or concerned Government offices i.e. updating or amending the professional practice regulation, necessary plan or action to deal with sub-region or globalized agreements.

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