

## **PREFACE**

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## CRITICAL BEHAVIOR IN $\text{La}_{0.7}\text{Sr}_{0.3}\text{Mn}_{0.98}\text{Cu}_{0.02}\text{O}_3$ COMPOUND

Le Viet Bau, Trinh Thi Huyen

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**Abstract:** *The magnetic data of  $\text{La}_{0.7}\text{Sr}_{0.3}\text{Mn}_{0.98}\text{Cu}_{0.02}\text{O}_3$  in the ferro-paramagnetic phase transition region has been analyzed using the Modified Arrott plots (MAP), the Kouvel-Fisher and the scaling hypothesis methods. The obtained data is compared to 4 theoretical models: Mean field, 3D Heisenberg, 3D Ising and Tricritical mean field. The results suggest that the magnetic interaction in the sample is corresponding to the 3D Ising model. The  $n$  value (which relates to the magnetic order) conducted by law  $\Delta S_{\text{max}} = a(\mu_0 H)^n$  is 0.641(8). This value is different from 0.556(5) derived from critical exponents of  $\beta$  and  $\gamma$  extracted from fitting values of spontaneous magnetisation and initial susceptibility to Kouvel-Fisher law. A low value of entropy is changed but the relative cooling power is improved.*

**Keywords:** *Magnetocaloric, critical exponents, manganites, perovskite.*

### 1. Introduction

The perovskite manganites  $(\text{La,Sr})\text{MnB}'\text{O}_3$ , where B' stands for the transition elements have recently attracted a wide range of research in laboratories because of their potential applications in electric devices that operate based on colossal magnetoresistance effect (CMR) and magnetocaloric effect (MCE) [1-4]. Basically, the magnetic-electronic properties of manganites are explained by the double exchange (DE) interaction. However, it is shown that the ferromagnetic clusters are formed and extracted as decreasing temperature below  $T_C$ . This is due to the existence of ferromagnetic clusters above  $T_C$  as well as inhomogeneity and phase separation, phase separation phenomenon and lattice distortion effect [5-9]. Those suggest that ferro-magnetic long-range order may be established by percolation of ferromagnetic regions as the temperature is lowered. Such magnetic inhomogeneities in the spin systems may be a result in a reduced local effective topological dimensionality [10], thereby leading to different critical behaviors. The CMR at the paramagnetic-ferromagnetic (PM-FM) transition is explained by the DE interaction [11]. In addition, the low-field-magnetoresistance (LFMR) effect existing in the low temperature region is also promising for application. Hence, the critical properties of the paramagnetic-ferromagnetic (PM-FM) phase transitions in manganites pose an important fundamental problem. On the other hand, the vast variability of competing mechanisms, which may influence the magnetic ordering, may also yield other types of paramagnetic-ferromagnetic transitions for different systems in this class

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of materials. Experimental studies [12-14] of the critical behavior of manganites near the PM-FM phase transition by using a variety of techniques have yielded a wide range of values for the critical exponent of  $\beta$ . The values range from about 0.3 - 0.5, which embrace mean-field ( $\beta=0.5$ ), three-dimensional (3D) isotropic nearest-neighbor Heisenberg ( $\beta=0.365$ ) and 3D Ising ( $\beta=0.325$ ) estimates. Static dc-magnetization measurements [12-15], in addition to  $\beta$ , also yield the critical parameters  $\gamma$  and  $\delta$  for initial susceptibility  $\chi(T)$  and critical isotherm  $M(T,H)$ , respectively. However, they may fail to determine a unique universality class for the phase transition of these manganites. The very low values of  $\beta=0.095$  for  $\text{LaMnO}_3$  [13] and 0.147 for  $\text{La}_{0.7}\text{Ca}_{0.3}\text{MnO}_3$  [14] obtained from static magnetization measurements suggest that the PM-FM transition in these compounds is first-order transition. Further, a first-order PM-FM phase transition has been reported [25] for  $\text{La}_{0.7}\text{Ca}_{0.3}\text{MnO}_3$  based on the sign of the slope of the isotherm plots,  $(H/M)^{1/\gamma}$  vs.  $M^{1/\beta}$  ( $\gamma = 1$  and  $\beta = 0.5$  or  $\gamma = 1.336$  and  $\beta = 0.365$ ).

Besides, one of the most important effects is magnetocaloric effect (MCE). Similar to the CMR, MCE occurs with the highest value at ferro-paramagnetic phase transition temperature  $T_C$ . Thus it could be related to critical parameters.

In this study, the critical parameters and magnetocaloric of the compound of  $\text{La}_{0.7}\text{Sr}_{0.3}\text{Mn}_{0.98}\text{Cu}_{0.02}\text{O}_3$  were studied. The results are compared with theoretical models to find out intrinsic magnetic interaction in the sample.

## 2. Experiment

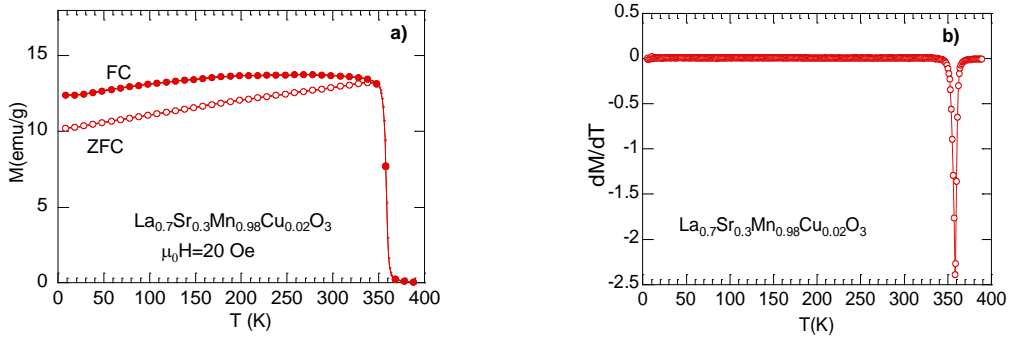
The samples of  $\text{La}_{0.7}\text{Sr}_{0.3}\text{Mn}_{0.98}\text{Cu}_{0.02}\text{O}_3$  were prepared by standard solid state reaction method. The crystal structure, chemical composition of the samples were proved by powder X-ray diffraction (XRD) with D2 Phaser instrument. The X-ray data confirmed that the samples are a single-phase rhombohedral structure with space group  $R-3c$ . Magnetic data were collected using a superconducting quantum interference device magnetometer Quantum Design Magnetic Property Measurement System (MPMS).

## 3. Results and discussions

In order to define the critical parameters from magnetic measurements,  $M(H)$ , the ferro-paramagnetic phase transition temperature should be explored.

Figure 1(a) shows the temperature dependence of magnetisation of the sample measured in the applied field of 20 Oe using zero field cooled and field cooled mode. It is shown that in the low temperature, the sample expresses ferromagnetic phase. Paramagnetic phase is formed in the high temperatures. Phase transition behaves a large of the range of temperature. This is a typical behavior of perovskite fabricated by solid state reaction method. The wide of phase transition as well the difference between the zero-field cooled and field cooled in the range of low temperature does not seem to reflect the chemical disorder but seems due to the disorder in magnetism. It may be in the result of phase separation phenomenon [8].

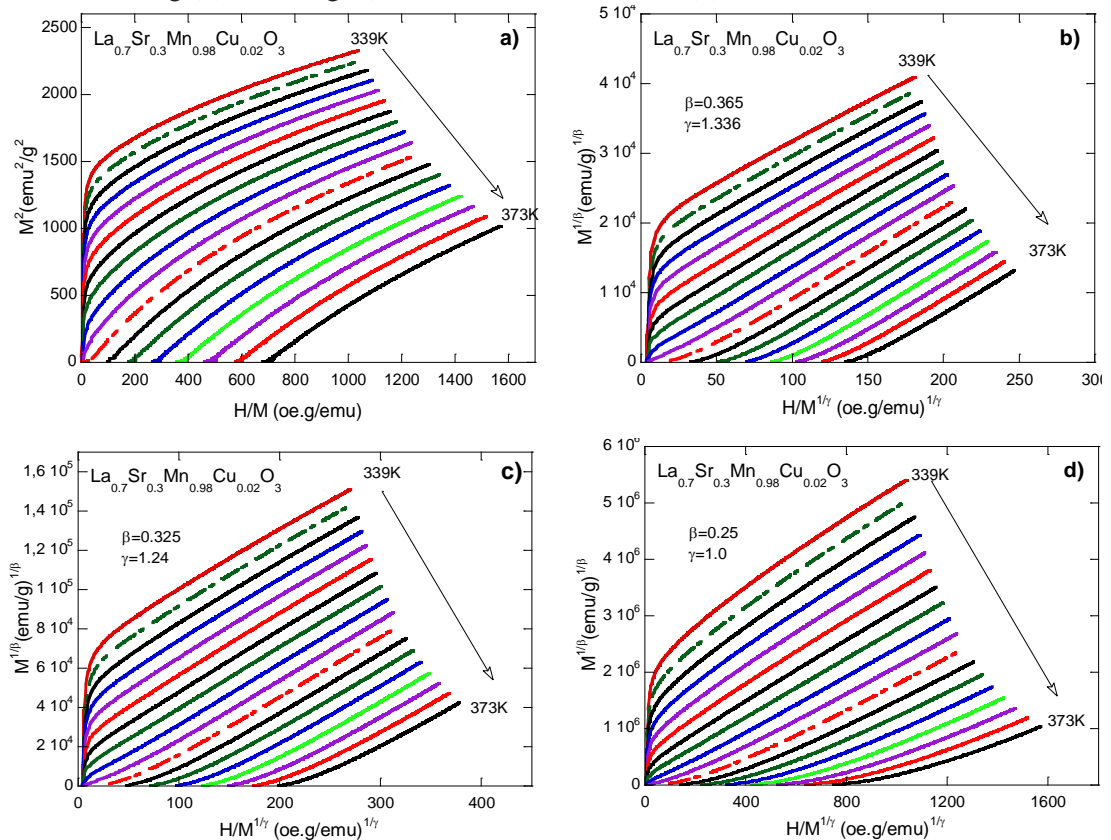
In order to determine the  $T_C$ , the curves of  $dM/dT$  vs  $T$  has been constructed and shown in Figure 1(b). This figure explores that the  $T_C$  is approximately 355 K.



**Fig.1.** The magnetization vs temperature in zero-field cooling (empty symbol) and field cooling modes (filled symbol) (a) and the  $dM_{FC}/dT$  vs  $T$  curve of the sample (b)

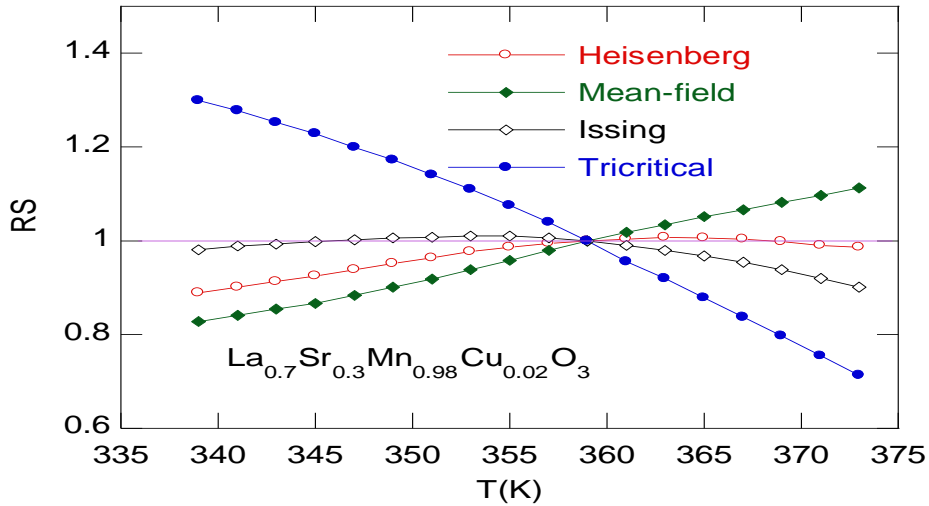
In order to analyze the nature of magnetic interaction near the phase transition, the critical exponents should be explored. The applied field dependence of magnetizations of the samples was measured at several temperatures in the phase transition region. The theoretical models are then applied to analyze the experimental data deduced from magnetic measurements.

Figure 2 (a)-(d) display the magnetic data of the samples applied by mean-field (a), 3D-Heisenberg (b), 3D Ising (c) and tricritical mean-field (d) models.



**Fig.2.** The isotherm magnetic data of the  $x=0$  sample drew by mean-field (a); 3D Heisenberg (b); 3D Ising (c); and tricritical mean-field (d) models

The best model is collected if the curves in the figure are series of straight lines and the line corresponding  $T_C$  should pass through the 0. It can be seen from Figure 2, the panel a and d are not collected. The models of 3D Ising (panel b) could be better than the panel c. This could be confirmed using the values of RS defined by  $RS(T) = S(T)/S(T_C)$ . If the model is suitable, the  $RS(T)$  should be 1 [17]. Figure 3 shows the values of RS vs T for the samples.



**Fig.3.** The values of RS in the 4 models for the  $x = 0$  (a) and  $x = 0.05$  (b) samples

As can be seen in Figure 3, the RS values diverse from 1 at temperatures far from  $T_C$  in all models. However, the best one is 3D Ising model for  $x = 0$  and mean-field model for  $x = 0.05$ . Therefore, these models will be applied to analyze the corresponding samples.

In Figure 2, the  $(H/M)^{1/\gamma}$  vs  $M^{1/\beta}$  curves exhibit a positive slope. According to Banerjee [18], the sample behaves second order magnetic transition (SOMT). For a SOMT, in the range of the ferro-paramagnetic transition temperature, the scaling law was used for the spontaneous magnetisation and initial susceptibility could be described by [19-22]:

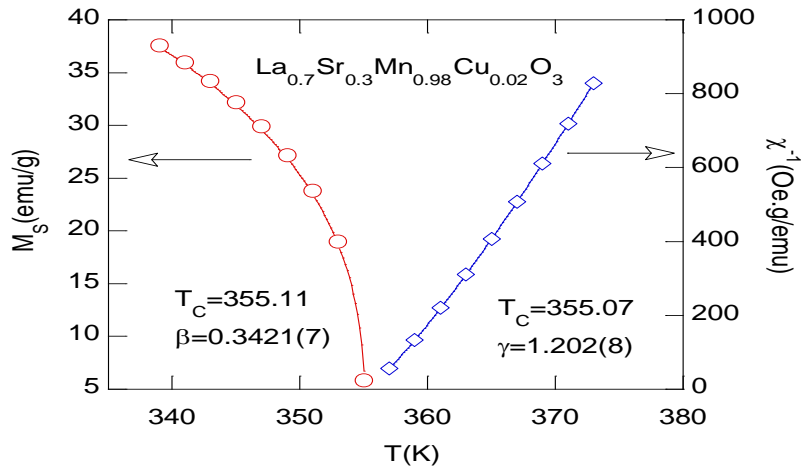
$$M_s(T) = M_0 |\varepsilon|^\beta, \quad \varepsilon < 0, \quad T < T_C \quad (1)$$

$$\chi^{-1}(T) = (h_0 / M_0) \varepsilon^\gamma, \quad \varepsilon > 0, \quad T > T_C \quad (2)$$

$$M = DH^{1/\delta}, \quad \varepsilon = 0, \quad T = T_C \quad (3)$$

With  $\varepsilon$  is the reduced temperature  $(T - T_C)/T_C$ .  $M_0$ ,  $h_0$ , and  $D$  are the critical amplitudes. The critical parameters  $\beta$ ,  $\gamma$ , and  $\delta$  are critical parameters associated with the spontaneous magnetization  $M_s(T, 0)$ , the initial magnetic susceptibility  $\chi(T)$  and critical magnetization isotherm  $M(T_C, H)$ , respectively. The value of  $M_s(T)$  and  $\chi^{-1}(T)$  deduced from the magnetic data using the 3D Ising model is displayed in Figure 4.





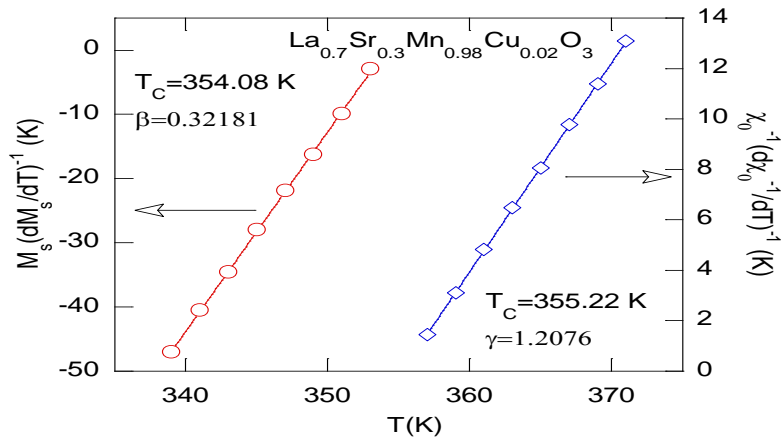
**Fig.4.** Temperature dependence of  $M_S(T,0)$  and  $\chi_0^{-1}(T)$ . The lines display the fitting the sample using the power laws

Figures 4 describes the temperature dependence of  $M_S(T)$  and  $\chi^{-1}(T)$  of the sample. The curves display the fitting  $M_S(T)$  and  $\chi^{-1}(T)$  curves to the modified Arrot plots (MAP) to find out the critical exponents. The critical parameters of the sample are defined of  $\beta=0.342(1)$ ,  $\gamma=1.202(8)$ . These values of  $\beta$  and  $\gamma$  are close to those of the 3D-Ising model ( $\beta = 0.325$ ,  $\gamma = 1.24$ ).

Alternately, the critical parameters  $\beta$ ,  $\gamma$  and  $T_C$  can be determined more accurately by the Kouvel-Fisher (KF) method [18]:

$$\frac{M_s}{dM_s} = \frac{T - T_C}{\beta}, T < T_C \quad (4)$$

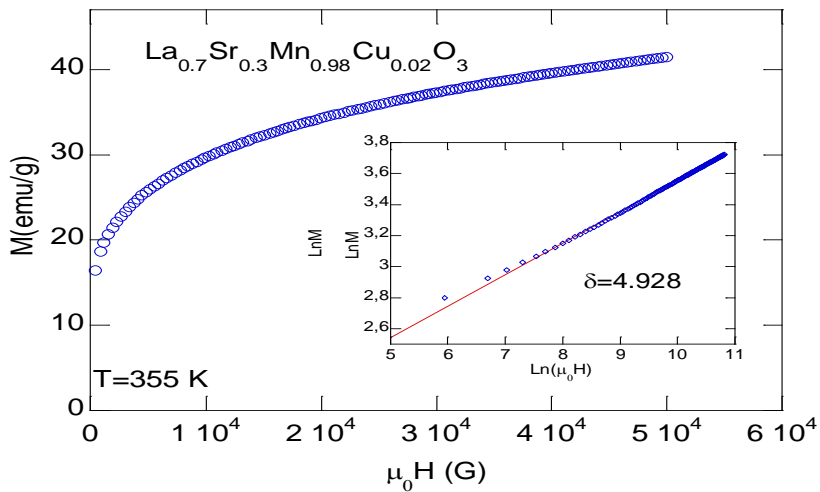
$$\frac{\chi^{-1}}{d\chi^{-1}} = \frac{T - T_C}{T_C}, T > T_C \quad (5)$$



**Fig.5.** The temperature dependence of  $M_S$  and  $\chi_0^{-1}$ . The straight lines are fitted to Kouvel-Fisher

The fitting values of the critical parameters and Curie temperature ( $T_C$ ) of the samples are also displayed in the same figures. It can be seen that these values are similar to that deduced by fitting experimental data to MAP method.

The value of  $\delta$  can be deduced using equation (3). The value of  $T_C$  is assumed to be mean value of those deduced by equation (2) and (3) as in Figure 5. Thus  $T_C = 354.65$ . The  $M(H)$  curves at  $T = 355$  K is chosen and displayed in the Figures 6. In the insert panel, the  $\ln(M)$  vs  $\ln(H)$  is displayed to find out the value of  $\delta$  by linear. It can be seen from the insert panel, the data fitting can be seen in Figure 6, when plotted in Ln-Ln scale (the insert figure), the  $M(H)$  curves for both samples are straight lines. This could prove that 354K is close to the actual ferro-paramagnetic transition temperatures. It can be seen from the insert of Figure 6, using the formula (3), the  $\ln M - \ln H$  data at  $T \approx T_C$  are fitted to determine values of  $\delta$ . The results show  $\delta = 4.928$ .



**Fig.6.** The applied field dependence of isothermal magnetization measured at  $T = 355$  K.

The insets display the best fit following Eq. 3

Moreover, the value of  $\delta$  can be deduced by Widom scaling relation [24]:

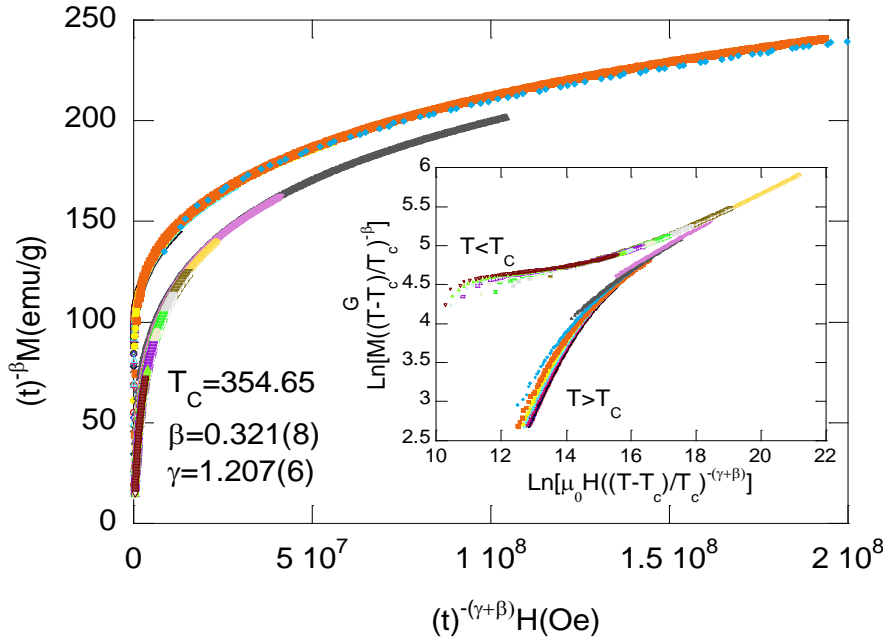
$$\delta = 1 + \gamma / \beta \quad (6)$$

Using values of  $\gamma$  and  $\beta$  obtained by the Kouvel-Fisher method, the value of  $\delta$  is found to be 4.752(6). The value of  $\delta$  is slightly different from  $\delta$  noted in the inserts of Figure 6. Such difference was also observed in several previous studies [25,26] and could be due to several reasons such as Jahn-Teller, disorder effects, phase separation phenomenon, etc.,. In order to verify the reliability of the exponents and  $T_C$ , the scaling hypothesis is constructed. The relation between magnetic isotherms and applied field is described by equation [27]:

$$M(\mu_0 H, \varepsilon) = \varepsilon^\beta f_{\pm}(H / \alpha^{\beta+\gamma}) \quad (7)$$

where  $f_+$  and  $f_-$  stand for regular functions above and below  $T_C$ , respectively.

Eq. (7) suggests that for true  $\beta$ ,  $\gamma$ , and  $\delta$  values, the curves of  $M|\varepsilon|^\beta$  vs  $\mu_0 H / |\varepsilon|^{\beta+\gamma}$  will fall into two identified universal curves above and below  $T_C$ . Figure 7 displays the curves of  $M|\varepsilon|^\beta$  vs  $\mu_0 H / |\varepsilon|^{\beta+\gamma}$  with  $\beta$  and  $\gamma$  derived from the Kouvel-Fisher method. The inserts in these figures represent the same plots in the Ln-Ln scale.



**Fig.7.** Scaling plots  $M|\varepsilon|^\beta$  vs  $\mu_0 H / |\varepsilon|^{\beta+\gamma}$  of the sample. The plots in log - log scale are represented in the inset

As can be seen in Figure 7, the  $M(H, T)$  in the vicinity of  $T_C$  fall into two branches above and below  $T_C$ , confirming the reliability of the obtained critical exponents.

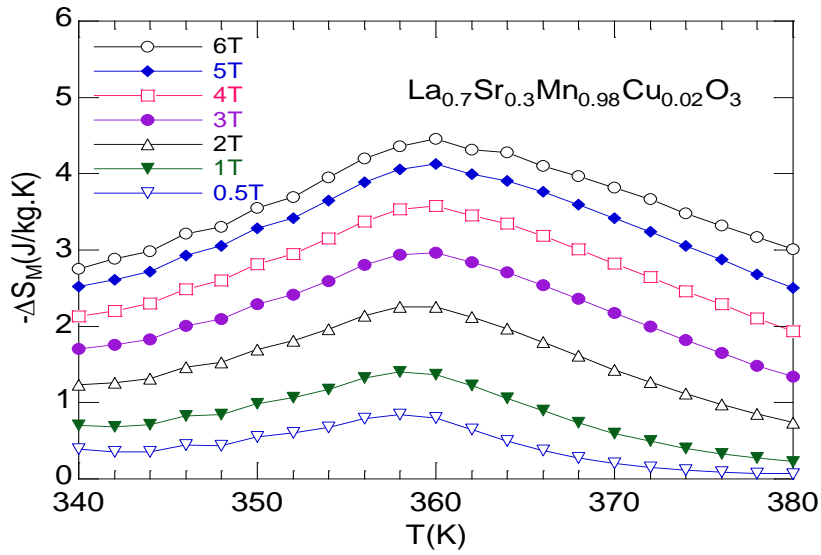
The magnetocaloric phenomena was investigated using the applied field dependence of the magnetisation,  $M(H)$ , at different temperatures. The entropy change at finite temperature is defined by [28, 29].

$$-\Delta S_M \left( \frac{T_1 + T_2}{2} \right) = \frac{1}{T_2 - T_1} \left[ \int_0^H M(T_2, H) dH - \int_0^H M(T_1, H) dH \right] \quad (8)$$

In the case of approximate calculation, it can be calculated by

$$-\Delta S_M \left( \frac{T_1 + T_2}{2} \right) = \sum_0^H \frac{\left( \frac{M(T_2, H) - M(T_1, H)}{\Delta H} \right)}{T_2 - T_1} \quad (9)$$

The result is displayed in Figure 8.



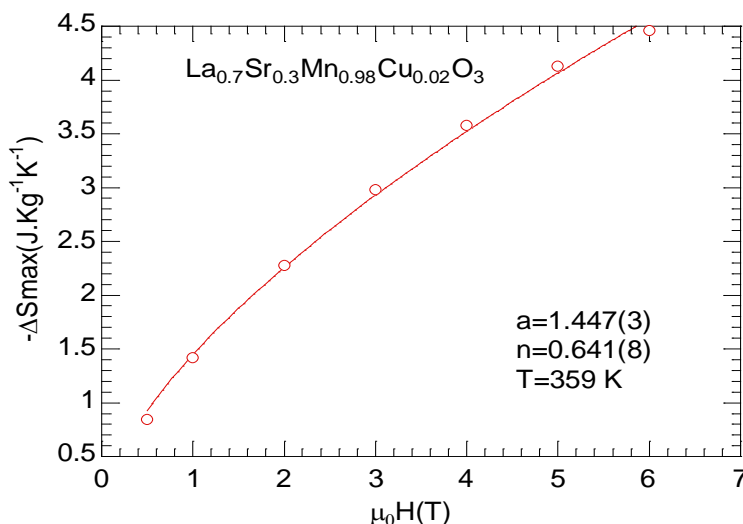
**Fig.8.** The MCE of the sample in the difference applied fields

The magnetocaloric curves are calculated for the applied fields of 0.5T up to 0.7 kg/K. As can be seen from Figure 8, the peaks of those curves shift to the higher temperature in higher applied field. In the low field, magnetocaloric shift to the ferro-paramagnetic transition temperature,  $T_C=354.65\text{K}$ . This can be understood that the magnetocaloric phenomenon is strongest at the phase transition temperature related to the applied field for the thermo-magnetisation measurements. The shifting of the peaks due to the transition phase temperature is shifted to higher in high applied field. Approximate of  $4.5\text{J/Kg.K}$  is the maximum value of magnetocaloric gained in the applied field of 6T. Despite of the small value but it is close to room temperature. It reduces sharply as increasing temperature higher  $T_C$  whereas it reduces more slowly in the temperature lowers  $T_C$ . This can be explained that in the temperature higher  $T_C$ , the material is paramagnetic and it is ferromagnetic in the lowers  $T_C$ . It is interesting that the magnetocaloric phenomenon broad over temperature region. This leads to enhancing the range of temperature existing MCE and improves the efficiency of a magnetic refrigerant material or the relative cooling power (RCP).

As mentioned above, the samples are second-order phase transition materials, then the relation between maximum magnetic entropy change and the applied field can be described by a power law  $\Delta S_{\max} = a(\mu_0 H)^n$  with  $n$  is an parameter related to the magnetic order and  $a$  is a constant [30].

Figure 11 displays the curve  $\Delta S_{\max}$  vs.  $\mu_0 H$  for the sample. The values of the critical exponent  $n$  defined by  $\Delta S_{\max} = a(\mu_0 H)^n$  is 0.641(8). A relationship between  $n$  and critical exponents of  $\beta$  and  $\gamma$  is demonstrated by [31]:

$$n(T_C) = 1 + \left[ \frac{\beta - 1}{\beta + \gamma} \right] \quad (10)$$



**Fig.9.** The maximum of entropy changes vs. the change of the sample. The lines show the best fit to equation  $\Delta S_{max} = a(\mu_0 H)^n$

Using the values of  $\beta$  and  $\gamma$  obtained from the Kouvel-Fisher method and Eq. 13, the values of  $n(T_C)$  is found to be = 0.556(5). This value disagrees with the value displayed in Figure 11. This difference was also previously observed in several manganites [25, 32]. The difference between the exponent  $n$  deduced from the maximum entropy change and the Kouvel-Fisher method could be caused by the existence of the local inhomogeneities, the superparamagnetic clusters in the vicinity of  $T_C$  [23] or the phase separation phenomenon in the samples. In addition, demagnetizing field  $H_d$  produced by the material itself could responsible for these differences [33, 34]. Besides, the  $M(H)$  curves have been measured in the large range of temperatures and the applied field up to 6T.

#### 4. Conclusion

The critical exponents and magnetocaloric effect of perovskite  $\text{La}_{0.7}\text{Sr}_{0.3}\text{Mn}_{0.98}\text{Cu}_{0.02}\text{O}_3$  has been derived from the isothermal magnetization data. The value of critical parameters  $\beta=0.321(8)$ ,  $\gamma=1.207(6)$ . The value of  $\delta=4.928(1)$  which is different from the value of 4.752(6) reduced from Widom scaling relation. The parameter related to the magnetic order,  $n$ , calculated from experimental data and theory is 0.556(5), which is different from 0.641(8) derived from fitting the maximum of entropy change data to  $\Delta S_{max} = a(\mu_0 H)^n$ . The differences of the values of  $\delta$  and  $n$  could due to several reasons such as inhomogeneities, Jahn-Teller, or phase separation. The magnetocaloric effect reaches 4.5 Jkg/K in the change of applied field of 6T. The maximum of MCE shifts to the higher temperature in higher applied field change. Although the value of MCE is not high, the relative cooling power is improved.

## References

- [1] Ramirez (1997), A.P. Colossal magnetoresistance, *J. Phys.: Condens. Matter*, 9, 8171.
- [2] Phong, P.T.; Bau, L.V.; Hoan, L.C.; Manh, D.H.; Phuc, N.X.; Lee, In-Ja (2015), B-site aluminum doping effect on magnetic, magnetocaloric and electro-transport properties of  $\text{La}_{0.7}\text{Sr}_{0.3}\text{Mn}_{1-x}\text{Al}_x\text{O}_3$ , *J. Alloys Compd.*, 645, 243.
- [3] Dinh Chi Linh, Nguyen Thi Ha, Nguyen Huu Duc, Le Huu Giang Nam, Le Viet Bau, Nguyen Manh An, Seong-Cho Yu, Tran Dang Thanh (2018), Na-doped  $\text{La}_{0.7}\text{Ca}_{0.3}\text{MnO}_3$  compounds exhibiting a large magnetocaloric effect near room temperature, *Physica B*, 532, 155.
- [4] M'nassri, R.; Chniba-Boudjada, N.; Cheikhrouhou, A. (2015), 3D-Ising ferromagnetic characteristics and magnetocaloric study in  $\text{Pr}_{0.4}\text{Eu}_{0.2}\text{Sr}_{0.4}\text{MnO}_3$  manganite, *J. Alloys Compd.*, 640, 183.
- [5] Teresa J.M. De; Ibarra M.R.; Algarabel P.A.; Ritter, C.; Marquina, C; Blasco, J; Garca, J.; Moral, A. del; Arnold, Z. (1997), Evidence for magnetic polarons in the magnetoresistive perovskites, *Nature (London)*, 386, 256.
- [6] Uehara, M.; Mori, S.; Chen, C.H.; Cheong, S.-W (1999), Percolative phase separation underlies colossal magnetoresistance in mixed-valent manganites, *Nature (London)*, 399, 560.
- [7] Fath, M.; Freisem, S.; Menovsky, A.A.; Tomioka, Y.; Aarts, J.; Mydosh, J.A (1999), Spatially Inhomogeneous Metal-Insulator Transition in Doped Manganites, *Science*, 285, 1540.
- [8] Millis, A.J, Littlewood, P. B. and Shraiman, B. I. (1995), Double Exchange Alone Does Not Explain the Resistivity of  $\text{La}_{1-x}\text{Sr}_x\text{MnO}_3$ . *Phys. Rev. Lett.*, 74, 5144.
- [9] Bau, L.V.; Khiem, N.V.; Phuc, N.X.; Hong, L.V.; Nam, D.N.H.; Nordblad, P. (2010), Observation of mixed-phase behavior in the Mn-doped cobaltite  $\text{La}_{0.7}\text{Sr}_{0.3}\text{Co}_{1-x}\text{Mn}_x\text{O}_3$  ( $x = 0-0.5$ ), *J. Magn. Magn. Mater*, 322, 753.
- [10] Millis, A. J. (1996), Cooperative Jahn-Teller effect and electron-phonon coupling in  $\text{La}_{1-x}\text{A}_x\text{MnO}_3$ , *Phys. Rev. B*, 53, 8434.
- [11] Kaul, S.N (1985), Static critical phenomena in ferromagnets with quenched disorder, *J. Magn. Magn. Mater*, 53, 5.
- [12] Zener, C (1951), Interaction between the d-Shells in the Transition Metals. II. Ferromagnetic Compounds of Manganese with Perovskite Structure, *Phys. Rev.*, 82, 403.
- [13] Martin, M.C.; Shirane, G.; Endoh, Y.; Hirota, K.; Moritomo, Y.; Tokura, Y. (1996), Magnetism and structural distortion in the  $\text{La}_{0.7}\text{Sr}_{0.3}\text{MnO}_3$  metallic ferromagnet, *Phys. Rev. B*, 53(14), 285.
- [14] Freitas, R.S.; Haetinger, C.; Pureur, P.; Alonso, J.A.; Ghivelder, L. (2001), Static critical behavior of the ferromagnetic transition in  $\text{LaMnO}_{3.14}$  manganite, *J. Magn. Magn. Mater*, 226-230, 569.
- [15] Shin, H.S.; Lee, J.E.; Nam, Y.S.; Ju, H.L.; Park, C.W. (2001), First-order-like magnetic transition in manganite oxide  $\text{La}_{0.7}\text{Ca}_{0.3}\text{MnO}_3$ . *Solid State Commun*, 118, 377.
- [16] Hong, C.S.; Kim, W.S.; Hur, N.H. (2001), Transport and magnetic properties in the ferromagnetic regime of  $\text{La}_{1-x}\text{Ca}_x\text{MnO}_3$ . *Phys. Rev. B*, 63, 092504.

- [17] Mira, J.; Rivas, J.; Rivadulla, F.; Vazquez-Vazquez, C.; Lopez-Quintela, M.A. (1999), Change from first- to second-order magnetic phase transition in  $\text{La}_{2/3}(\text{Ca},\text{Sr})_{1/3}\text{MnO}_3$  perovskites. *Phys. Rev. B*, 60, 2998.
- [18] Belov, K.P. (1965), *Magnetic Transitions*, Boston Technical, Boston.
- [19] Banerjee, S. K. (1964), On a generalised approach to first and second order magnetic transitions, *Phys. Lett*, 12, 16.
- [20] Kadanoff, L.P.; Gotze, W.; Hamblen, D.; Hecht, R.; Lewis, E.A.S.; Palciauskas, V.V.; Rayl, M.; Swift, J.; Aspnes, D.; Kane, J.(1967), Static Phenomena Near Critical Points: Theory and Experiment, *Rev. Mod. Phys*, 39, 395.
- [21] Arrott, A.; Noakes, J.E.(1967), Approximate Equation of State for Nickel Near its Critical Temperature, *Phys. Rev. Lett*, 19, 786.
- [22] Fisher, M.E.; Ma, S.-K.; Nickel, B.G.(1972), Critical Exponents for Long-Range Interactions, *Phys. Rev. Lett*, 29, 917.
- [23] Arrott, A. (1957), Criterion for Ferromagnetism from Observations of Magnetic Isotherms, *Phys. Rev*, 108, 1394.
- [24] Kouvel, J.S.; Fisher, M.E. (1964), Detailed Magnetic Behavior of Nickel Near its Curie Point, *Phys. Rev*, 136, 1626.
- [25] Widom, B.(1965), Surface Tension and Molecular Correlations near the Critical Point, *J. Chem. Phys*, 43, 3892.
- [26] Le Viet Bau, Nguyen Manh An, Nguyen Le Thi, Le Thi Giang, Tran Dang Thanh, Pham Thanh Phong , Seong-Cho Yu (2019), Critical Exponents and Magnetocaloric Effect in  $\text{La}_{0.7}\text{Sr}_{0.3}\text{Mn}_{1-x}\text{Ti}_x\text{O}_3$  ( $x = 0$  and  $0.05$ ) Compounds, *J. Elec. Materi*, 48, 1446.
- [27] Mohamed, Za.; Tka, E.; Dhahri, J.; Hlil, E.K. (2015), Short-range ferromagnetic order in  $\text{La}_{0.67}\text{Sr}_{0.16}\text{Ca}_{0.17}\text{MnO}_3$  perovskite manganite, *J. Alloys Compd*, 619, 520.
- [28] Stanley, H. E.(1971), *Introduction to Phase Transitions and Critical Phenomena*, Oxford University Press, London; pp.1-21.
- [29] Földeàki, M.; Chachine, R.; Bose, T.K. (1995), Magnetic measurements: A powerful tool in magnetic refrigerator design, *J. Appl. Phys*, 77(7), 3528.
- [30] Amaral, J.S.; Amaral, V.S. (2010), *On estimating the magnetocaloric effect from magnetization measurements*. *J.Magn.Magn.Mater*, 322, 1552.
- [31] Oesterreicher, H. and Parker, F.T. (1984), Magnetic cooling near Curie temperatures above 300 K, *J. Appl. Phys.*, 55, 4334.
- [32] Franco, V.; Conde, A.; Romero-Enrique, J.M.; and Blazquez, J.S. (2008), A universal curve for the magnetocaloric effect: an analysis based on scaling relations, *J. Phys.: Condens. Matter.*, 20, 28, 5207.
- [33] M'nassri, R.; Chniba-Boudjada, N.; Cheikhrouhou, A. (2015), 3D-Ising ferromagnetic characteristics and magnetocaloric study in  $\text{Pr}_{0.4}\text{Eu}_{0.2}\text{Sr}_{0.4}\text{MnO}_3$  manganite, *J. Alloys Compd*, 640, 183.
- [34] Blundell, S. (2014), *Magnetism in condensed matter*, Reprint, Oxford Univ. Press, Oxford.
- [35] Hankey, A.; Stanley, H.E. Systematic Application of Generalized Homogeneous Functions to Static Scaling, Dynamic Scaling, and Universality. *Phys. Rev. B: Condens. Matter*, 6, 3515.

# JURISDICTION OF THE COURT IN THE SETTLEMENT OF BUSINESS AND COMMERCIAL DISPUTES UNDER CURRENT LAW

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**Abstract:** *A frequent and common phenomenon occurring during the operation of a market economy is business and commercial disputes. Among effective dispute settlement methods, court litigation is one of the most common ones. Determining jurisdiction of the Court in dispute settlement clearly, accurately, legally helps to ensure the effective settlement of disputes. In fact, there are still deficiencies and limitations in the current law on the issue of determining first instance jurisdiction among courts. Therefore, it is necessary to clarify the Jurisdiction of the Court in resolving business and commercial disputes in accordance with applicable laws.*

**Keywords:** *Jurisdiction of the Court; business and commercial disputes.*

## 1. Introduction

In the period of openness and global economic integration, businesses and traders must always have a close connection with each other to make profits together when doing business. In accompanying with the cooperation and development, trade relations have become more and more diversified and complex. Enterprises can be established in different forms and operate in many different industries leading to the increase of cooperation, connection and even competition among them.

Among effective business and commercial dispute settlement methods, the Court litigation is one of the most popular ones. Jurisdiction of the Court in disputes resolution must be clearly and accurately defined to ensure the effective resolution of disagreement.

## 2. Research content

Commercial business disputes are those specified in Article 30 of the Code of Civil Procedure 2015; and grounds for jurisdiction of Courts to settle disputes specified in Articles 35, 36, 37, 38, 39 and 40 of the Code of Civil Procedure 2015.

### 2.1. Overview of business and commercial disputes and dispute resolution

Disputes in business and commerce are a common and indispensable phenomenon, frequently taking place during the operation of a market economy. Due to the nature of frequency, the consequences of the dispute have a great impact on the subjects involved in the dispute in particular and the economy in general.

In the Code of Civil Procedure 2015, disputes arise in business and commercial activities between individuals and organizations with business registrations and are for

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profit<sup>1</sup>. Also, it is stipulated in the Law on Commercial Arbitration that disputes arise between the parties in which at least one of the parties are engaged in commercial activities<sup>2</sup>.

In the curriculum of Hanoi Law University, the definition of commercial disputes is the conflicts (disagreements or conflicts) about rights and obligations between the parties in the process of commercial activities performance [3, pp.316].

From these bases, it might be understood that: Business and commercial disputes are major disagreements, conflicts or dissenting opinions about economic interests, rights and obligations among related subjects when engaging in business activities not prohibited by law and for profit purposes.

A business and commercial dispute is essentially a civil dispute in its nature and has the following characteristics:

*Firstly, causes of business and commercial disputes*

Business and commercial disputes are contradictions arising on rights and obligations between the parties in business and commercial activities. Conceptually, commercial activity is perceived as a profit-making activity including the sale of goods, provision of investment services, trade promotion and other profitable activities<sup>3</sup>. The ultimate goal of entities engaging in business and commerce is profitability, so the causes of the conflict in business and commerce are the profits and interests of the parties.

*Secondly, the subjects of business and commercial disputes*

Business and commercial disputes happen commonly between traders when participating in business activities. In some cases, other individuals and organizations operating in commerce and business but not being traders may also be the subject of business and commercial disputes. Stemming from the specific characteristics of each commercial business relationship, apart from traders being the main subject of business and commercial disputes, there are commercial business relations that can be entered between traders and non-business individuals and organizations defined in Clause 4, Article 30 of the Civil Procedure Code. It is a dispute between the company and its members; a dispute between a company and a manager in a limited liability company or a member of the Board of Directors, director, general director of a joint stock company, between members of the company regarding the establishment, operation, dissolution, merger, consolidation, division, splitting, transfer of company assets, transformation of organizational form of the company<sup>4</sup>. In certain cases, it is an activity that is not intended to generate a profit by a party in dealing with a trader in the event that the party performing such a non-profit activity chooses to apply commercial law<sup>5</sup>.

*Thirdly, content of business and commercial disputes*

Business and commercial disputes are often of great value, arising in the investment of capital and assets to earn profits, affecting the economic activities of both involved parties

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<sup>1</sup> Clause 1, Article 30 of the Code of Civil Procedure 2015

<sup>2</sup> Article 2 of the Law on Commerce 2010

<sup>3</sup> Clause 1, Article 3 of the Law on Commerce 2005

<sup>4</sup> Clause 4, Article 30 of the Code of Civil Procedure 2015

<sup>5</sup> Clause 3, Article 1 of the Law on Commerce 2005

and other business entities. Business and commercial relations are essentially property relations, so the content of business and commercial disputes is often directly related to the interests of the parties, specifically arising in the relationships:

Purchase and sale of goods, services provision; distribution; representatives, agents; deposit; rent, lease, hire-purchase; construction; technical advice; transport of goods and passengers by rail, road, inland waterway; transport of goods and passengers by air and sea; purchase and sale of stocks, bonds and other papers; investment in finance and banking; insurance; exploration and exploitation.

Disputes over intellectual property rights, technology transfer between individuals and organizations, and for profit.

Disputes between the company and its members, among its members related to the establishment, operation, dissolution, consolidation, merger, division, separation and transformation of organizational forms organization.

Other disputes on business and commerce as stipulated by law [5, pp.317].

#### *Fourthly, nature of business and commercial disputes*

Commercial business and commercial disputes are of a diverse and complex nature of economic relations between subjects with different interests in a market economy. When engaging in business activities, goods trading and goods exchange are regular and continuous activities, therefore subjects may establish many relationships with each other. A number of cases of disputes arising in one relationship will result in disputes in other commercial business relationships.

Settlement of business and commercial dispute is the method as well as activities to resolve and handle disputes arising from commercial business activities in order to protect rights and legal benefits of subjects participating in the economic market, to protect the social discipline and state laws.

Disputes and conflicts when engaging in business or commerce are inevitable. The measures of resolving disputes, ensuring the best rights and affecting relationships between the parties at the lowest level, time saving and cost saving are always concerned by stakeholders. Some accepted methods of settling business and trade disputes by state laws are as follows: *Negotiations, mediation, litigation and arbitration.*

In particular, resolving disputes at People's Courts at all levels is a method of resolving disputes at trial agencies in the name of the state power, conducted in strict order and procedures; without the voluntary compliance of the disputing parties, judgments and decisions of courts on the settlement of business and commercial disputes will be guaranteed to enforce judgments by the coercive force of the State.

## ***2.2. Basic characteristics of methods of resolving business and commercial disputes by court litigation***

*Firstly*, the settlement of business and commercial disputes in a court is attended by a third party, which is the court, through the trial activities of a jury including judges and people's jurors. The people's courts are judicial organs of the state that conducts trials and settles business and commercial disputes without prior agreement of the parties to the dispute. When the parties in business and commercial dispute do not have any agreement on the mode

of dispute settlement or self-negotiation or mediation fails, the commercial dispute will be resolved in court. Similar to arbitration, the members of the jury must also meet the conditions prescribed by law. If these conditions are not met, they may not participate in the trial or the sentence declared by these persons may not come in to effect.

*Secondly*, the settlement of disputes in court must comply with the procedural principles prescribed by law. Any misconduct of the procedural rules may be appealed against according to the appellate procedure or the judicial review procedure.

*Thirdly*, the dispute settlement results in the judgment declared by the Jury which is compulsory to the parties when it takes legal effect. This judgment may be appealed or protested. When the judgment takes effect, the parties must voluntarily execute it, otherwise they will be coerced in accordance with the law.

According to the Law on Organization of the People's Court 2014: "*The Supreme People's Court, the local People's Courts, the Military Courts and the other Courts prescribed by law are the judicial bodies of the Socialist Republic of Vietnam. The Court conduct trials of criminal, civil, marriage and family, labor, economic, administrative cases and settles other matters in accordance with the law*"<sup>6</sup>.

In order to determine the jurisdiction of the People's Court in resolving cases of business and commercial disputes, the People's Court should rely on the specific requirements of the petitioner to determine legal relations of the dispute. Thereby, it serves as a basis to determine whether the litigants' request for lawsuits is under the jurisdiction of the People's Courts after comparison with the provisions on jurisdiction of the People's Courts in accordance with the Civil Procedure Code.

In fact, it is not easy to determine legal relations on business and commercial disputes due to the following reasons:

At different times, depending on the political, economic and social situation, the legal provisions on social relations are governed by different rules of commercial business;

In the same social relationship but under the scope of regulation of different laws. Each branch of law has its own rules to distinguish social relations such as entities, objectives, subjects etc. but the determination of legal relations is still challenging;

There are legal documents on commercial business that generally stipulate the transactions under the scope of adjustment. Because of the openness of these regulations, when disputes occur, decision on which legal document covers the transactions still face some difficulties and problems.

In considering the jurisdiction of the Court, civil proceedings divide the Court's authority of commercial business requests into several categories. In particular, the jurisdiction of the Court is commonly divided into 4 categories, as follows:

Jurisdiction to deal with the case or the general jurisdiction of the Court. The jurisdiction by types of case is the delimitation between the jurisdiction of the Court and other agencies in the resolution of civil matters.

Jurisdiction at the trial level is the determination of which court has jurisdiction to handle the case according to the first instance procedure. Under current law, there are two levels of courts competent to adjudicating under first instance procedures: District-level

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<sup>6</sup> Article 1, Law on Organization of People's Courts 2014

people's courts include courts of district, towns and provincial cities and Provincial-level courts include provincial courts and municipality court.

Territorial jurisdiction specifies which Court is obliged to resolve commercial business cases at the request of the litigants when initiating lawsuits.

Jurisdiction to the plaintiff's choice. The involved parties may reach agreement with each other when signing a written contract to ask the court of the place of residence of the plaintiff to settle the dispute.

In order to accurately and clearly determine the competence to settle business and trade disputes and avoid confusion, it is necessary to follow the following principles:

*Based on the nature of the case (civil/ economic/ labor/ administrative/ criminal case...) to determine jurisdiction*

Based on the nature of the case, the competence to resolve business and commercial disputes under the jurisdiction of the People's Court can be determined. If it is under the court's jurisdiction, which court is competent to accept and handle it. In the organizational structure of our country's court system, beside the Supreme People's Court, the High-level People's Courts, and the Courts. Provincial-level People's Court and District-level People's Courts, specialized courts are also provided. The delimitation of such levels to determine the jurisdiction of the Court. Jurisdiction of the Court is specified in the Code of Civil Procedure 2015.

*Based on the complexity of the case to determine jurisdiction*

When a business dispute including civil disputes in general and business and commercial disputes in particular occurs, it is necessary to determine which jurisdiction of first instance the Court that civil disputes belong to. Depending on the nature of the case, the jurisdiction of first instance trial at a district court or a provincial court. The delimitation of jurisdiction at the judicial level to ensure professional ability, professional conditions, facilities and people to resolve the dispute effectively, quickly, accurately, and obey the law the law.

*Based on the place of residence or residence of the defendant to determine jurisdiction*

It is a specific determination of which court is competent to settle business and commercial disputes in the first instance. Territorial court jurisdiction is the division of jurisdiction between courts of the same level, in order to determine the most favorable court to resolve the dispute, to ensure the prompt settlement of the case, creating convenience for the parties to the proceedings, but at the same time ensuring the right of self-determination of the involved parties. In some cases, the determination of territorial jurisdiction is difficult, the Civil Procedure Code offered a number of cases where plaintiffs have the right to choose a court to resolve disputes.

Regarding the determination of jurisdiction to resolve business and commercial disputes by the Court, arbitration procedures arise only on the basis of the selection of the parties to the dispute. Dispute resolution in commerce and business at the People's Court or commercial arbitration are all forms of settlement that play a neutral role with the parties in the commercial and business dispute. The similarity of dispute resolution in people's courts and commercial arbitration. Thereby, they are different from other forms of commercial and business dispute resolution because they are based on legal provisions and appropriate content of the contract between parties involved in the dispute, to review, make a verdict and

ensure execution of sentence. The procedure of court and commercial arbitration is very strict because they are both competent to review and make decisions in accordance with the law. Although there are similarities, these are two separate types of dispute resolution, so there are basic differences between dispute resolution by court and commercial arbitration methods:

*The legal nature of both methods of dispute resolution*

The People's Court is essentially a state agency within the system of judicial agencies. When conducting legal proceedings, the People's Court shall, on behalf of the State, conduct judicial activities to consider and handle violations in order to maintain public order and protect the legitimate rights and interests of participating business entities. Unlike the People's Court, commercial arbitration centers are all non-governmental organizations with social and professional characteristics.

*Jurisdiction to resolve disputes*

Regarding jurisdiction over the case, the People's Court is awarded broader authority than commercial arbitration. While the People's Court is competent to resolve almost all business and commercial disputes, the jurisdiction of the arbitration varies depending on the arbitration center. When considered by territory, not all business and commercial disputes are settled by the Court. Disputes in business activities shall be handled by the Court with the law on the jurisdiction of the Territorial People's Courts. Meanwhile, the arbitration does not raise the issue of territorial jurisdiction. Parties of a commercial dispute have the right to choose any arbitration center to resolve the dispute.

### **3. Conclusion**

In the current period, together with acceleration of economic reform and national administration reform, judicial reform is also being actively implemented by the Party and the State. This is regarded as an important breakthrough, promoting the process of building and perfecting the Socialist Republic of Vietnam. In order to improve the effectiveness and efficiency of the court's judicial activities in dealing with business and commercial disputes, it is one of the basic and important contents in the reform. On that basis, perfecting the mechanism to protect the legitimate rights and interests of citizens, agencies and organizations, contributing to promoting economic development, maintaining political security and international integration.

The law is built on the generalization of the models of common behaviors in society, so law explanation is an evitable need that happens in the process of law application. When the law is applied, it is not possible to stiffly apply in different cases. The laws themselves are sometimes difficult to understand and not consistent in the content. Although the law is elaborately drafted and continuously issued, it is inevitable that there will be overlaps and gaps between regulations. That is even more true in case of our country's legislative activities today where many normative documents are still “framework”, “oriented” so that the management agencies can easily amend and supplement them by subordinate documents, easily leading to different interpretations in the process of applying the law.

There are cases of disputes occurring in judicial practice that are not currently anticipated by the law but need to be resolved. However, in the Code of Civil Procedure 2015, the Court must not refuse to resolve civil cases because there is no applicable law.

*“Article 4. Right to request the Court to protect legal rights and interests*

*The court must not refuse to resolve a civil case which related law is unavailable”.*

As a system of specialized agencies regularly resolving legal disputes affecting people's lives, the court, on behalf of the State, shall explain to stakeholders about the causes, meanings and purposes, the applicable value of each legal law, thereby classifying and determining jurisdiction to resolve the case. Each court judgment will harmonize and actualize specific laws, explain how to apply the law properly. All are aimed at building trust in justice and equality for not only each person involved in a case but also the whole society.

In fact, most of the law explanation needs arise and are associated with a specific case. In other words, most of the explanations of the law are explanations of the case and attached to the resolution of a certain dispute and according to the assignment of state power, the People's Court is the competent body to resolve this dispute.

Thus, the People's Court shall clearly understand and is attached to the law explanation; is the most objective, honest and practical interpretation of laws. It is necessary to recognize the form of factual interpretations alongside the current normative interpretation of the Standing Committee of the National Assembly. This is also one of the bases for determining the scope of the Court's jurisdiction and the form and legal validity of the explanatory content. That is, during the course of the court settling a specific case under its jurisdiction that arose the need to explain the law of application, the Judge need to explain the law. The explanations must be written in the relevant documents, especially the official explanation must be presented in the judgment or decision to resolve the case. The legal value of the explanatory content is the legal value of the declared judgment.

The Constitution should acknowledge the people's Court's right to interpret laws so that the People's Court can perform its functions more effectively, thereby helping the People's Court accurately determine the jurisdiction of the case. The Law on Organization of the People's Court must specify the authority and method of interpretation of law in the operation of the Court, through which the Court has the right to explain the Law when determining jurisdiction. The procedural law should supplement the provisions on the recognition of explanation rights for the People's Court in judgments and decisions by the Court which have come into effect.

## References

- [1] National Assembly of the Socialist Republic of Vietnam (2015), Code of Civil Procedure.
- [2] National Assembly of the Socialist Republic of Vietnam (2010), Law on Commerce.
- [3] National Assembly of the Socialist Republic of Vietnam (2005), Law on Commerce.
- [4] National Assembly of the Socialist Republic of Vietnam (2014), Law on Organization of People's Courts.
- [5] Hanoi Law University (2017), Curriculum of Vietnam Business Law Volume II, Justice Publishing House, Hanoi.

## A TRIAL OF *NEOLAMARCKIA CADAMBA* IN THANH HOA PROVINCE

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**Abstract:** *A trial of Neolamarckia cadamba in Thanh Hoa province has the following results: Neolamarckia cadamba is the easy growing and photophillic tree, highly adaptable to natural conditions of Thuong Xuan, Nhu Thanh, and Tinh Gia which are representatives of the mountainous area, midland area and delta coastal area, respectively, in Thanh Hoa province. The tree grows fast in the months with the average rainfall ranging from 178.6 to 437.8mm, with the average temperature from 24 to 30°C, and with the mean humidity from 65.9 to 87.9%. Neolamarckia cadamba grows well in deep, moist arable layers, with pH ranging from acidity to slight alkalinity, with a high total organic matter and high dissolved organic nitrogen content. The capable areas of Neolamarckia cadamba growing and developing in Thanh Hoa province include 45 communes of 9 districts.*

**Keywords:** *Neolamarckia Cadamba, capable areas, Thuong Xuan, Nhu Thanh, Tinh Gia.*

### 1. Introduction

*Neolamarckia cadamba* is the woody, straight and evergreen tree. It can reach up to 35m in height and over 100cm in diameter [5]. It has a high utilization rate of timber. The timber has lightly yellow colour with a fine texture, straight grains. The timber air dries rapidly without cracking and being termites. The timber is used to produce household items, handicrafts, trunks, architectural decorations, etc. It is also a very good material for making artificial fiberboards, medium density fiberboard and pulp, etc. *Neolamarckia cadamba*'s bark and roots can be used to produce medicines. Its leaves can be used as animal food [5]. Especially, the trees are valuable in protecting soil, regenerating forests and windbreaking in agroforestry systems [4].

So far, there has not been any research in generating and planting *Neolamarckia cadamba* in Thanh Hoa province. Therefore, the implementation of the study "A trial of *Neolamarckia cadamba* in Thanh Hoa province" is necessary.

### 2. Methodology

#### 2.1. Study areas and time

The representative of the ecological regions in Thanh Hoa province chosen for the study included: Thuong Xuan district (a representative of the mountainous area), Nhu Thanh district (a representative of the midland area), and Tinh Gia district (a representative of delta coastal area).

The study was implemented from June 2016 to the end of December 2018.

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## 2.2. Study contents

The study includes the following contents: (1) Selecting sites for the trial models of *Neolamarckia cadamba*; (2) Carrying out the trial, (3) Identifying suitable sites to grow *Neolamarckia cadamba* in Thanh Hoa province.

## 2.3. Study methods

The research methods used in the study included inheritance methods, expert methods, analysis methods and mapping methods [1], [2], [3]. The 1<sup>st</sup> content was carried out by the methods: Determining the slope of planting soil with a DQY-1 compass [1]; Determining the vegetative state by the actual observation methods [1]; Determining soil factors by soil profile excavation methods (in each district, three areas were excavated for soil analysis). The criteria of soil profile included soil thickness, organic matter content (OM), pH, dissolved organic nitrogen content (N<sub>dt</sub>), and content of easily digestive phosphorus P<sub>2</sub>O<sub>5</sub> (Number of samples: 3 samples/ point x 3 points = 9 samples).

The 2<sup>nd</sup> content was implemented by planting, tending and indicators monitoring in Tinh Gia district, Nhu Xuan district and Thuong Xuan district. *Neolamarckia cadamba* models were arranged in three sites (0.5 ha/site) as follows: Xuan Loc commune of Thuong Xuan district: 1.5 ha; 1, 2, 3 lots; 2 plot and 530 sub-area; Phuong Nghi commune of Nhu Thanh district: 1,5 ha; 1, 2, 3 lot; 5A plot and 572 sub-area; Truong Lam commune of Tinh Gia district: 1.5 ha; 1, 2, 3 lots; 3 plot; 37 sub-area. The trees were planted under a monoculture method with a planting density of 1,100 trees/ ha, a 3.0m distance from tree to tree; 3.0m distance from row to row and planted by pot seedlings [5]. Every month, growth data including survival rate, diameter of stump, twig growing height, and diameter of crown were noted and collected. The 3<sup>rd</sup> content were carried out by collecting, processing, synthesizing and analysing data to determine suitable sites for planting *Neolamarckia cadamba*; establishing commune and district maps for planting and developing areas in Thanh Hoa province (Digital map of commune 1/10,000 scale: 45 communes, digital maps of district 1/50,000 scale: 09 districts).

## 3. Results and discussion

### 3.1. Trial site selection for *Neolamarckia cadamba*

#### 3.1.1. Site types, soil sampling and soil sample analysis

##### *Representative of the mountainous area*

Xuan Loc commune of Thuong Xuan district was selected as a representative of the mountainous area. The slope of planting soil, soil profile, and vegetative state of three sites were determined and summarized in Table 1.

**Table 1.** The slope of planting soil, soil profile, and vegetative state of three sites in Xuan Loc commune of Thuong Xuan district

Content	1 <sup>st</sup> site	2 <sup>nd</sup> site	3 <sup>rd</sup> site
Soil type	Grayish brown feralite soil	Grayish brown feralite soil	Grayish brown feralite soil
Soil thickness (cm)	>80	>80	>80
Soil mechanical composition	Medium clay	Medium clay	Medium clay
Mixed stones percentage (%)	15 - 20	15 - 23	15 - 20



Floating rocks percentage (%)	5	6	4
Average slope (degree)	10 - 15	10 - 15	15 - 25
pH	5,67 (slightly acidic)	5,09 (slightly acidic)	5,86 (slightly acidic)
OM (%)	1,564 (poor)	2,302 (poor)	1,383 (poor)
Digestible P <sub>2</sub> O <sub>5</sub> (mg/100g)	2,31 (neutral)	2.38 (neutral)	3,92 (neutral)
Dissolved organic nitrogen Ndt (mg/100g)	4,2 (very poor)	6,44 (very poor)	1,95 (very poor)
Vegetative state	IA ( <i>Lophatherum gracile</i> Brongn., <i>Phragmites australis</i> , <i>Chromolaena odorata</i> , with 0.5÷ 1.5m average height, normal growth and 20÷ 30% coverage)	IB ( <i>Lophatherum gracile</i> Brongn., <i>Saccharum spontaneum</i> , <i>Phragmites australis</i> , <i>Chromolaena odorata</i> , <i>Holarrhena pubescens</i> , <i>Cratoxylum maingayi</i> with 1.5÷ 2.5m average height, normal growth and 25÷ 40% coverage)	IB ( <i>Lophatherum gracile</i> Brongn., <i>Coix lacryma-jobi</i> , <i>Chromolaena odorata</i> , with 1.5÷ 2.5m average height, normal growth and 25÷ 45% coverage)

Representative of the midland area

Phuong Nghi commune of Nhu Thanh district was selected as a representative of the midland area. The slope of planting soil, soil profile, and vegetative state of three sites were determined and summarized in table 2.

**Table 2.** The slope of planting soil, soil profile, and vegetative state of three sites in Phuong Nghi commune of Nhu Thanh district

Content	1 <sup>st</sup> site	2 <sup>nd</sup> site	3 <sup>rd</sup> site
Soil type	Light yellow feralite soil	Light yellow feralite soil	Light yellow feralite soil
Soil Thickness (cm)	>100	>100	>100
Soil mechanical composition	Medium clay	Medium clay	Medium clay
Mixed stones percentage (%)	8 - 12	4 - 5	4 - 5
Floating rocks percentage (%)	5 - 7	3	3
Average slope (degree)	10 - 15	10 - 15	20 - 25
pH	4,60 (acidic)	4,60 (acidic)	4,84 (acidic)
OM (%)	1,564 (poor)	1,841 (poor)	1,241 (poor)
Digestible P <sub>2</sub> O <sub>5</sub> (mg/100g)	5,66 (neutral)	4,09 (neutral)	7,99 (neutral)
Dissolved organic nitrogen Ndt (mg/100g)	4,38 (very poor)	5,88 (very poor)	3,64 (very poor)
Vegetative state	IA ( <i>Lophatherum gracile</i> Brongn., <i>Imperata</i> )	IB ( <i>Lophatherum gracile</i> Brongn., <i>Phragmites</i> )	IB ( <i>Lophatherum gracile</i> Brongn., <i>Phragmites</i> )

	<i>cylindrica</i> (L.) Beauv, <i>Phragmites australis</i> , with 1.0÷2.5m average height, normal growth and 25÷30% coverage)	<i>australis</i> , <i>Coix lacryma-jobi</i> , <i>Chromolaena odorata</i> , <i>Schizostachyum</i> sp, with 2.5÷3.0m average height, good growth and 30÷45% coverage)	<i>australis</i> , <i>Coix lacryma-jobi</i> , <i>Chromolaena odorata</i> , <i>Schizostachyum</i> sp, with 2.5÷3.0m average height, good growth and 30÷50% coverage.)
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Representative of the delta coastal region

Truong Lam commune of Tinh Gia district was selected as a representative of the delta coastal area. The slope of planting soil, soil profile, and vegetative state of three sites were determined and summarized in table 3.

**Table 3.** The slope of planting soil, soil profile, and vegetative state of three sites in Truong Lam commune of Tinh Gia district

Content	1 <sup>st</sup> site	2 <sup>nd</sup> site	3 <sup>rd</sup> site
Soil type	Reddish yellow feralite soil	Reddish yellow feralite soil	Reddish yellow feralite soil
Soil thickness (cm)	>50	>50	>50
Soil mechanical composition	Low to medium clay	Low to medium clay	Low to medium clay
Mixed stones percentage (%)	8 - 10	25 - 35	20 - 30
Floating rocks percentage (%)	5 - 7	10 - 12	10 - 13
Average slope (degree)	11 - 15	10 - 15	15 - 20
pH	6.99 (neutral)	7.35 (neutral)	6.46 (neutral)
OM (%)	1.288 (poor)	1.610 (poor)	1.288 (poor)
Digestible P <sub>2</sub> O <sub>5</sub> (mg/100g)	2.84 (very poor)	2.48 (very poor)	2.85 (very poor)
Dissolved organic nitrogen Ndt (mg/100g)	4.2 (neutral)	6.16 (neutral)	4.2 (neutral)
Vegetative state	IA ( <i>Lophatherum gracile</i> Brongn, <i>Saccharum spontaneum</i> , <i>Phragmites australis</i> , <i>Chromolaena odorata</i> , <i>Holarrhena pubescens</i> , <i>Cratoxylum maingayi</i> with 0.5÷1.4m average height, normal growth and 25÷40% coverage)	IB ( <i>Lophatherum gracile</i> Brongn, <i>Saccharum spontaneum</i> , <i>Chromolaena odorata</i> , with 0.5÷1.5m average height, normal growth and 20÷30% coverage)	IB ( <i>Lophatherum gracile</i> Brongn, <i>Saccharum spontaneum</i> , <i>Phragmites australis</i> , <i>Chromolaena odorata</i> , <i>Holarrhena pubescens</i> , <i>Cratoxylum maingayi</i> with 1.5÷2.5m average height, normal growth and 25÷40% coverage)

### 3.1.2. Meteorological results

In the areas where *Neolamarckia cadamba* have been planted, the mean yearly temperature of 2013, 2014, and 2015 ranged from 16.7°C to 30°C. The highest mean temperature was in June and the lowest one was in January. The mean monthly temperature was from 24.0°C to 24.4°C. These temperature ranges were ecologically suitable for the growth and development of *Neolamarckia cadamba* [5].

In 2013, 2014 and 2015, the mean air humidity in Thuong Xuan, Tinh Gia and Nhu Thanh districts were 85.3%, 84.2%, and 84.3%, respectively. The highest mean humidity was in March with 92.2% (in Tinh Gia) and the lowest one was in June with 65.9%.

The mean rainfall in Nhu Thanh, Tinh Gia, and Thuong Xuan districts was 1.696 mm, 1.883 mm, and 1.836 mm, respectively. In Nhu Xuan, the highest mean rainfall was in September (387.3 mm), the lowest one was in January (13.3 mm). In Tinh Gia, the highest mean rainfall was in September (437.8 mm) and the lowest one was in January (12.2 mm). In Thuong Xuan, the highest mean rainfall was in July (336.7 mm) and the lowest one was in January (27.4 mm). Therefore, in Nhu Xuan and Thuong Xuan, the rains were mainly from May to November, while in Tinh Gia, they were mainly from June to November.

### 3.2. Trial results of planting *Neolamarckia cadamba*

#### 3.2.1. Survival rates of *Neolamarckia cadamba* at the sites

The survival rates of *Neolamarckia cadamba* after one month of planting in the sites of three districts are shown in Table 4.

The survival rates of *Neolamarckia cadamba* at all sites were high. The highest rate was in 2<sup>nd</sup> site in Thuong Xuan with 95% and the lowest one was in 3<sup>rd</sup> site of Thuong Xuan and Tinh Gia with 80%.

The survival rates of *Neolamarckia cadamba* after 24 months of planting at all sites were high with over 90% (Table 1). The results show that *Neolamarckia cadamba* has a high survival rate if they are planted by standard seedlings with right tending, planted on the cool days and planted in high humidity soil.

**Table 4.** Survival rate of *Neolamarckia cadamba* after one month and after 24 months of planting (%)

District	After one month of planting			After 24 months of planting		
	1 <sup>st</sup> site	2 <sup>nd</sup> site	3 <sup>rd</sup> site	1 <sup>st</sup> site	2 <sup>nd</sup> site	3 <sup>rd</sup> site
Tinh Gia	85.0	91.0	80.0	91.0	94.0	89.0
Nhu Thanh	85.0	90.0	83.0	95.0	97.0	93.0
Thuong Xuan	90.0	95.0	80.0	92.0	94.0	90.0

#### 3.2.2. Monthly growth of *Neolamarckia cadamba*

##### *In mountainous area*

In Thuong Xuan district, measuring the growth of *Neolamarckia cadamba* after 24 months shows that the mean diameter of stump, the mean twig growing height, and the mean diameter of crown was 7.62cm, 3.22 m, and 3.06m, respectively at the 1<sup>st</sup> site; was 8.78cm, 3.25m, and 2.88m at the 2<sup>nd</sup> site; and was 6.92cm, 2.99m, and 2.64m at the 3<sup>rd</sup> site (Table 5).

Table 5. Monthly growth of *Neolamarckia cadamba* in Thuong Xuan

Month	Growth indicators								
	1 <sup>st</sup> site			2 <sup>nd</sup> site			3 <sup>rd</sup> site		
	D <sub>s</sub> (cm)	H <sub>t</sub> (m)	Dc (m)	D <sub>s</sub> (cm)	H <sub>t</sub> (m)	Dc (m)	D <sub>s</sub> (cm)	H <sub>t</sub> (m)	Dc (m)
10/2016	0.51	0.45	0.25	0.60	0.47	0.26	0.49	0.45	0.22
11/2016	0.53	0.45	0.25	0.62	0.47	0.26	0.50	0.45	0.22
12/2016	0.54	0.45	0.25	0.62	0.47	0.26	0.51	0.45	0.22
1/2017	0.55	0.45	0.25	0.63	0.47	0.26	0.52	0.45	0.22
2/2017	0.59	0.47	0.27	0.70	0.49	0.28	0.56	0.47	0.24
3/2017	0.71	0.53	0.32	0.8	0.54	0.32	0.67	0.51	0.28
4/2017	0.82	0.57	0.36	0.96	0.58	0.36	0.77	0.55	0.31
5/2017	1.11	0.68	0.47	1.30	0.69	0.47	1.02	0.65	0.41
6/2017	1.45	0.82	0.63	1.66	0.83	0.58	1.31	0.76	0.52
7/2017	2.03	1.04	0.85	2.37	1.06	0.81	1.87	0.99	0.73
8/2017	2.47	1.21	1.02	2.88	1.23	0.98	2.27	1.15	0.88
9/2017	3.09	1.43	1.26	3.58	1.45	1.20	2.82	1.35	1.09
1/2018	3.84	1.75	1.57	4.45	1.77	1.48	3.51	1.64	1.35
2/2018	4.02	1.81	1.63	4.65	1.84	1.55	3.67	1.70	1.41
3/2018	4.34	1.94	1.76	5.02	1.96	1.67	3.95	1.82	1.52
4/2018	4.69	2.07	1.90	5.42	2.10	1.80	4.27	1.94	1.64
5/2018	5.17	2.26	2.09	5.97	2.29	1.97	4.70	2.11	1.80
6/2018	5.74	2.48	2.32	6.62	2.51	2.19	5.22	2.32	2.00
7/2018	6.34	2.72	2.56	7.32	2.75	2.41	5.77	2.54	2.21
8/2018	6.98	2.97	2.81	8.05	3.00	2.65	6.34	2.76	2.43
9/2018	7.62	3.22	3.06	8.78	3.25	2.88	6.92	2.99	2.64

Note: D<sub>s</sub>: Diameter of stump , H<sub>t</sub>: twig growing height, Dc : Diameter of crown

However, the mean diameter of tree trunks in Thuong Xuan increased unevenly by month (Figure 1). The mean diameter of *Neolamarckia cadamba*'s trunks increased slowly in the period from the end of October to the end of May (Figure 1). On the other hand, it increased significantly in the period from early June to the end of September (Figure 1). The climatic factors of the years shows that the mean rainfall from October of the last year to May of the following year was low, and the one from June to the end of September was high. All these results indicates that *Neolamarckia cadamba* grew quickly in the rainy season.

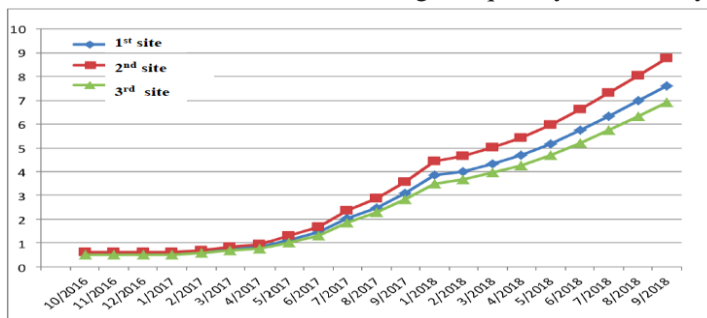


Figure 1. The mean diameter of tree trunks in Thuong Xuan

At 2<sup>nd</sup> site, *Neolamarckia cadamba* grew best, followed by those at 1<sup>st</sup> site, and 3<sup>rd</sup> site, respectively. Matching this to the characteristics of soil at the sites shows that trees planted on the site with high content of organic matter (OM) and high dissolved organic nitrogen (Ndt) grew best.

In Nhu Thanh district, measuring the growth of *Neolamarckia cadamba* after 24 months shows that the mean diameter of stump, the mean twig growing height, and the mean diameter of crown was 11.75cm, 4.84m, and 3.53m, respectively at the 1<sup>st</sup> site; was 13.76cm, 5.29m, and 3.89m at the 2<sup>nd</sup> site; and was 11.09cm, 4.62m, and 3.33m at the 3<sup>rd</sup> site (Table 6).

**Table 6.** Monthly growth of *Neolamarckia cadamba* in Nhu Thanh

Month	Growth indicators								
	1 <sup>st</sup> site			2 <sup>nd</sup> site			3 <sup>rd</sup> site		
	D <sub>s</sub> (cm)	H <sub>t</sub> (m)	Dc (m)	D <sub>s</sub> (cm)	H <sub>t</sub> (m)	Dc (m)	D <sub>s</sub> (cm)	H <sub>t</sub> (m)	Dc (m)
10/2016	0.52	0.45	0.25	0.58	0.49	0.26	0.50	0.44	0.22
11/2016	0.57	0.47	0.26	0.63	0.51	0.28	0.52	0.46	0.24
12/2016	0.58	0.47	0.26	0.66	0.51	0.28	0.54	0.46	0.24
1/2017	0.59	0.47	0.26	0.68	0.51	0.28	0.56	0.46	0.24
2/2017	0.62	0.49	0.27	0.73	0.52	0.29	0.58	0.47	0.25
3/2017	0.80	0.56	0.32	0.94	0.60	0.35	0.72	0.53	0.29
4/2017	1.09	0.67	0.41	1.27	0.72	0.44	0.99	0.64	0.37
5/2017	1.51	0.83	0.53	1.74	0.90	0.58	1.38	0.79	0.48
6/2017	2.08	1.06	0.70	2.40	1.15	0.76	1.92	1.00	0.64
7/2017	3.01	1.42	0.97	3.47	1.55	1.06	2.81	1.35	0.90
8/2017	4.37	1.95	1.37	5.03	2.13	1.50	4.09	1.86	1.27
9/2017	5.40	2.36	1.67	6.22	2.57	1.84	5.08	2.25	1.57
10/2017	6.24	2.68	1.91	7.18	2.93	2.10	5.87	2.56	1.80
11/2017	6.26	2.69	1.92	7.21	2.94	2.11	5.90	2.57	1.81
12/2017	6.29	2.70	1.93	7.24	2.95	2.12	5.92	2.58	1.81
1/2018	6.31	2.71	1.94	7.27	2.96	2.13	5.95	2.59	1.82
2/2018	6.52	2.80	2.00	7.51	3.05	2.20	6.14	2.67	1.88
3/2018	6.83	2.92	2.09	7.86	3.18	2.30	6.44	2.79	1.97
4/2018	7.22	3.07	2.20	8.31	3.35	2.42	6.81	2.93	2.07
5/2018	7.80	3.29	2.37	8.97	3.60	2.61	7.35	3.14	2.23
6/2018	8.52	3.58	2.58	9.80	3.91	2.84	8.04	3.42	2.43
7/2018	9.51	3.97	2.87	10.94	4.33	3.16	8.98	3.78	2.71
8/2018	10.76	4.45	3.24	12.37	4.86	3.57	10.16	4.25	3.06
9/2018	11.75	4.84	3.53	13.60	5.29	3.89	11.09	4.62	3.33

However, the mean diameter of tree trunks in Nhu Thanh increases unevenly by month (Figure 2). The mean diameter of *Neolamarckia cadamba*'s trunks increased slowly in the period from the end of October to the end of May (Figure 2). On the other hand, it increased significantly in the period from early June to the end of September (Figure 2). The climatic factors of the years shows that the mean rainfall from October of the last year to May of the following year was low, and the one from June to the end of September was high. All these results indicates that *Neolamarckia cadamba* grow quickly in the rainy season.

At 2<sup>nd</sup> site, *Neolamarckia cadamba* grew best, followed by those at 1<sup>st</sup> site, and 3<sup>rd</sup> site, respectively. Matching this to the characteristics of soil at the sites shows that trees planted on the site with high content of OM and high easily digestible (Ndt) grew best.

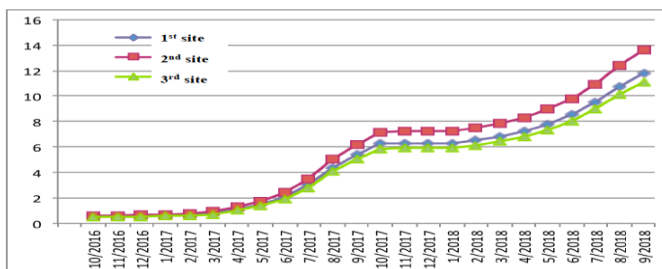


Figure 2. The mean diameter of tree trunks in Thuong Xuan

In the delta coastal region

In Tinh Gia district, measuring the growth of *Neolamarckia cadamba* after 24 months shows that the mean diameter of stump, the mean twig growing height, and the mean diameter of crown was 7.24cm, 3.84m, and 2.95m, respectively at the 1<sup>st</sup> site; was 7.38cm, 4.16m, and 3.49m at the 2<sup>nd</sup> site; and was 5.87cm, 2.70m, and 2.56m at the 3<sup>rd</sup> site (Table 7).

Table 7. Monthly growth of *Neolamarckia cadamba* in Tinh Gia

Month	Growth indicators								
	1 <sup>st</sup> site			2 <sup>nd</sup> site			3 <sup>rd</sup> site		
	D <sub>s</sub> (cm)	H <sub>t</sub> (m)	Dc (m)	D <sub>s</sub> (cm)	H <sub>t</sub> (m)	Dc (m)	D <sub>s</sub> (cm)	H <sub>t</sub> (m)	Dc (m)
10/2016	0.54	0.47	0.25	0.58	0.49	0.28	0.48	0.45	0.22
11/2016	0.55	0.47	0.25	0.60	0.49	0.28	0.49	0.45	0.22
12/2016	0.56	0.47	0.25	0.61	0.49	0.28	0.50	0.45	0.22
1/2017	0.57	0.47	0.25	0.62	0.49	0.28	0.51	0.45	0.22
2/2017	0.61	0.49	0.27	0.66	0.52	0.30	0.53	0.46	0.24
3/2017	0.73	0.55	0.32	0.77	0.58	0.36	0.63	0.51	0.28
4/2017	0.85	0.61	0.36	0.88	0.64	0.41	0.74	0.54	0.32
5/2017	1.14	0.76	0.48	1.18	0.80	0.55	0.90	0.60	0.42
6/2017	1.47	0.92	0.61	1.51	0.98	0.70	1.16	0.72	0.54
7/2017	1.98	1.18	0.82	2.03	1.26	0.95	1.57	0.89	0.72
8/2017	2.60	1.39	0.99	2.65	1.49	1.15	2.02	1.03	0.86
9/2017	3.27	1.83	1.34	3.34	1.97	1.57	2.60	1.33	1.17
10/2017	3.52	1.96	1.44	3.59	2.11	1.69	2.80	1.42	1.26
11/2017	3.55	1.97	1.45	3.62	2.12	1.71	2.82	1.43	1.27
12/2017	3.63	2.02	1.49	3.71	2.17	1.75	2.89	1.46	1.30
1/2018	3.69	2.04	1.51	3.77	2.20	1.77	2.94	1.48	1.32
2/2018	3.85	2.13	1.58	3.93	2.29	1.85	3.07	1.53	1.37
3/2018	4.15	2.28	1.70	4.24	2.46	2.00	3.31	1.64	1.48
4/2018	4.48	2.45	1.83	4.57	2.64	2.16	3.57	1.75	1.59
5/2018	4.93	2.67	2.02	5.03	2.89	2.38	3.93	1.90	1.75
6/2018	5.47	2.95	2.23	5.58	3.18	2.64	4.36	2.09	1.94
7/2018	6.04	3.24	2.46	6.16	3.50	2.91	4.82	2.28	2.14
8/2018	6.64	3.54	2.71	6.77	3.83	3.20	5.30	2.49	2.35
9/2018	7.24	3.84	2.95	7.38	4.16	3.49	5.78	2.70	2.56

However, the mean diameter of tree trunks in Tinh Gia increases unevenly by month (Figure 3). The mean diameter of *Neolamarckia cadamba*'s trunks increased slowly in the period from the end of October to the end of May (Figure 3). On the other hand, it increased significantly in the period from early June to the end of September (Figure 3). The climatic factors of the years shows that the mean rainfall from October of the last year to May of the following year was low, and the one from June to the end of September was high. All these results indicates that *Neolamarckia cadamba* grew quickly in the rainy season.

At 2<sup>nd</sup> site, *Neolamarckia cadamba* grew best, followed by those at 1<sup>st</sup> site, and 3<sup>rd</sup> site, respectively. Matching this to the characteristics of soil at the sites shows that trees planted on the site with high content of OM and high Ndt grew best.

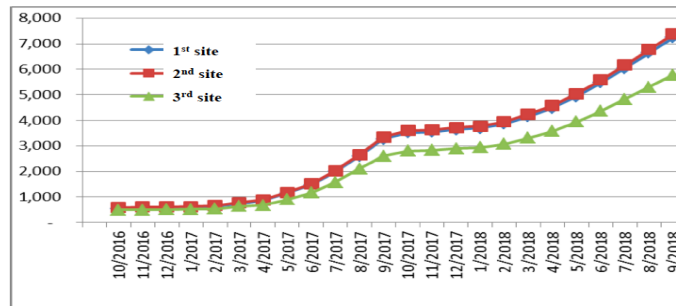


Figure 3. The mean diameter of tree trunks in Tinh Gia

### 3.2.3. Growth of *Neolamarckia cadamba* after 24 months of planting

Studying the growth ability of *Neolamarckia cadamba* in 24 months of planting, the results are described in the Figure 4.

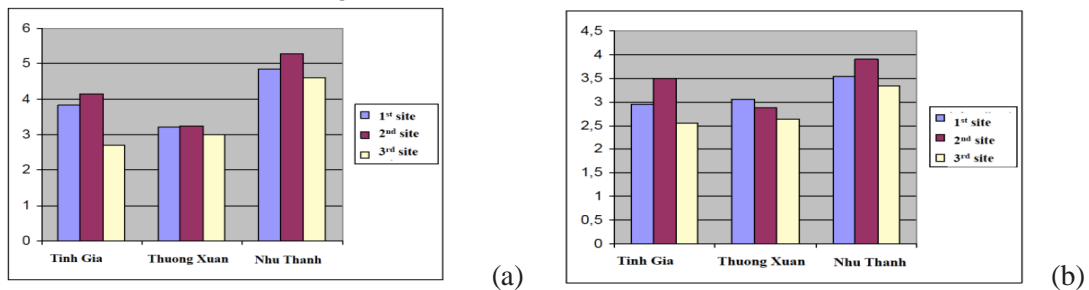


Figure 4. (a) Mean diameter of trunk; (b) Mean height of *Neolamarckia cadamba* after 24 months of planting

The results showed that in all three areas, *Neolamarckia cadamba* grew best at the 2<sup>nd</sup> site, followed by trees at the 1<sup>st</sup> site and trees at the 3<sup>rd</sup> site. *Neolamarckia cadamba* grew best in the soil with high total organic matter content OM (%) and high easily digestible protein content (Ndt). They grew best in Nhu Thanh and grew worst in Tinh Gia. Comparing OM and Ndt in soil of three districts, the indicators were relatively homogenous in all sites. However, the pH soil, which reflects the degree of acidic or alkaline soil, was disparate. In Tinh Gia, soil pH was from slightly acidic to neutral, ranging from 6.46 to 7.35. In Thuong Xuan, soil pH was medium acidic, ranging from 5.09 to 5.86. In Nhu Thanh, soil pH was strongly acidic, ranging from 4.6 to 4.84. Therefore, *Neolamarckia cadamba* grew best in strongly acidic soil.

#### 3.2.4. Pests and diseases in *Neolamarckia cadamba*

In all three areas, only leaf-eating caterpillars appeared in the months of the first year with high air humidity (from February to April). Most of defoliated *Neolamarckia cadamba* were in Thuong Xuan (about 30% of defoliated leaf) as there are many shade trees around the sites. Pesticides used to kill caterpillars included Apphe 666EC and ACCETA. These helped *Neolamarckia cadamba* recovered and and grewed stably.

#### 3.2.5. Natural disasters resistance of *Neolamarckia cadamba*

*Neolamarckia cadamba* were not collapsed and died due to the rain, storms, whirlwinds and flood in 2017 and 2018. Meanwhile, many *Acacia auriculiformis* and other plant species were collapsed, uprooted and died because of these disasters in the areas surrounding the model.

### 3.3. Determination of suitable sites for planting *Neolamarckia cadamba* in Thanh Hoa province

Thanh Hoa province has 647,055 ha of forests and forestry, including 598,573 ha of forest land, 48,482 ha of bare land, and bare hills. The results of the map overlay show that the forest land has a slope of less than 25°, with an area of 131,915 ha of forest land. The sites which is suitable for planting *Neolamarckia cadamba* was determined based on the study results of *Neolamarckia cadamba* growth as well as the effects of factors on *Neolamarckia cadamba* and on using site maps, topographic maps and specialized software (Mapinfo, forest- tool, etc.). The area of the sites is 3,200 ha including 45 communes of 9 districts (Cam Thuy 410 ha, Lang Chanh 430 ha, Ngoc Lac 457 ha, Nhu Thanh 261 ha, Nhu Xuan 577 ha, Thach Thanh 195 ha, Thuong Xuan 625 ha, Tinh Gia 175 ha and Trieu Son 70 ha).

## 4. Conclusion

*Neolamarckia cadamba* is the easy growing and photophillic tree, highly adaptable to natural conditions in Thanh Hoa province. The tree grows fast in the months with the average rainfall ranging from 178.6 mm to 437.8 mm, with the average temperature from 24 °C to 30°C and with the average humidity from 65.9% to 87.9%.

*Neolamarckia cadamba* grows well in deep, moist arable layers, with pH ranging from acidity to slight alkalinity and with a high organic matter and high dissolved organic nitrogen content.

The capable areas of *Neolamarckia cadamba* planting and developing in Thanh Hoa province include 45 communes of 9 districts with the total of 3,200 ha (Cam Thuy 410 ha, Lang Chanh 430 ha, Ngoc Lac 457 ha, Nhu Thanh 261 ha, Nhu Xuan 577 ha, Thach Thanh 195 ha, Thuong Xuan 625 ha, Tinh Gia 175 ha and Trieu Son 70 ha).

## References

- [1] Nguyen Ba Chat (1998), *Method and density of forestation*, Forestry Magazine, no.2, Vietnam Forest Science Institute.



- [2] Le Minh Cuong (2014), *Research on breeding and intensive cultivation techniques of Oak trees (Lithocarpus fissus (Champ. Ex Benth.) A. Camus) and White Dipper (Neolamarckia cadamba) provide large timber in some key areas*, Center for North East Coast Agro-Forestry Development.
- [3] Department of Science, Technology and Product Quality - Ministry of Agriculture and Rural Development (2001), *Silviculture technical standards document*, Hanoi Agriculture Publishing House.
- [4] Ministry of Agriculture and Rural Development (2004), *Choosing priority species for afforestation programs in Viet Nam*, A handbook for forestry.
- [5] Soerianegara, I. and Lemmens, R.H.M.J. (1993), *Plant resources of South-east Asia 5. Timber trees: Major commercial timbers*, Pudoc Scientific Publishers, Wageningen, Netherlands.
- [6] Thai Nguyen University of Agriculture and Forestry (2017), *The project of planting intensive forests of Thien Ngan trees to provide large timber in the Northern Mountainous provinces*.

## USING KNOW-HOW PRESENTATION IN TRANSLATION CLASSES FOR ENGLISH LINGUISTICS MAJORS

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**Abstract:** *This study suggests using know-how presentation in translation classes and examines its effectiveness in developing English linguistics majors' translation skills. An experimental research was done in which the control group was taught with common steps of a translation lesson while the experimental group was taught with integrated know-how presentation. A pretest and a posttest were administered to both groups before and after the experimental program to measure the efficacy of know-how presentation in translation classes. A questionnaire and interviews were conducted to the experimental group to investigate students' reaction to the program. The obtained results revealed that know-how presentation did help English linguistics majors develop their translation skills.*

**Keywords:** *Know-how presentation, translation steps, translation methods, translation strategies, translation evaluation.*

### 1. Introduction

With the global trade and cultural exchange in the modern world, translation has become an integral part in connecting different countries. In order to facilitate both linguistic and cultural transfer, translators require certain knowledge and skills. Lam Quang Dong (2007) argued that people working in translation field need a wide range of knowledge: language, culture, general knowledge or background knowledge and professional knowledge. They need to be proficient in language, grasp a rich variety of vocabulary, have a thorough understanding of linguistic issues of both languages, have an in-depth insight into the similarities and differences between the two languages not only in grammar but also in terms of semantics and pragmatics.

The knowledge and skills required for a translator poses a major challenge for teaching translation at foreign language departments in general and the Foreign Language Department at Hong Duc University in particular. In reality, our initial survey showed that many translation classes were quite tedious and monotonous with English texts being translated into Vietnamese and vice versa.

In order to create a positive change to translation classes, it is imperative that different teaching methods with various activities be exploited. This article reports an attempt to use know-how presentation as an integrated activity in translation lessons.

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## **2. The study**

### **2.1. Subjects**

The participants were sixty third-year English linguistics majors of Foreign Language Department at Hong Duc University. They were divided into two groups with one served as the control and the other as the experimental group. These students had completed the Translation Theory course in their second year and were taking the Translation 1 course.

### **2.2. Instruments**

In order to find out whether this activity worked well in translation classes and how the students reacted to the experimental program, different instruments were exploited in the study.

Pretest and posttest: A pretest was administered at the beginning of the course before the experimental program to make sure that two groups had the same level of translation competence. At the end of the course, a posttest was conducted to find out whether know-how presentation made any difference to the translation competence of the experimental group compared to the control group. Both tests included texts to be translated from English into Vietnamese and vice versa.

Survey questionnaire and interviews: A small-scale survey questionnaire and interviews were conducted to the experimental group at the end of the semester to investigate into students' reaction to the experimental program.

### **2.3. Research methods**

In order to measure the efficacy of the experimental program, both quantitative and qualitative methods were utilized.

Quantitative method: Results of the pretest and posttest as well as the survey questionnaire were synthesized and compared between the control and experimental groups to find out whether know-how presentation could improve English linguistic majors' translation competence.

Qualitative method: Interviews with the students in the experimental group provided the researchers with raw data for analyzing the students' reaction and attitude to the experimental program.

### **2.4. Procedure**

At the beginning of the semester, the control group were divided into 10 small groups of 3 students. Each group chose one source text in English and one in Vietnamese. The source texts may be articles, short stories, reading passages or other documents with a length of about 300 words. They would be relevant to the topics of the lessons in the syllabus, and have vocabulary of levels from B2 to C1.

These texts were to be sent to teachers for review and approval. When the teacher accepted the group's chosen texts, the groups would work together to determine the know-how, i.e. translation steps, translation methods and strategies, translation evaluation. Then they translated the source texts into the target language.

During the semester, apart from other activities of a translation lesson, a presentation of one group was integrated either at the beginning or the end of the lesson. In the total 13

weeks of the semester, the first two weeks were reserved for the introduction of the intervention program and the pretest. The next 10 weeks, each of which consisted of two lessons, were for presentations with texts translated from English into Vietnamese in one lesson and texts translated from Vietnamese into English in the other. The remaining week was for the posttest and survey questionnaire delivery.

The primary purpose of each presentation was to help students apply theory into practice. Therefore, the contents of the presentation were comprised of translation steps the students followed, methods and techniques they exploited, and how they evaluated their final translation version.

The source text, target language translation, and PowerPoint presentation were to be sent to the teacher and the whole class 2 days before the presentation day. On the day of the presentation, the group members took turns to deliver the presentation. Other groups in the class would give comments on the translation version as well as the presentation itself. Teachers provided final feedback and graded each member in the group.

#### 2.4.1. Translation steps

To ensure that students follow the steps in the translation process, the first part of the presentation required the group to describe the steps the group had applied to proceed with the translation work. Based on the theories about the steps in translation which students had learned in the Translation Theory course, students presented what they actually did in each step.

The following was the teacher’s suggested approach for students to use in their presentations.

**Table 1.** Translation steps (adapted from Nguyen Quoc Hung’s)

No.	Description	Presenter groups’ expected work
Step 1	Read through	Identify topic of the source text. Identify aim of the source text. Find out main ideas of the source text.
Step 2	Identify difficult vocabulary such as new words, technical terms, or idiomatic expressions.	List the new and difficult words in the source text. Look up the meaning of these words in the target language.
Step 3	Identify sentence structures	Choose 5 significant sentences with different grammar structures in the source text. Analyze the components in these sentences. Find the equivalent structures in the target language.
Step 4	Translate sentence by sentence, paragraph by paragraph.	Show the translation work to the whole class. Point out the difficulties they encountered when translating. Explain what they had done to overcome these difficulties.
Step 5	Edit the translation using appropriate language style	Point out what sentences were edited to suit the style of the target language.
Step 6	Comments on the translation work	Presenter group self-evaluated their work. Other groups gave comments. Teacher gave final feedbacks.

2.4.2. Translation methods and techniques

Based on translation methods and techniques students had learned in the Translation Theory course, students pointed out what methods and techniques they used in translating the chosen source text into the target language.

The following translation methods of Newmark's (1988b) and translation techniques of Mona Baker's (1992) were a suggestion for students.

*Table 2. Translation methods and strategies*

No.	Description	Presenter groups' expected work
<b>I. Translation Methods (Newmark, 1988b)</b>		
1	Word-for-word translation	Point out which sentences are translated in which word order is preserved and the words translated singly by their most common meanings, out of context.
2	Literal translation	Point out which grammatical constructions are converted to their nearest target language equivalents, but the lexical words are translated singly, out of context.
3	Faithful translation	Point out which sentences are translated with the attempts to produce the precise contextual meaning of the original within the constraints of the target language grammatical structures.
4	Semantic translation	Point out which sentences are translated with more account of the aesthetic value of the source text.
5	Adaptation	Point out whether the source text is translated into the target text with the freest form of translation, the source culture converted to the target culture and the text rewritten.
6	Free translation	Point out whether the source text is translated into the target text without the style, form, or content of the original.
7	Idiomatic translation	Point out which sentences are translated keeping the 'message' of the original but tending to distort nuances of meaning by preferring colloquialisms and idioms although these do not exist in the original.
8	Communicative translation	Point out which sentences are translated with the attempt to render the exact contextual meaning of the original in such a way that both content and language are readily acceptable and comprehensible to the readership.
<b>II. Translation strategies (Mona Baker, 1992)</b>		
1	Translation by a more general word	Point out which sentences are translated using this strategy to deal with nonequivalence.
2	Translation by a more neutral/ less expressive words	Point out which sentences are translated using a more neutral/less expressive words.
3	Translation by cultural substitution	Point out which sentences are translated using this strategy which involves replacing a culture-specific item or expression with a target language item considering its impact on the target reader.
4	Translation using a loan word or loan word plus explanation	Point out which sentences are translated using this strategy which deals with culture-specific items, modern concepts, and buzz words.

5	Translation by paraphrase using a related word	Point out which sentences are translated using this strategy in which the source item is lexicalized in the target language but in a different form.
6	Translation by paraphrase using unrelated words	Point out which sentences are translated using this strategy when the concept in the source item is not lexicalized in the target language.
7	Translation by omission	Point out which sentences are translated using this strategy in which translators omit some information to avoid lengthy explanations if the meaning conveyed by a particular item or expression is not necessary to mention in the understanding of the translation.
8	Translation by illustration	Point out which sentences are translated using this strategy in which the target equivalent item does not cover some aspects of the source item and the equivalent item refers to a physical entity which can be illustrated, particularly in order to avoid over-explanation and to be concise and to the point.

2.4.3. Translation evaluation

The presenter group themselves had to evaluate their own translation version based on the criteria provided by the teacher. Furthermore, after the oral presentation was completed, the rest of the class gave comments on the translation and the presentation itself. The evaluation criteria were based on those of Massoud [4, pp.19-24] and Nguyen Thi Minh Tam et al. [6, pp.90-104].

Table 3. Translation evaluation

No.	Description	Evaluators' work
<b>I. Criteria for a good translation</b>		
1	The translation is easy to understand	Point out which sentences/parts are easy/not easy to understand.
2	The translation is fluent and neat	Point out which sentences/parts are neat and fluent/confusing and verbose.
3	The translation uses common phrases or idioms	Point out which common phrases or idioms are used.
4	The translation conveys, to some degree, the subtleties of the original text	Point out to what extent the translation can convey the subtleties of the original text.
5	The translation can reconstruct the cultural/historical context of the original text	Point out whether the translation can reconstruct the cultural/historical context of the original text. How?
<b>II. Translation mistakes and errors</b>		
1	Spelling mistakes	List the spelling mistakes in the translation.
2	Work choice mistakes	List the work choice mistakes in the translation.
3	Grammar mistakes	List the grammar mistakes in the translation
4	Errors in style (commercial, formal, administrative, vocative ...)	Give comments on whether the language style is appropriate? Why?
5	Errors in redundant or missing content	Point out the words/sentences/parts that are redundant or missing.

**2.5. Results and discussions**

The results of the pretest and posttest administered at the beginning and at the end of the reading course to find out to what extent using group presentation in translation classes can help students improve their translation skills are presented in the following table.

**Table 4. Results of the pretest and posttest**

Points (/10)	Control group		Experimental group	
	Pretest (%)	Posttest (%)	Pretest (%)	Posttest (%)
8.0 - 10	10.00	13.33	13.33	20.00
6.5 - 7.5	43.33	43.33	26.67	53.33
5.0 - 6.0	30.00	33.33	40.00	20.00
0 - 4.5	16.67	10.00	20.00	6.66

It is clear from the table that both the control and experimental groups have more or less the same level of translation competence in the pretest. However, after the experimental program, the experimental group witnessed better results with more students achieving 8-10 points (20%). The number of the students who received 6.5 - 7.5 points also increased from 26.67% to 53.33%. Fewer students got 5 - 6 points (with the number halved from 40% in the pretest to 20% in the posttest). The number of students with 0 - 4.5 points also decreased significantly from 20% to 6.67%. In the meantime, the results of the control group experienced less change with only 13.33% of the students achieving excellent marks in the posttest as opposed to 10% in the pretest. The number of the students who got marks 6.5 - 7.5 remained the same at 43.33%. As regards marks 5.0 - 6.0, the control group also experienced negligible increase from 30% to 33.33%. The figures for weak marks (0 - 4.5) dropped from 16.67% to 10%. It can be said that the experimental program helped to improve translation skills for the students of the experimental group.

In addition to the tests, a survey questionnaire was also administered to the experimental group to find out how students reacted to the intervention program. The questionnaire was composed of five closed questions. The following table shows the results of the survey.

**Table 5. Students' evaluation of the intervention program**

No.	Questions	A (%)	B (%)	C (%)	D (%)
1.	<i>How much do you like group presentation in translation classes?</i> A. very much                      B. much C. not very much                  D. not at all	16.70	76.67	6.67	0
2.	<i>What do you think of the class atmosphere during lessons with group presentation?</i> A. very interesting                B. interesting C. boring                              D. very boring	6.67	83.33	10.00	0
3.	<i>What can you learn from the presentations in translation classes? (more than one answer can be accepted)</i> A. Better command of your native language B. Better command of your second language C. Better translation methods and strategies D. Better translation evaluation	66.70	63.33	70.00	76.67

4.	<i>What other skills have you improved after the course (more than one answer can be accepted)</i> A. Extensive cultural knowledge in both languages B. Sound research skills (for words, structures, meanings, jargon, background information) C. Attention to details D. Self-motivation and organization	53.30	60.00	63.30	60.00
5.	<i>What difficulties have you encountered in translation classes with group presentations? (more than one answer can be accepted)</i> A. Too much pre-class preparation B. Lack of IT skills C. Not finding the suitable source texts D. Working with lazy partners	16.70	53.33	40.00	26.67

The figures in the table show that most of the students liked know-how presentation in translation classes. 16.7% liked it very much, and up to 76.67% like it much. Only 6.67% did not like it very much. No student stated that they did not like it at all. Similarly, many students remarked translation lessons with know-how presentations are ‘very interesting’ and ‘interesting’ (6.67% and 83.33% respectively). Only 10% found them boring and no student rated them very boring. Moreover, the students also assumed that they had better command of their native language (66.7%), better command of their second language (63.33%), better translation methods and strategies (70%), and better translation evaluation (76.67%). In terms of other skills involved in translation process, the students maintained that they improved their extensive cultural knowledge in both languages (53.3%), sound research skills (for words, structures, meanings, jargon, background information) (60%), attention to details (63.3%), and self-motivation and organization (60%).

However, there still existed some difficulties for students. 16.7% claimed there was too much pre-class preparation. 53.33% lacked IT skills and 40% found it hard to find suitable source texts. 26.67% complained that other members in their group were too lazy to fulfil their duty which delayed the group’s process to complete their presentation as required.

Interviews with the students of the experimental group also reinforced that although there were still some students who were not completely satisfied, most of them agreed that know-how presentation in translation classes helped students to improve their translation skills. They became more autonomous, active and interested in the translation lessons.

### 3. Conclusion

No one can deny that translation plays an indispensable role in the modern society as an essential means of exchanging information, contributing to the success of economic, political and cultural connection among countries. However, translation work requires intricate knowledge and skills. Training of translators at universities, therefore, needs continuous improvement to meet the rigorous requirements of the job.



Within the scope of this study, the author has proposed using know-how presentations in teaching translation modules for English linguistics majored students at Hong Duc University. This is a solution to help students master the major translation process which involves following the translation steps, applying suitable methods and techniques, as well as evaluating the translation.

An experimental research has been carried out to examine the effectiveness of the intervention program. A pretest and a posttest were delivered to both control and experimental groups before and after the experimental program. A survey questionnaire was also administered to the control group. The obtained results showed that using know-how presentations in translation classes helps students improve their translation competence. Moreover, it helps translation lessons to be more vivid, creating students' positive and proactive attitude to acquiring knowledge.

### References

- [1] Baker, M. (1992), *In other words: A course book on translation*. London: Routledge.
- [2] Lam Quang Dong (2007), About the Professionalism of Translation, *Journal of Language and Life*, 10 (144), pp.25-28.
- [3] Nguyen Quoc Hung (2007), *Technical Instructions for English-Vietnamese, Vietnamese-English translation*, Ho Chi Minh City General Publishing House.
- [4] Massoud, M. F. (1988), *Translate to Communicate, A Guide for Translators*, New York: David C. Cook Foundation.
- [5] Newmark, P. (1988b), *Approaches to Translation*, Hertfordshire: Prentice Hall.
- [6] Nguyen Thi Minh Tam, Nguyen Dieu Hong, Tran Thi Long (2017), An Investigation into the Current Situation of Using English in Guide Signs for Tourists in Some Tourist Spots in the North of Vietnam, *VNU Journal of Foreign Studies*, 33(2), pp.90-104.

# FACTORS AFFECTING EMPLOYEES' MOTIVATION AND PERFORMANCE: A CASE STUDY OF JOINT VENTURE ENTERPRISES IN MANUFACTURING SECTOR AT NGHI SON ECONOMIC ZONE

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**Abstract:** *The research has studied motivational aspect of employees and their performance at joint venture enterprises in manufacturing sector at Nghi Son Economic Zone. A research model was proposed with 3 determinants of Motivation, which may affect Work Performance; they are: Leadership, Organizational Support and Organizational Culture. With the primary data in questionnaire surveys from 250 employees, the results of theoretical model tests showed that all three components affect Work Motivation, especially Work Motivation affects Performance. The most influenced component of the Motivation is Organizational Support, followed by Leadership and finally is Organizational Culture. In order to enhance employees' motivation and performance, it is necessary to elicit passion in the work by well performing both physical and mental support. This is in line with the views of classical and modern researchers in this field.*

**Keywords:** *Motivation, Performance, Employees, Nghi Son Economic Zone, Joint venture enterprises, manufacturing.*

## 1. Introduction

Human resource is the source of the ability to create material and spiritual wealth for society in a certain quantity and quality at a given time. In the theory of economic development, people are considered as a factor to ensure sustainable economic growth; even people are considered to be a special source of capital for development - human capital (Bui Tat Thang, 2017). Therefore, motivating employees is all the activities that businesses should perform in order to affect the ability to work, the attitude of working in a positive way to bring about further high efficiency in their labor. The expression of enterprises with a working environment that creates many motivations for employees not only includes positive business results, high salaries, good remuneration, but also includes long-term employee engagement with business or not. In other words, the efficiency, working attitude and performance of workers is a good testament to the effectiveness of work motivation for employees.

Currently, in the industrial parks of Thanh Hoa province in general and Nghi Son Economic Zone in particular, the form of joint venture is becoming very popular because this is a form of business that really brings many advantages for both Vietnamese investors and foreign investors. For Vietnamese investors, when participating in joint venture enterprises, in addition to dividing profits according to their capital contribution ratio, Vietnamese investors also have access to modern technology, style and advanced economic management

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skills. For foreign parties, the advantage is to be guaranteed higher success due to the completely unfamiliar business and legal environment. However, the form of a joint venture also has the disadvantage of having close ties in a different legal entity between completely different parties, not only in language but also in tradition, customs and practices, business style, human resource management, so may raise conflicts that are not easily to be solved. Therefore, human resource management in general, and motivating employees to increase performance in particular is not a simple thing in these enterprises. From that point of view, this research worked on the issue of motivation, and its positive relationship to the performance of employees so that it can draw lessons and solutions to improve the motivation for employees of joint venture enterprises in today's business.

## **2. Literature Review and Research Model**

### **2.1. Work Motivation**

Work motivation relates to human desire and willingness to increase effort to achieve a specific goal or outcome. In other words, motivation includes all the reasons why people act. Research on motivation refers to the reason people think and act in certain circumstances. These actions are often studied in terms of the behavior of each individual person, cherished time of thinking about the action, the level of effort that people take action, the persistence of action and cognitive and emotional reactions in the course of action (Lycourgos H., 2012). According to authors of the Human Resource Management textbook by National Economic University publisher, "Labor motivation is the desire and willingness of workers to enhance efforts towards achieving the organization's goals" (Nguyen Van Diem & Nguyen Ngoc Quan, 2012). According to Hersey and Blanchard (1969), labor motivation is the desire and willingness of workers to increase efforts to aim at a certain goal and result. Labor dynamics are internal factors that motivate people to actively work in conditions that enable high productivity and efficiency. The expression of motivation is readiness, effort, passion for work to achieve the organization's goals as well as the employees themselves (Kovach, 1995). Thus, labor motivation is associated with stimulating factors that make employees voluntarily act for the organization's goals.

Scholars also agreed to divide motivation into two main areas: Intrinsic motivation and extrinsic motivation. As Deci observed in his research, the internal dynamics bring about energy and persistence in human action through self-satisfaction associated with effective action on will (Deci et.al, 1999). The intrinsic motivational part of the worker motivates them to work because of an internal satisfaction rather than a certain isolated result comparing to the external motivation. When a person is stimulated from within, the worker will work for joy, desiring to discover, the eagerness of the results of work or the desiring to conquer certain obstacles at work. The natural tendency of these actions of workers is an important part of their own cognitive, social and physical development as their natural needs develop along the knowledge and skills they have accumulated (Sun Joo Yoo et.al, 2012). In addition, the external motive force motivates workers to work because of outside work impacts such as rewards, work environments or work rules that require employees to comply (Vinay Chaitanya Ganta, 2014). Studies have suggested that when the peripheral motivations increase, the internal motivations of workers are somewhat reduced. Moreover, according to Ryan and Deci (2000), other components of the external motive force may also be external regulations that involve workers acting to satisfy external needs.

However, all these factors come from the perception of the external perceived locus of causality that workers have, so they are all considered peripheral motives.

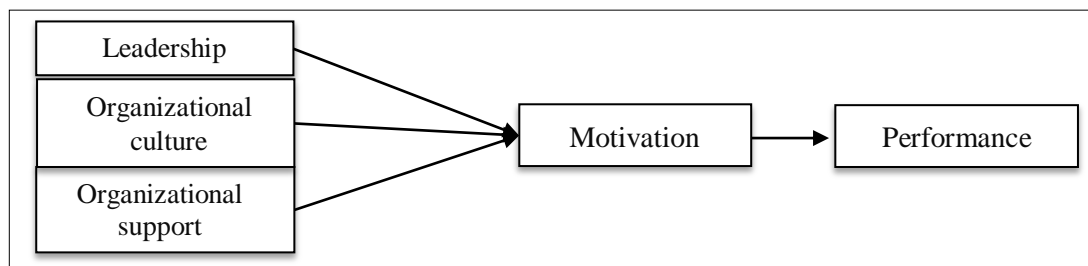
## **2.2. Work Performance**

According to Rothman and Coetzer (2003), performance is the result of achieving results, goals or standards based on the expectations established by the organization. Employees will be assessed how well they do their job compared to the standards. In short, it is the fulfillment of the assigned tasks compared to the standards of accuracy, completeness, cost, duration, proposed initiatives, creativity in solving problems and ability to manage the use of limited resources, time and effort. According to Mathis and Jackson (2009), the results of work are related to the quantity, quality, and timeliness of output, presence, efficiency and effectiveness of completed work.

Brett & Stroh (2003) have shown that employee commitment affects job performance. Employees who work longer hours through research have shown higher work performance and commitment to work. Fort & Voltero (2004) argued that factors affecting employee performance such as clear goals, job expectations, job fit, quick response, skills to do the job, understanding the structure of the organization, the feedback system and encouragement. When studying work performance, previous researchers have found many factors that may affect employees' performance. These factors vary very much in studies, such as personal factors, organizational factors and elements of the corporate environment (Jaramilloa, Mulki & Marshal, 2005; AlAhmadi, 2009).

## **2.3. Relationship between Work Motivation and Performance**

In organizational human resource policies, motivation is considered as “an effective instrument in the hands of managers for inspiring the workforce and creating confidence in it” (Abonam, 2011). By motivating the workforce, management creates “will to work” which is necessary for the achievement of organizational goals (Chhabra, 2010). Said Abdi Mohamud's study (2017) has shown that the reward system and job enrichment have a strong and positive impact on employees, in which development training is also proven to have a relationship with employee performance. According to the results of this study, there is a direct and significant relationship between work motivation and performance, whereby the motivation has positively impact to the performance of Hormuud Company employees in Mogadishu Somalia. Phan Hoang Kim Yen (2013) in the study of the factors affecting the performance of employees at Saigon Paper Joint Stock Company showed that the same motivational factors on efficient work at this organization. Employers' motivation does not appear to be the result of the simultaneous factors including employee resources, their working environment and their work responsibilities. Behavior at work, work performance is the result of the mix of such factors. Nguyen Thi Phuong Thao, Vo Van Viet (2017) studied the factors influencing the teaching effectiveness of lecturers including salary, bonus, co-worker relationship, management and leadership, training and promotion opportunities, facilities, feedback and results. Research results showed that these factors affect the performance of the work of lecturers. Tracy (2013) emphasized four factors that are the basics of motivating to anyone in any organization: (1) leadership style, (2) the reward system, (3) the organizational climate, and (4) the structure of the work. Of which, leadership style can change the psychological climate of the company and, in turn, the whole performance of people in the organization.



*Figure 1. Research Model*

Based on the practical characteristics of enterprises operating in Joint venture enterprises in manufacturing sector in Nghi Son Economic Zone, this study focuses on clarifying 3 motivational factors which may affect to the work of employees: (1) The factor belongs to the leader - Leadership); (2) Organizational culture; (3) Supportive factor (Organizational support). These factors follow Herzberg's model of maintenance factors, which are elements of the working environment of workers, which may include: compensation (support factor group), policies and management regulations as well as business management style (leadership style) and working environment (organizational culture).

### 3. Methodology

An official survey with 4 big projects in Nghi Son EZ which have been put into operation for at least 5 years, with joint venture investment capital between Vietnam and foreign investors was conducted.

Hair et al. (2006) suggested that to use EFA, the minimum sample size might be 50, the better was 100 and the observation rate on measurement variables (items) was 5 : 1; meaning a measurement variable needs minimum 5 observations, preferably 10 : 1 or more. In this research, with 20 observed variables for 5 proposed components, the minimum number of samples needed is:  $20 * 10 = 200$ . In the study, the authors used the balanced stratified sampling method. In this approach, the number of subjects selected from each enterprise is proportional to the size of the number of employees. The total number of questionnaires intended to be issued is 270, divided and calculated proportionally according to the labor rate of each enterprise according to the data in Table 1.

*Table 1. Number of questionnaires divided by number of enterprise's employees*

No.	Projects/ Companies	Number of employees	Number of questionnaires divided by number of employees	Number of valid questionnaire collected
1	Nghi Son Cement Company	612	57	50
2	Nghi Son Refinery and Petrochemical Company, Limited	1332	152	145
3	Fercrom Thanh Hoa Company Limited	100	25	25
4	Northern Nortalic Vegetable Oil Company, Limited	319	36	30
	<b>Total</b>	<b>2363</b>	<b>270</b>	<b>250</b>

In the scope of this research, the scale was built on the basis of the theory of work motivation of employees: Herzberg's model of maintenance factors (1959), Maslow (1943) and Vroom & Brown (1964). They were modified and supplemented to suit research purposes referenced from other researchers in this field (Table 2).

*Table 2. Scale Development*

Factor	Code	Statements	Source
<b>Leadership</b>	LEDER1	The manager presents a clear management vision.	James Gerard Caillier (2014); Bass & Riggio (2006)
	LEDER2	Managers have a strategic mindset.	
	LEDER3	The manager's decision making ability is agile.	
	LEDER4	Managers are firmly committed to service innovation	
<b>Organizational Culture</b>	CULTU1	Communication among employees is being smoothly carried out.	Daniel I. Prajogo (2010), Denison, D.R. and Mishra, A.K. (1995)
	CULTU2	Sharing customer-oriented minds among employees.	
	CULTU3	Employees share market-oriented minds	
	CULTU4	Our company has an atmosphere for creativity development	
<b>Organizational Support</b>	SUPPORT1	Our company is giving physical compensation	Yüksel Gündüz (2014)
	SUPPORT2	Our company fosters and supports people	
	SUPPORT3	Our company supports the business through the management system.	
	SUPPORT4	Our company distributes and supports resources reasonably.	
<b>Motivation</b>	MOTIV1	Our company makes me work more motivated.	Nguyen Quoc Nghi (2014)
	MOTIV2	I think my company recognizes my achievements.	
	MOTIV3	I feel a sense of accomplishment for good performance.	
	MOTIV4	I have a willingness to achieve my goals.	
<b>Performance</b>	PERFO1	I am generally satisfied with my current job.	James Gerard Caillier (2014); Daniel I. Prajogo (2010)
	PERFO2	I have an attachment to my work.	
	PEFOR3	I want to continue my current work.	
	PERFO4	I am satisfied with my relationship with the company.	

The method used to deliver questionnaires is the convenient sampling method, based on the list of employees taken from the administrative organization of the companies. Data collected after being encrypted, was cleaned and tested by SPSS and AMOS 22.

4. Results

*Table 3. General description of the enterprises surveyed in the research*

No.	Name of project	Forms of inves-	Add	Inves- capital (mil \$)	Time
1	Nghi Son Cement Company	Joint venture: Vietnam, Japan	Hai Thuong Commune - Tinh Gia - Thanh Hoa	621.91	30/06/2011 Re-register businesses 24/9/2013
2	Nghi Son Refinery and Petrochemical Company, Limited	Joint venture: Vietnam, Japan & Kuwait	Nghi Son EZ	9,000.00	14/04/2008 Re-register businesses 21/6/2013
3	Fercrom Thanh Hoa Company Limited	Joint venture: Vietnam, & China	Lien Son village, Hai Thuong commune, Tinh Gia, Thanh Hoa	15.00	25/4/2008 Re-register businesses 12/8/2013
4	Northern Vietnam Vegetable Oil Limited Company	Joint venture: Vietnam, & Singapore	Hai Ha Commune - Tinh Gia - Thanh Hoa	71.50	10/6/2013 Re-register businesses 18/10/2013

The 4 enterprises were chosen to survey because of the reasons: (1) They are all manufacturing enterprises so they may have common characteristics and similar human resource structure and management style; (2) they are joint venture companies; (3) operating for 5 years or more (corporate culture has been clearly formed and developed because corporate culture is one of the main factors proposed in this study). These 4 businesses all went into operation in 2013 with the investment capital ranging from 15m to 9000m USD.

*Table 4. Respondents of the survey*

	Respondents	Total	In %
Gender	Male	156	62.4
	Female	94	37.6
	<b>Total</b>	<b>250</b>	<b>100</b>
Nationality	Vietnamese	180	72.0
	Foreigner	70	28.0
	<b>Total</b>	<b>250</b>	<b>100</b>
Educational level	Post graduate	75	30.0
	Bachelor	125	50.0
	Lower	50	20.0
	<b>Total</b>	<b>250</b>	<b>100</b>

The basic information describing the respondents by gender, nationality and education level is presented in Table 4. The total number of questionnaires given out is 270; the number of responses collected was 256, of which 6 questionnaires were rejected due to the lack of information. The number of responses accepted for analysis was 250, ensuring the required sample size determined. In addition, the number of responses collected is also quite balanced according to the labor rate of each enterprise (Table 1). Therefore, the number of valid questionnaires collected ensures the representative of the study.

## 5. Findings

Descriptive statistics on the Leadership scale show that employees in joint venture companies appreciate good leadership style. The most appreciated element in the scale is the “manager presents a clear management vision” (3.94); Next is “The manager's decision making ability is agile” (3.92). Two factors with lower scores on the scale are “Managers are committed to service innovation” and “Managers have a strategic mindset”. However, in general assessment, the elements of leaders are highly appreciated by employees. This proves that the leaders of joint-venture enterprises are often very persistent, clear and have a great influence on their employees.

As for the Organizational Culture element of joint ventures, it can be seen that employees also greatly appreciate the statements on the scale. The scale of almost all factors is assessed at 4 of 5 point, which is a high score, demonstrating the corporate culture in joint ventures has been shown very clearly, has an important effect in determining direction and guidance for employees in the organization to focus on common goals. Especially, the most appreciated factor is "Communication among employees is being smoothly carried out" (mean = 4.02), this proves that communication culture in joint ventures is smoothly.

The most appreciated factor in the scale is the “Organizational Support” factor. All statements on the scale are rated above 4 points; the highest is the factor “Our Company supports the business through the management system”. This proves that the joint venture does not only focus on the style of leadership, organizational culture but also focus on the most essential factor “Support” for employees because it is, in fact, the most important factor to motivate the work motivation of individuals. Currently, Vietnam is still one of the developing countries, the income per capita is low, and the demand for people's lives is almost unmet. However, with the policy of supporting employees placed on top of interest, it has achieved a positive effect in the perception of employees, making them feel secure and satisfied with their dedication to the work.

In term of work motivation factors, in general, the comments of the employees are good, the highest is the assessment of “company recognizes my achievements”, scoring above 4/5. Thanks to that, every employee easily sees that the contribution is always worthy of recognition, which helps to motivate them to repeat their achievements in the future. Therefore, the way that joint venture enterprises are applying to recognize achievements in rewarding employees has a great effect in stimulating workers to achieve higher achievements in their work.

After the EFA, no variables were excluded because the Factor loadings are more than 0.5. The KMO test results and the Rotation are as follows:



*Table 5. KMO and Bartlett's Test*

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.871
Approx. Chi-Square		2882.997
Bartlett's Test of Sphericity	df	190
	Sig.	.000

The variables retained exactly as the groups in the original scale after Factor Loading Step. The results of Reliability Analysis show that the scales both have a strong Cronbach's Alpha Coefficient. The Corrected item - Total correlation of items are all more than 0.3. Thus, the proposed items measure the same concepts and the scales are reliable for using in the next steps.

*Table 6. Reliability Analysis*

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
<b>Leadership</b>	<b>Cronbach's Alpha = 0.889</b>			
LEDER1	11.70	5.473	.751	.861
LEDER2	11.76	4.956	.762	.856
LEDER3	11.72	4.988	.770	.852
LEDER4	11.74	5.155	.751	.860
<b>Organizational Culture</b>	<b>Cronbach's Alpha = 0.785</b>			
CULTU1	11.84	3.846	.576	.742
CULTU 2	11.89	3.714	.717	.670
CULTU 3	11.92	4.133	.503	.778
CULTU 4	11.92	4.038	.585	.737
<b>Organizational Support</b>	<b>Cronbach's Alpha = 0.822</b>			
SUPPORT1	12.40	4.314	.628	.784
SUPPORT 2	12.40	4.104	.749	.729
SUPPORT 3	12.36	4.496	.560	.815
SUPPORT4	12.51	4.235	.653	.773
<b>Motivation</b>	<b>Cronbach's Alpha = 0.902</b>			
MOTIV1	11.79	4.752	.730	.893
MOTIV2	11.70	4.773	.785	.873
MOTIV3	11.86	4.611	.819	.860
MOTIV4	11.81	4.622	.793	.870
<b>Performance</b>	<b>Cronbach's Alpha = 0.876</b>			
PEFOR1	12.15	4.844	.669	.868
PEFOR 2	11.98	4.682	.775	.825
PEFOR 3	11.99	4.964	.714	.849
PEFOR 4	11.95	4.721	.783	.822

The results of confirmatory factor analysis (CFA) showed that Chi-square = 221.838; df = 157 (p = 0.001 < 0.05). Chi-square /df = 1.413 (df < 3) ; TLI = 0.972; CFI = 0.977 (TLI, CFI > 0.9); GFI = 0.915 > 0.8 and RMSEA = 0.041 < 0.08. The research uses structural equation model to assess relevance of the model and reevaluate relationships in the model.

The results of Structural equation modeling indicated that Chi-square = 260.217; df = 162 (p = 0.000 < 0.05); CFI = 0.965, TLI = 0.959, GFI = 0.904 (both more than 0.9) and RMSEA= 0.049 < 0.08. Therefore, it is possible to conclude that the model achieves compatibility with market data.

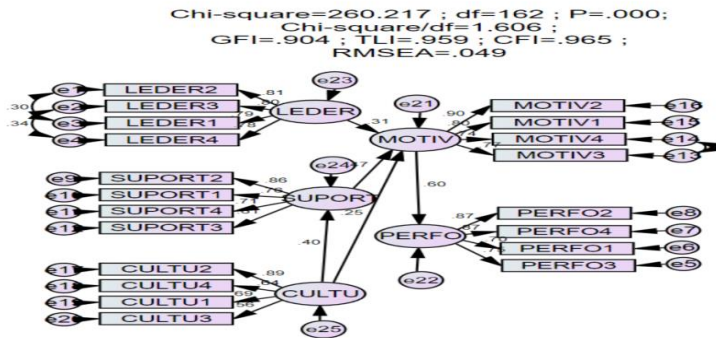


Figure 2. Structural equation model - SEM

The results of Hypothesis Testing after SEM mean that the elements Leadership, Organizational Support and Organizational Culture have a positive impact on Job Motivation of employees and Motivation has positive impact on Performance (Coefficient is 0.609); in which the strongest influence on Motivation is Organizational Support (Coefficient is 0.409), followed by Leadership (0.254), and finally Organizational Culture (0.213). All Hypotheses were accepted.

Table 7. Hypothesis Testing after SEM

	Estimate	S.E.	C.R.	P	Hypothesis	Result
<b>MOTIV &lt;--- LEADER</b>	.254	.055	4.603	***	H1	Accepted
<b>MOTIV &lt;--- SUPOR</b>	.409	.063	6.522	***	H2	Accepted
<b>MOTIV &lt;--- CULTU</b>	.213	.058	3.659	***	H3	Accepted
<b>PERFO &lt;--- MOTIV</b>	.609	.077	7.949	***	H4	Accepted

## 6. Discussion

The scale of motivating components that affect Work Performance after the proposition achieves reliability and permissible values. The results of theoretical model tests showed that all three components affect work motivation, especially Work Motivation affecting Performance. The most powerful component of the motivation is the Organizational Support component. Scientific studies have shown that the spirit of excitement can help promote creativity and increase work efficiency. And to enhance the inspiration of working, it is necessary to elicit passion in the work by well performing both physical and mental support for employees. This is in line with the views of classical researchers such as A. Maslow who claimed that when the minimum to highest human needs are met, they will feel more satisfied and motivated. In empirical studies, this is also proved to be true (Nguyen Thi Phuong Thao, Vo Van Viet, 2017; Morris, 2009; Chhabra, 2010; Abonam, 2011; Said Abdi Mohamud, 2017). Besides, the factor of leaders is also an important factor affecting the motivation for employees according to this research. When the managers show respect, acknowledges dedication and cares about their employees, this not only helps improve the working spirit but also helps them to be more

respectful and eager to work hard and stick long-term with the business. Instead of strict control, managers give the direction and empower employees to be more proactive in their work and they will feel valued (James Gerard Caillier, 2014); Bass & Riggio, 2006). The least impact on Motivation of this study is Organizational Culture. Science and practice have proved that cultural elements are indispensable spiritual dishes of human life, like other material needs. During labor activity, muscle and nerve stress occurs regularly, causing fatigue and psychological stress. Bringing material and spiritual elements into business activities from designing workplaces, working equipment and tools, working style, communication style and leadership style, will reduce the frequency of that stress. In particular, bringing cultural activities can create excitement; erase mental fatigue and stress to help people recover more quickly. The stronger the organizational culture is, the more members of the organization accept the basic values of the organization. When these values are shared widely, intentionally, the commitment of the members will be greater. Strong culture does not only influence the behavior of organizational members, strong culture is also directly related to reducing the level of replacement of workers because strong culture can gather high consensus among members about what their organization has set out to improve productivity and efficiency. Such agreement on purpose will create the bond, loyalty and commitment to the organization of the members (Daniel I. Prajogo, 2010).

## 7. Conclusion

Modern economic theories have shown that human resources are the most important resource of a nation, especially in an organization. Manpower is the most important asset of an organization; this is reflected in a number of aspects such as: the cost of human resources in an organization is difficult to estimate, benefits due to human resources created cannot be specified in a specific way, it can achieve a tremendous value. Manpower in an organization is both a goal and a driving force for the organization's activities. Manpower is the basic element that constitutes an organization, which is a condition for organizations to exist and develop. Therefore, an organization that is assessed as strong or weak depends largely on the effectiveness and quality of its human resources. With the understanding of the relationship between Work Motivation and Working Performance of workers in Nghi Son economic zone, the research wants contributed to orienting more effective solutions to increase motivation and working capacity and performance for employees, contributing to building strong business organizations in the area of Nghi Son economic zone in particular and Thanh Hoa province in general.

## References

- [1] Abonam, N.D. (2011), *The Role of Motivation on Employee Performance in the Public Sector: A Case Study of the University for Development Studies*, WA Campus. Thesis, Institute of Distance Learning, Kwame Nkrumah University of Science and Technology, in Partial Fulfillment of the Requirement for the Degree Bachelor of Arts.
- [2] Al-Ahmadi, H. (2009), Factors affecting performance of hospital nurses in Riyadh Region, Saudi Arabia, *International Journal of Health Care Quality Assurance*, vol.22 no.1, pp.40-54.

- [3] Bass, B. M., & Riggio, R. E. (2006), *Transformational leadership*. Mahwah, NJ: Lawrence Erlbaum.
- [4] Brett, J. M., & Stroh, L. K. (2003), *Working 61 plus hours a week: Why do managers do it*, Journal of Applied Psychology, vol.88, pp.67-78.
- [5] Chhabra, D. (2010), *Branding authenticity*, Tourism Analysis, vol.15(6),. <https://doi.org/10.3727/108354210X12904412050134>, pp.735-740.
- [6] Daniel I. Prajogo (2010), *The relationship between multidimensional organizational culture and performance*, International Journal of Operations & Production Management, vol.31, no.7, pp.712-735.
- [7] Deci et.al. (1999), A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation, *Psychological Bulletin*, vol.125, pp.627-668.
- [8] Nguyen Van Diem, Nguyen Ngoc Quan (2012), *Curriculum of Human Resource Management*, National Economics University Publishing House.
- [9] Fort, A. & Voltero, L. (2004), Factors affecting the performance of maternal health care providers in Armenia, *Human Resources for Health*, vol.2(1):8, pp.114-119
- [10] Hair.Jr., J. F., Black., W. C., Babin., B. J., Anderson., R. E., & L.Tatham., R. (2006). *Multivariate Data Analysis*, New Jersey: Pearson International Edition.
- [11] Hersey, P., Blanchard, K. (1969), *Management of Organizational Behaviour*. Englewood Cliffs, New Jersey: Prentice-Hall, Inc.
- [12] James Gerard Caillier (2014), *Toward a Better Understanding of the Relationship Between Transformational Leadership, Public Service Motivation, Mission Valence, and Employee Performance: A Preliminary Study*, Public Personnel Management, vol.43(2), pp.218-239.
- [13] Jaramillo, F., Mulki, J. P., & Marshall, G.W. (2005), A meta-analysis of the relationship between organizational commitment and salesperson job performance: 25 years of research, *Journal of Business Research*, vol.58(6), pp.705-714.
- [14] Kovach, K.A. (1995), *Employee motivation: Addressing a crucial factor in your organization's performance*. Employment Relations Today, vol.22(2), pp.93-107.
- [15] Lycourgos H. (2012), Examining employee motivation in large scale organizations in Cyprus, *Journal of Business Administration Online*, European University Cyprus, vol 11(2), pp.347-353.
- [16] Mathis, R.L. and Jackson, J.H. (2010), *Human Resource Management*. 13th Edition, South-Western College Publishing, Ohio.
- [17] Morris, J.A., Jr. (2009), *The biology and ecology of invasive Indo-Pacific lionfish*. Ph.D, Dissertation. North Carolina State University, Raleigh, NC. 168p.
- [18] Nguyen Quoc Nghi, Hoang Thi Hong Loc (2014), Developing a theoretical framework on motivation to work in the public sector in Vietnam, *Scientific Journal of Can Tho University*, vol.32.
- [19] Rothman and Coetzer (2003), The big five personality dimensions and job performance, *SA Journal of Industrial Psychology*, vol.29, no.1, pp.66-72.
- [20] Ryan and Deci (2000), Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions, *Contemporary Educational Psychology*, vol.25, pp.54-67.

- [21] Said Abdi Mohamud, Abdiaziz Ahmed Ibrahim and Jamal Mohamud Hussein (2017), The effect of motivation on employee performance: Case study in Hormuud Company in Mogadishu Somalia, *International Journal of Development Research*, vol 07(11):17009-17016.
- [22] Sun Joo Yoo et.al. (2012), The roles of intrinsic motivators and extrinsic motivators in promoting e-learning in the workplace: A case from South Korea, *Computers in Human Behavior*, vol.28, pp.942-950.
- [23] Bui Tat Thang (2017), *Sustainable economic development and issues for public investment*, Development Strategy Institute, Vietnam Ministry of Planning and Investment' website, <https://nif.mof.gov.vn.>, pp.45-49.
- [24] Nguyen Thi Phuong Thao, Vo Van Viet (2017), Factors affecting the teaching effectiveness of lecturers, *VNU Science Review: Education Research*, vol.33,(2), pp.14-22
- [25] Tracy, B. (2013), *Motivation Retrieved from <http://unitec.eblib.com.au/patron/FullRecord.aspx?p=1153982>*.
- [26] Vinay Chaitanya Ganta (2014), Motivation in the workplace to improve the employee performance, *International Journal of Engineering Technology, Management and Applied Sciences*, vol.2(6), pp.221-230.
- [27] Phan Hoang Kim Yen (2013), *Factors affecting the performance of employees' work, typical case studies at Saigon Paper Joint Stock Company*, Master thesis in Ho Chi Minh City Open University.
- [28] Yüksel Gündüz (2014), The Effect of Organizational Support on Organizational Commitment, *Anthropologist*, vol.18(3): 1041-1057.

# SOLUTIONS FOR DEVELOPING AQUACULTURE AND AQUATIC PRODUCTS CONSUMPTION IN COASTAL AREAS OF THANH HOA PROVINCE

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**Abstract:** *Thanh Hoa province which has a coastline of more than 100 km brings many advantages to the development of aquaculture. In recent years, aquaculture has developed rapidly, quite comprehensively, positively contributing to the growth of the agriculture and socio-economic development of coastal districts. However, in the process of producing and consuming aquatic products in these areas, there are still many difficulties and shortcomings. In this study, the authors focus on SWOT analysis to show the potentials and challenges of aquaculture and consumption of some key aquatic products (*Meretrix lyrata* and *Litopenaeus Vannamei*). From which, the authors propose solutions to develop aquaculture and the consumption of those key aquatic products in the coastal area of Thanh Hoa province.*

**Keywords:** *Aquatic products, aquaculture, consuming, *Meretrix lyrata*, *Litopenaeus Vannamei*, coastal area, Thanh Hoa province.*

## 1. Introduction

Fishery is an important industry in the economy of Vietnam. The Prime Minister's Decision No. 332/QD-TTg dated March 3<sup>rd</sup>, 2011, mentioned rapid development of aquaculture in industrialization, modernization, efficiency, high competitiveness and sustainable development orientation; to become the main production industry that provides raw materials for export and domestic consumption; at the same time creating more jobs, increasing income for farmers and fishermen, ensuring social security, contributing to poverty reduction and protecting national security. The Decision No. 1445/QD-TTg dated August 16<sup>th</sup>, 2013 of the Prime Minister clearly stated that the fisheries sector will basically be industrialized by 2020, modernized by 2030 and continue developing comprehensively and effectively and becoming a large production industry, with reasonable production structure and forms, with high productivity, quality, efficiency and competitiveness. The estimated total fishery production would be about 7.0 million tons; Seafood export value would be about 11 billion USD.

The coastal area of Thanh Hoa province, with 6 districts, towns and cities, has potentials for developing aquaculture. Thanh Hoa province plans to orient and focus on raising *Meretrix lyrata* and *Litopenaeus Vannamei* (*Meretrix lyrata* takes advantage of the existing coastal areas, and *Litopenaeus Vannamei* is a product with the orientation to expand

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and meet the needs of consumers with higher efficiency). However, in the process of producing and consuming aquatic products in coastal areas, there are still many difficulties and shortcomings such as: Policy access is not timely and sufficient; consumption market is not stable, production resources such as food, seeds, labor are still weak, the environment is still polluted, etc. Therefore, there should be key solutions to develop aquaculture and consume aquatic products in coastal areas of Thanh Hoa province towards the strategic goals.

In this study, we focus on SWOT analysis to see the potentials and challenges in aquaculture and consumption of aquaculture (*Meretrix lyrata* and *Litopenaeus Vannamei*). From which, we propose solutions to develop farming and consumption of some key aquatic products in the coastal area of Thanh Hoa province.

## 2. Research results and discussion

### 2.1. Current status of cultivating some aquatic products in Thanh Hoa coastal areas

*The aquaculture area is divided by district*

Thanh Hoa province has a coastline of more than 100km; it has many advantages in the development of aquaculture. In recent years, aquaculture has developed rapidly, quite comprehensively, positively contributing to the growth of the agriculture and socio-economic development of coastal districts. With 5 districts including Quang Xuong, Nghi Son, Hoang Hoa, Nga Son, Hau Loc and Sam Son city; aquaculture occupies the majority of the aquaculture area of the province and is increasing. Aquaculture area of the coastal areas in 2019 was 9.358 hectares, accounting for 46,5% of the aquaculture area of the province, the growth rate in 2019 compared to 2015 was 24.4%; This proves the potential for aquaculture in the coastal area of Thanh Hoa province has been exploited popularly.

**Table 1.** Aquaculture area in coastal areas of Thanh Hoa province, 2015 - 2019

Item	Area (ha)					Comparison (%)
	2015	2016	2017	2018	2019	2019/2015
The whole province	16.156	16.340	17.058	18.504	20.098	124.4
Coastal area	<b>7.904</b>	<b>8.026</b>	<b>8.086</b>	<b>8.695</b>	<b>9.358</b>	<b>118.4</b>
Sam Son	58	213	171	158	139	239.7
Hoang Hoa	2.150	2.183	2.384	2.423	2.692	125.2
Nghi Son	1.008	1.022	849	855	1.067	105.9
Quang Xuong	1.450	1.319	1.265	1.377	1.271	87.7
Hau Loc	1.720	1.769	1.768	1.920	2.138	124.3
Nga Son	1.518	1.520	1.649	1.962	2.051	135.1

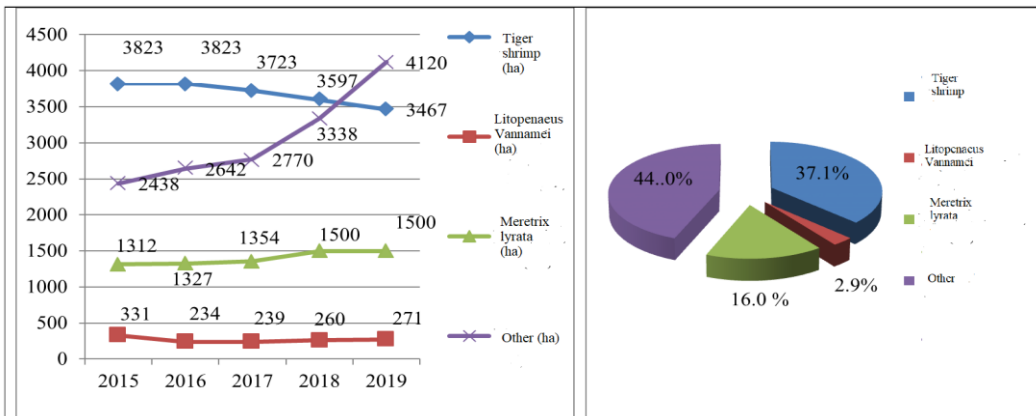
*Source: Thanh Hoa Statistical Office, 2019*

The increase of aquaculture areas in coastal areas shows the right direction under the guiding presented in the Fishery Law of Vietnam, contributing to the strategy of restructuring the fisheries sector of Thanh Hoa province. However, due to regional characteristics, the aquaculture area is unevenly distributed among districts and the development rate is also different. In 2019, Hoang Hoa district had the largest aquaculture area of 2.692 hectares

(accounting for 28,8%) while Hau Loc district reaches 2.138 hectares. The changes in the rate of aquaculture development in different districts are due to the planning of agricultural land for projects; the transition, merge and division of administrative boundaries.

*Area distributed by species*

Coastal aquaculture in Thanh Hoa province is characterized by development of diverse species adapted to the environment. Tiger shrimp as largest farming area and was accounted for 44% of aquaculture area in 2019. The area of tiger shrimp farming is decreasing slightly because many households have invested in infrastructure and technology to switch to intensive farming with the new type of shrimp farming. Therefore, the area of *Litopenaeus Vannamei* has increased significantly, although only 2.9%. *Litopenaeus Vannamei* develops in line with the general trend of Vietnam's shrimp farming industry to meet the tastes of consumers and is the orientation in the development strategy of the aquaculture industry in Thanh Hoa province [3]. That is also very effective, creating jobs for many laborers in the region, but without professional qualifications, it will lead to high risks of unsustainability such as its impact on the farming environment around the region. With the advantage of coastal area, being able to exploit for breeding mollusks, especially *Meretrix lyrata* which is a typical breed of 16% in the war zone. At present, *Meretrix lyrata* concentrates mainly in Hau Loc and Nga Son districts.



**Chart 1.** Area of aquaculture in coastal areas by species, 2015-2019

**Chart 2.** Aquaculture area structure in coastal areas by species in 2019

Source: Summary of reports on fisheries sector in coastal districts 2015-2019

*Productivity and volume of aquaculture in coastal areas*

*Meretrix lyrata* has high productivity (10 tons/ ha/ year) compared to other aquatic species (tiger shrimp is only 0.27 tons/ ha/ year). The remarkable yield of *Litopenaeus Vannamei* averaged 11.54 tons/ ha/ crop), because this farm was usually raised 2 crops/ year, compared with tiger shrimp raised 1 crop/ year. Along with the increase in the aquaculture area, the aquaculture production in the coastal area is quite high, accounting for 55.8% of the total aquaculture production of the province, of which the *Meretrix lyrata* production is the highest with 15.000 tons. Thus, the farming of *Meretrix lyrata* and *Litopenaeus Vannamei* are only in the coastal area.



## ***2.2. Strengths, weaknesses, opportunities and challenges for the development of aquaculture and consumption of some key aquatic products in coastal areas of Thanh Hoa province***

### *2.2.1. Strengths (S)*

Coastal zone has potential of climatic conditions and terrain for the development of aquaculture *Meretrix lyrata*, with 102 km long coastline, stretching along the coast is the river mouth and distributed all districts and cities in the coastal area. The coastal sandy land has an average elevation of 3-6 m; there are large tidal zones that are favorable for *Meretrix lyrata*. This is also a condition for forming the water environment for *Litopenaeus Vannamei*.

More than 20 years experience of raising *Meretrix lyrata* (from 1996 the first clam was kept in Nghi Son, then replicated in the following years, to other coastal districts), and 18 years experience of raising *Litopenaeus Vannamei* (starting from 2002).

Road and waterway transportation in coastal areas is convenient for trade, tourism development, creating opportunities for the consumption of aquatic products (Tourism in Sam Son, Hai Tien, Hai Hoa, Quang Loi, etc.). In 2019 - 2020, Sam Son city, and Nghi Son town has created more advantages in developing the aquatic products consumption market in general and for *Meretrix lyrata* and *Litopenaeus Vannamei* in particular.

*Meretrix lyrata* and *Litopenaeus Vannamei* is exported products, which have majority market in China and the EU. In the future, the market share and product consumption in other countries is also gradually expanding.

### *2.2.2. Weaknesses (W)*

The productivity of *Meretrix lyrata* and *Litopenaeus Vannamei* are low compared to other regions, such as Nam Dinh reached 17 tons/ ha/ year (Coastal area of Thanh Hoa province reached 10 tons/ ha/ year). The quality of *Meretrix lyrata* is still low, the consistency and uniformity of the clam is not high. *Litopenaeus Vannamei* productivity in the coastal area of Thanh Hoa province reached about 11 tons/ ha/ crop, meanwhile the Southern Provinces achieved higher productivity.

The level of access to policies related to farming aquatic products is limited, only through the passive direction of agricultural extension workers and local authorities. The farmers' have not yet grasped the opportunity to access.

Aquatic product processing facilities are weak: *Meretrix lyrata* processing factories are not yet available in the area. Some shrimp processing and exporting factories have weak infrastructure, few functions of collecting, preliminarily processing and preserving fresh products for export.

The association is simple, not effective yet. Vertical and horizontal linking is still simple; it has not been paid much attention. This is a difficulty in farming and consumption, especially the weakness in chain linkage.

The consumer market is not stable, the export market share is not large; almost products from *Meretrix lyrata* of Thanh Hoa are only for domestic consumption or small export to the Chinese market. The main reason is the change in color of *Meretrix lyrata* and

poor quality. This is due to the high density of *Meretrix lyrata* and water sources are polluted in many places. The product's origin has not been traced. Modern channels of consumption are still limited and difficult.

Farming conditions: Inadequate infrastructure, seed supply is difficult, quality labor is low, lack of capital is the difficulties in raising *Meretrix lyrata* and shrimp.

### 2.2.3. *Opportunities (O)*

Convenient international exchange is an opportunity to develop markets for products, especially when Vietnam joins world organizations. Especially in the context of the development orientation of Thanh Hoa province is to become one of the four northern economic poles along with Hanoi, Quang Ninh and Hai Phong.

The area of tiger shrimp farming to *Litopenaeus Vannamei* farming is being encouraged and selected. The planned farming area in 2025 will reach 710 hectares (also possibly expanding to 450 hectares) [3].

Government attention: The orientation of restructuring the fisheries and aquaculture sector has also been interested in such as supporting policies on bidding for *Meretrix lyrata* farm, loan policy for changing shrimp farming areas, guidance on technical support, fishery infrastructure has been upgraded and newly built by the province and localities.

Consumers tend to use natural products, replacing other food, so they tend to use *Meretrix lyrata* and *Vannamei* Shrimp.

Export potential: *Meretrix lyrata* and *Litopenaeus Vannamei* are two products with relatively large export volume. It is forecasted that by 2025, *Litopenaeus Vannamei* of Vietnam will be exported to US with the value of \$6541 million (76% of shrimp export value) [5].

### 2.2.4. *Threats(T)*

There are many seafood products competing with *Meretrix lyrata* and *Litopenaeus Vannamei* in the coastal area of Thanh Hoa province (There are 28 coastal provinces in the whole country; many coastal areas thrive to raise *Meretrix lyrata* and *Litopenaeus Vannamei*).

Pollution from aquaculture, seafood processing, and polluted water cause risks in farming. Climate change also affects aquaculture. The waste treatment in the *Litopenaeus Vannamei* farming areas still has many facilities that do not arrange settling ponds or do not ensure the capacity to store and filter wastewater. This causes the risk of environmental pollution, causes epidemics to spread and breaks out in concentrated aquaculture areas, etc.

Climate change has a negative impact on the agricultural sector. *Meretrix lyrata* and *Litopenaeus Vannamei* have a quite strong impact; (1) Effect of temperature: An increasing in temperature could reduce fisheries production in ponds and lakes; (2) The effects of droughts, floods, and thunderstorms, decreasing salinity in ponds suddenly beyond the tolerance level, causing shock, death or slow growth; (3) Impacts of sea level rise on the fisheries sector [4].

From there, the SWOT model is built in Table 2.

*Table 2. SWOT model*

<b>SWOT</b>	<p><b>Opportunities (O)</b>                  Convenient international exchange.                  The ability to expand the farming area of Litopenaeus Vannamei is still large.                  The attention of the State.                  Needs of consumers increasing.                  Litopenaeus Vannamei is Having the most potential to export.</p>	<p><b>Threats(T)</b>                  There are many competitive products.                  Pollution from aquaculture wastewater,seafood processing.                  Climate Change</p>
<p><b>Strengths (S)</b>                  There is potential in natural conditions.                  Experienced in farming.                  Road and waterway traffic is convenient.                  Export product</p>	<p><b>Strengths - Opportunities (SO)</b>                  Expanding export markets.                  Expanding the farming area of Litopenaeus Vannamei like implementing the planning of the farming area.                  Creating conditions to register the origin of products; issuing Viet GAP certificate to Viet GAP farm.</p>	<p><b>Strengths - Threats (ST)</b>                  Searching for new consumer markets.                  Increasing application of technical progress.                  Taking solutions to reduce environmental pollution.</p>
<p><b>Weaknesses (W)</b>                  The productivity of Meretrix lyrata and Vannamei Shrimps is low compared to other regions.                  Missing policies; Policy access remains difficult.                  Aquatic product processing establishments are weak.                  The association is simple, not effective yet.                  The consumer market is not stable; the share of export is not broad.                  The conditions for farming:                  Infrastructure is weak; Limited quality seed supply, control of feed for Litopenaeus Vannamei is difficult; The quality of labor has not met the requirements of farming techniques, the capacity to access the market is limited; Lack of funds.</p>	<p><b>Weaknesses - Opportunities (WO)</b>                  Complete policy; Improve access to policies for Meretrix lyrata and Litopenaeus Vannamei farming in terms of capital.                  Encouraging investment in developing and processing aquaculture.                  Strengthening links in farming and consumption of Litopenaeus Vannamei, Meretrix lyrata, especially chain linkage.                  Promoting investment and awareness of high quality seed.                  Increasing investment in regional infrastructure for Meretrix lyrata and Litopenaeus Vannamei; support for production loans, control seed and feed supply.                  Train to improve the quality of labor to meet farming techniques and improve the capacity to access consumer markets.</p>	<p><b>Weaknesses - Threats (WT)</b>                  Exploiting market in the province.                  Orienting farmers to aware and adapt to climate change.                  Controlling imported seed.</p>

### **3. Some solutions to develop farming and consumption of some key aquatic products in coastal areas of Thanh Hoa province**

*First, Complete and improve the accessibility of policies, plan to support farming and consumption of some key aquatic products:* It is necessary to have policies which support production, capital, seeds, supplies, advanced scientific and technological approach, technical training, infrastructure and farming areas; linking production and consumption; attracting businesses to participate in the production chain; Research and implement insurance policies in fisheries, especially insurance policy for key seafood products; Continue to improve the policy access, planning aquaculture, vertical management functions.

*Second, strengthen chain linkage, reorganize production by value chain from raw material production to processing and consumption; Building typical chain models for zones:* Reorganizing production in the value chain from raw material production to consumption processing, creating cohesion, profit and risk sharing between raw material producers and seafood processing enterprises; Strengthening the linkage of 4 partners: government, scientists, businesses and farmers; ensuring the rights farmers; create conditions for farmers to feel secure in production; Pilot construction link farming and consumption of *Meretrix lyrata* and *vannamei* shrimp at one of the areas, then continues to replicate typical model other districts in coastal areas; Developing models of cooperative groups, fisheries cooperatives and community management practices .

*Third, increase production conditions to improve efficiency for aquaculture and consumption:* (1) The farmers need to perform construction and infrastructure sufficient to handle pollution of aquaculture water (for *vannamei*, they need to invest in building settling ponds to treat the water environment); Focus on investment and planning infrastructure for farming areas from tiger shrimp to *Litopenaeus Vannamei*; (2) Strengthen technical training program for aquaculture households, need to pay attention to popularization market news, market approach for households; (3) Encourage banks and credit institutions to participate in the strategic linkage between banks - enterprises - households; (4) Seed in the province did not meet, need to actively seed source; (5) For feed supply: select suppliers, respect feed ingredients carefully and consult technical experts.

*Fourth, promote the application of technical advances in aquaculture to improve productivity and enhance climate change adaptive capacity:* Develop VietGAP farming model to meet product quality trends and reduce disease risks.

*Fifth, stabilize and develop the aquaculture consumption market:* Building a joint venture mechanism, linkage between aquaculture farmers as raw material areas with businesses; Planning to develop a system of processing factories and commercial cold storage to increase efficiency and regulate a stable source of raw materials; Developing modern distribution channels in seafood consumption to encourage farmers to consume through contracts with restaurants, processing enterprises, etc.

*Sixth, minimize water pollution in aquaculture:* For farmers, perfecting the infrastructure system for farming, environmental treatment when epidemic outbreaks occur. For processing facilities, focus on investment and operation of centralized collection systems, rational

classification of industrial and domestic solid waste; manage, store and transfer hazardous solid waste in accordance with regulations. For State, propagate and raise community awareness about the responsibility of environmental protection, strengthen inspection and control. For communities in farming areas, carry out monitoring communities, concentrated farming areas should have community management solutions in the management of the water environment.

#### 4. Conclusion

Exploiting the advantages of coastal areas in order to develop suitable types of aquatic products is the restructuring strategy of Thanh Hoa province in the direction of increasing added value and promoting development of seafood consumption in coastal areas by sustainable direction. Solutions to develop aquaculture and consuming aquatic products for coastal areas in Thanh Hoa province will be the basis to ensure stable output, also support original traceability, improve product reputation, and increase competitiveness to bring higher economic efficiency to aquatic products in general and *Litopenaeus Vannamei* and *Meretrix lyrata* in particular for the coastal areas of Thanh Hoa province.

#### References

- [1] Division of Agriculture and Rural Development in coastal districts (2015-2019), *Report on the fisheries sector in coastal districts in 2015-2019*.
- [2] Institute of Fisheries Economics and Planning (2016), *Report on restructuring of Vietnam's fisheries sector*.
- [3] Institute of Fisheries Economy and Planning (2016), *Fisheries Development Planning to 2020 with a vision to 2030*.
- [4] Pham Thi Ngoc, Nguyen Thi Duong Nga and To Dung Tien (2016), Development of sustainable clam farming in coastal areas of Thanh Hoa province, *Journal of Agriculture and Rural Development*, 295 (8): 96-104.
- [5] Thanh Hoa Provincial People's Committee (2014), *Irrigation master plan of Thanh Hoa province to 2020 and orientation to 2030*.
- [6] Thanh Hoa Statistical Office (2019), *Thanh Hoa Statistical Yearbook 2019*, Statistics Publish House.
- [7] Nguyen Thi Thuy Vinh (2014), *An analysis of the fisheries value chain of Nghe An province*. Economic doctoral thesis, Vietnam Academy of Agriculture.

## DEVELOPING SOCIAL COMMUNICATION SKILLS OF CHILDREN WITH AUTISM SPECTRUM DISORDERS AT PRESCHOOLS

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**Abstract:** *In recent years, the number of children with autism spectrum disorders is increasing rapidly, these children's need to learn and play is like many other children. However, defects in social interaction and communication are a barrier that make it difficult for them to participate in activities with their peers at school. Therefore, to create opportunities for children to integrate into the community, the role of the teacher in the process of organizing preschool activities is very important. This article provides some measures to developing social communication skills of children with autism spectrum disorders at preschools such as: Adjusting the classroom environment to encourage the communication of the children with autism spectrum disorders; Developing social communication skills based on an individualized education plan; Stimulating children with autism spectrum disorder to join play groups; Developing social interaction skills for children with autism spectrum disorders; Supporting language and communication of children with autism spectrum disorders; Coordinating with parents to support children with autism spectrum disorders in family activities. Research results will suggest preschool teachers in supporting children with autism spectrum disorder to develop communication skills when they participate in activities with their peers in preschool.*

**Keywords:** *Inclusive education, social communication skills, children with autism spectrum disorders, Kindergarten.*

### 1. Introduction

The right to access education of children with disabilities in general and children with autism spectrum disorder (ASD) in particular has always been affirmed in international documents, State policies and educational practice in Vietnam [11, 7]. The purpose of inclusive education is to create opportunities for children with autism spectrum disorders (ASDs) to integrate into the community, overcoming barriers caused by the effects of disabilities to access educational services. Early intervention and therapies are methods to help children with autism develop and integrate with the community, recent studies always aim to find measures to support them [2, 3, 5]. Timmons. V. et al. (2006) pointed out some language and communication difficulties of autistic children such as: Limited eye contact, not actively interacting with others, on the basis of which offers some ways to educate children in the inclusive classroom [10, 12]. Besides, some researchers also gave some ways to develop communication skills and adjust linguistic behavior for children with autism to integrate in

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preschool through educational activities and use of functional exercises [8, 9]. It shows that the educational environment in preschool plays an important role in supporting children with autism, stimulating them to communicate through interaction with their peers.

Currently, most children with autism spectrum disorders have been integrated into preschools. The organization of inclusive education is considered as an important educational goal in the intervention and therapy for children, basically meeting their needs and parents. However, it is difficult in educating them to integrate in preschool. In which many reasons stem from the competencies of preschool teachers [6]. Therefore, developing communicative skill of children with autism spectrum disorders in preschool is a priority task, at the same time, orient for fostering a responsive preschool teacher with the goal of teaching children with ASDs and equipping them for the next levels

## **2. The reaserch content**

### ***2.1. What is inclusive education?***

According to UNESCO 2009, inclusive education is an ongoing process that aims to provide quality education for all, respecting diversity, differences in learning needs, abilities, characteristics and expectations of students, the community as well as the elimination of all forms of discrimination [3]. The concept of inclusive education is linked to equality, social equity and every child's opportunity to participate. Inclusive education is seen as welcoming, creating values, empowering and helping all children to learn their knowledge and social skills in a common environment and a place to achieve their goals. The goal of quality inclusive education is the basis for achieving human, social and economic development. Besides, some other researchers said that inclusive education is the support for all children, including children with disabilities, to equally receive educational services with necessary supports in the classroom, at school, local in order to prepare them to become useful members of society [7].

According to the article 15 of the Education Law, inclusive education is a mode of education aimed at meeting the different needs and abilities of learners; ensure the right to equal learning, educational quality, and suit the needs, characteristics and capabilities of learners; respect for the diversity of learners and do not discriminate. The State adopts policies to support the implementation of inclusive education for learners being children with special circumstances in accordance with the Law on Children and other relevant laws.

Thus, inclusive education for children with autism spectrum disorders (ASDs) is also considered an educational method that meets the needs and abilities of each autistic spectrum disorder child, ensuring the right to equal learning and quality of education, in accordance with the children's needs, characteristics and abilities; respecting for diversity, differences and not discriminating against children with autism.

### ***2.2. The children with autism spectrum disorders***

ASDs are considered a brain developmental disorder that affects the ability to communicate and build up personal social relationships. Currently, there are many disagreements about the definition of autism as well as its relationship with childhood disabilities, including all learning and language difficulties. There are many opinions and

theories that have been made about the autism. According to the American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders (DSM - V), Autism Spectrum Disorders) are a lifelong developmental disability that usually occurs during the first three years of life. It is caused by a neurological disorder that affects the functioning of the brain. It can appear in any individual, regardless of gender, nationality or socioeconomic status [1]. ASDs have been identified with the three basic types of difficulty as follows:

- Difficulties in communicating and interacting with others;
- Limiting interests and stereotyped behavior;
- Symptoms impairing their abilities to perform functions in school, work, and other fields normally.

Autism Spectrum Disorder is a complex neurobiological disorder that is characterized by difficulty in communicating verbally and relating socially to others, alongside a need to engage in repetitive behaviors or language. Some common early signs noted by parents are delayed speech, restricted interests, not responding when called by name, and avoiding eye contact.

### ***2.3. The goals of developing social communication skills for children with autism spectrum disorders at preschool***

Inclusive education for children with ASDs has been strongly developed in the past two decades. In the years of 1999 - 2001, with the support of a number of international organizations such as UNICEF, CRS, the Vietnam - Netherlands Health Committee, many large-scale projects on early intervention and inclusive education for children with disabilities in general and children in particular are carried out in a number of major cities across the country. These projects have made a significant contribution to building and developing human resources for the special education sector in our country, in which early intervention and inclusive education for children of pre-school children get a lot of attention. However, in addition to these achievements, inclusive education for children with disabilities in general and autistic spectrum disorder in particular is still facing many difficulties. Some of the barriers affecting the quality of inclusive education for children with ASDs can be mentioned such as: Awareness of social communities on inclusive education, quality of management staff and preschool teachers, school environment practice and activities of children in inclusive learning, policy issues, mechanisms, programs, documents, facilities, equipment for inclusive education, and participation of communal forces festival. These are difficulties affecting the organization of inclusive education for children with autism spectrum disorders in preschools.

Preschool education program issued under Circular No.17/2009/TT-BGDĐT dated July 25, 2009 and amended according to Circular 28/2016/TT-BGDĐT dated December 30, 2016 was compiled based on point towards the comprehensive development of children, creating conditions for all children to develop continuously and ensuring to meet the diversity of regions and child groups [7]. Applying the preschool program to the process of caring and educating children with disabilities also poses a challenge for preschool teachers. The guiding documents for the implementation of the preschool program with suggestions for the care and education of children with disabilities are only orientation, reference sources about the content, methods and forms of organization and operation to educate children with ASDs have many limitations. Therefore, the goal of organizing an inclusive education for children



with autistic is to help children have opportunities to develop themselves, overcome the limited difficulties caused by the effects of disabilities and access educational services like all children. Through organizing inclusive education for children with autism spectrum disorder, it will aim to support them to communicate and interact better. They know how to flexibly apply their own communication experiences, at the same time, through the support from the teacher, the process of interacting with the classmates, they will know how to use language and non-verbal elements. In addition, the goal of teaching social communication skills also stimulates children to actively interact with their peers, establish relationships with people around them. In addition, teaching social communication for children with ASDs to intergrade in preschool also helps their parents and relatives believe in their development, reduce family's worries about the ability of children with ASDs to integrate into the community.

#### ***2.4. Measures of developing social communication skills for children with autism spectrum disorders in preschools***

*Measure 1: Adjusting the classroom environment to encourage children with ASDs to communicate with other peers*

The classroom environment has a great influence on the interaction and communication process between autistic children and their peers. Therefore, in order to stimulate them to communicate and express language during activities, it is necessary to pay attention to adjust the classroom environment, including the physical environment and psychosocial environment.

Adjusting the physical environment: Teachers select and rearrange classroom utensils and toys to suit their active topics and interests, ensure children's safety, and stimulate interaction between children with autism and their peers and vice versa.

Adjusting the psychological environment positively stimulates the autistic children to communicate: Help them feel safe, friendly, and barrier-free, teachers should adjust ways of communicating and interacting with children in all activities including welcoming children. Create feelings and emotions through talking with children with ASDs, praise them for their efforts that children have made during participating in school activities. Enhance interactions with the children in all activities so that they feel respected. Involve them in activities, promote their communication needs, use their appropriate language, pay attention to the use of non-verbal elements such as eye contact, facial expressions and gestures.

*Measure 2: Developing social communication skills based on an individualized education plan*

In addition to the educational program that is applied to all children, the children with ASDs also need an individual educational plan. Individual education plans help to create opportunities for children to achieve success, achieve set goals and make children feel successful, creating confidence and motivation to continue participating in activities. Therefore, individual education plans help teachers systematically achieve their educational goals. Identify the children's abilities, advantages and disadvantages when they interact with others around them. So, teachers will be more proactive in choosing the contents, methods, and forms that are suitable for the children's characteristics towards educational goals for

them. Adjusting plans and ways of impact to support children to integrate in preschool. In individual education plans, teachers need to focus on some of the following:

Determine educational goals for children with ASDs in the process of integrating.

Choose activities to develop skills for the children with ASDs.

Clearly define the goals, contents and ways of impacting each game in the education of inclusive kindergarten children.

Adjust the children's assessment to stimulate children to communicate and interact in other activities.

*Measure 3: Stimulating children with autism spectrum disorders to join play groups*

Participating in play groups has important implications for the development of children in general and the children with ASDs in particular. The children with ASDs have serious communication and social interaction disabilities, group play helps children with autism integrate with their peers of the same age, and encourages their friends in the group to play to communicate with autistic children. Through play groups, children will develop important social skills, especially the rule of turning and interacting with each other through appropriate eyes and facial expressions

The teacher identifies the children's difficulties in group play to choose the appropriate play contents, needs and interests with the aim of connecting friends with autistic children and friends in the group play, step by step supporting children to overcome language and communication barriers. Teachers can choose from different play groups to stimulate children to interact and socialize with their peers. However, when they joins the play group, the teacher needs to choose the content that attracts their interest and other friends towards the development of the children's essential skills. The teacher should encourage the children in the play group to interact with the children with ASDs by different methods, such as creating situations during play, talking face-to-face with children to involve them in play activities..

*Measure 4: Developing social communication skills of children with autism spectrum disorders through daily activities at preschool*

Teaching social communication skill to children with autism spectrum disorders in preschool will help them feel confident and reduce feelings of loneliness, frustration and abandoned in school activities. Besides, It is also a way to practice and develop a number of skills for them such as language skills, interactive skills; cognitive skills or motor skills.

Teachers observe the process of children participating in activities with their peers to recognize the difficulties they are facing, what barriers make it difficult for them to integrate with their peers to have a plan to support and help them. This support is done by direct interaction, or indirect interaction. Teachers can choose learning activities or play activities that give priority to activities that the children are interested in. After that, the teachers base on the classroom education plan to encourage the child to enter some activities where the child is still facing many difficulties. Every child with autism spectrum disorder has unique needs and abilities. Therefore, the selection of educational content must be based on the unique characteristics of each child, such as language restrictions, communication and social interaction, other children with behavioral disorders or tutoring syndrome "Attention Deficit - Hyperactivity Disorder" (AD/ HD) to have appropriate educational measures. Thus, the support for children with autism spectrum

disorder through personal education will create a sense of safety, reduce anxiety and isolation when they attend preschool. In addition, supporting the children also helps teachers to grasp the child's development level, see the progress in each play session, and recognize the child's difficulties in order to promptly adjust the support in individual education plan.

*Measure 5: Developing social interaction skills of children with autism spectrum disorders*

One of the most noticeable defects in children with autism spectrum disorder is social interaction skills, which is the reason why children have difficulty in joining activities at school. Therefore, developing social interaction skills to help children integrate into the community and actively participate in activities with their peers at preschool.

Teachers attract children's attention to school activities, even at the time of picking up and dropping off children, teachers need to pay attention to coordinate with parents to teach children to interact with teachers such as: greetings, express joy, say goodbye. Encourage autistic children to participate in group activities and group games. During the playing time, teachers need to maintain children's attention by calling their names often but purpose fully, using visual stimuli and symbols to maintain children's listening attention. When children with autism spectrum disorder tend to be isolated, or alone, they often play alone with their own interests in one area of the classroom, at school, and teachers connect with them regularly for them feel closeness, safety and express their needs and interests. On the other hand, the teacher encourages the peers, in the group to play support for children with autism and share some of their difficulties and gradually accept their differences.

*Measure 6: Supporting language and communication of children with autism spectrum disorders*

Language and communication of children with autism spectrum disorders are more limited than other children. Therefore, their learning and playing in preschool face many difficulties. Therefore, education of language and communication for children with autism spectrum disorders through school activities have an important role, to help them have a positive communication environment to interact with peers. On the other hand, the education of language and communication skills for children with autism spectrum disorder in preschool is also an intervention measure and therapy for children, limiting defects that make it difficult for children to integrate into the community and step by step help them become normal people like many other peers.

Teachers need to create a positive communication environment in the classroom, take regular care of the children, talk to them, combine attentive gestures so that children feel close, friendly and safe. When children participate in activities with their peers, the teacher needs to create excitement so that the child will be impressed and interested in what's happening. Call out children's names regularly while active activities are in progress to attract children's attention, stimulate children to communicate.

Encouraging children every time they complete a task, it could be words in front of their peers or by gestures that show closeness and love like holding the baby or gently touching the child's shoulder or head. In addition, through each activity, the teacher encourages children to use spoken language and make eye contact, smiles, and suggestions for children to use sentence patterns while communicating with their peers, for example: If the child can say the word "ball", the teacher should practice her to speak poorly with adjectives such as "the blue ball". On the contrary, the teacher encourages the other

classmates to stay close to the child, often play and support the child when the child shows signs of alienation to play alone. Teachers use everyday situations and topics that their classmates are interested in to create opportunities for children to interact with their peers on different communication topics. Encourage your child to communicate with different responses such as clapping, smiling, and cuddling so that he or she understands and wants to interact in a variety of preschool activities.

Teaching the children to communicate through personal education plans. In each activity, the teacher spends 10 - 15 minutes practising with the child, noting the communication difficulties that autistic children are facing such as: verbal skill; nonverbal; skills.

*Measure 7: Coordinating with parents to support children with autism spectrum disorder in family activities*

In order to follow a child's progress, schools and parents need a close coordination that will find ways to support children and development strategies through interactive family activities. A positive educational environment is a place where families can always share information about children's education and development at school, especially finding it difficult to plan intervention and support for children.

Teachers need to share about some educational methods for children to apply when children play at home. In addition, suggesting some activities to stimulate children to interact, communicate such as playing with children anytime, anywhere, chatting often at different times and needing attention to practice overall communication skills for children at home. In addition, teachers also need to discuss children's shortcomings while playing with their peers, inappropriate behaviors, and teachers' difficulties when educating children at school. On the contrary, a child's parents can share their child's progress on a daily basis, even if it is a very small change, while also providing the teacher with their child's unique traits for them to adjust to support children in classroom activities. Therefore, teachers can communicate directly with parents at pick up times or through other means. The coordination between teachers and parents of children will create an equal and friendly educational environment, demonstrating the right to access education for all children.

### **3. Conclusion**

The educational environment in preschool plays an important role in the process of intervention and therapy for children with autism spectrum disorders. The goal of teaching social communication skills for them in kindergatens is to create opportunities for children to establish and interact with other children, helping them integrate into the community. Besides, it helps parents to believe in their child's communication skill development, see the child as well as many other children. Children with autism spectrum disorders have communication and social interaction defects, building educational goals through preschool activities requires teachers to have understandings and skills at caring and educating the child, at the same time, it is necessary to know how to adjust the ways to support children through group activities and individual educational activities. Creating a positive psychological environment to stimulate children to participate in activities with their peers. The proposed measures will suggest teachers and children's parents in the process of

educating social communication skill of children with autism spectrum disorders in preschools which will support them to integrate into the community, get into high school and make contributions to society. The application of measures to develop communication skills of children with autism spectrum disorders in inclusive classes in preschools needs to be flexible and based on each child's ability. In addition, preschool teachers need to evaluate and monitor the child's communication skills development based on individual education plans to apply appropriate educational measures to support early integration into the community.

## References

- [1] American Psychiatric Association (APA).(2013), *Desk Reference to the Diagnostic Criteria from DSM - 5*: American Psychiatric Publishing.
- [2] Brock, J., Norbury, C. F., Einav, S., Nation, K,. (2008), Do individuals with autism process words in context?
- [3] Chita-Tegmark, M., Arunachalam, S., Nelson, C.A.,Tager-Flusberg, H,. (2015), Eye-trackingmeasurements of language processing: Developmental differences in children at high risk for ASD, *Journal of Autism and Developmental Disorders*, 45, 3327-3338.
- [4] Evidence from language-mediated eye-movements, *Cognition*, <https://doi.org/10.1016/j.j.108>, 896-904.
- [5] Guillon, Q., Hadjikhani, N., Baduel, S.Rogé, B,. (2014), Visual social attention in autism spectrum disorder: Insights from eye tracking studies, *Neuroscience and Biobehavioral Reviews*, 42, 279-297.
- [6] H.S.Hung (2019), Approach to inclusive education to develop communication skills for children with disabilities. *HNUE Science Journal* , 64(9AB), 193 -198.
- [7] Ly, L. T. B., Lâm, B. T., & Nho, H. T. (2015), *Inclusive Education for Children with Disabilities for Preschool*: Hanoi National University of Education, Publishing House.
- [8] N. T. Thanh (2014), *Measures to develop communication skills for autistic children 3-4 years old*.PhD thesis, Vietnam Educational Science Institute
- [9] Đ.T.Thuy (2008), *Develop overall communication development exercises for autistic children of preschoolers*. Retrieved from, ministry level scientific research
- [10] Timmons., V., Breitenbach., M., MEd., BCBA., MacIsaac., M., & MEd(c). (2006), *Educating Children about Autism in an Inclusive Classroom*.
- [11] United Nations Convention on the Rights of the Child. (1989), Retrieved from <https://www.unicef.es/causas/derechos-ninos/convencion-derechos-ninos>, <https://www.ohchr.org/RU/ProfessionalInterest/Pages/CRC.aspx>
- [12] Zhou., P., Zhan., L., & Ma., H. (2018), Predictive Language Processing in Preschool Children with Autism Spectrum Disorder: An Eye-Tracking Study, *Journal of Psycholinguistic Research*.

## ISOLATION AND MASS PRODUCTION OF *TRICHODERMA*

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**Abstract:** *Three Trichoderma isolates (THDU-1, THDU-2, and THDU-3) were isolated from the root zone area of healthy bananas on the farm in Ba Thuoc district, Thanh Hoa province. All of these isolates showed high inhibitory activity against soil borne diseases Rhizoctonia solani and Sclerotium rolfsii. Our study proposed a protocol of Trichoderma mass multiplication using rice media based on solid substrate fermentation (SSF) to produce commercial product of Trichoderma.*

**Keywords:** *Trichoderma, isolation, conidia, conidial propagation, Rhizotonia solani, Sclerotium rolfsii.*

### 1. Introduction

*Trichoderma* spp. are free-living fungi and common in soil and root ecosystems. They are versatile, ubiquitous filamentous fungi, colonizing dead organic matter, and in beneficial endophytic associations with plant species. Their capability to synthesize antagonistic compounds (proteins, enzymes, and antibiotics) and micro-nutrients (vitamins, hormones, and minerals) enhance their biocontrol activity. Therefore, *Trichoderma* species are the most commonly used biological control agent against several soil borne fungal pathogens (fungi, bacteria, and nematodes) [2, 9, 13]. Effective biocontrol is achieved through a combination of mechanisms including mycoparasitism, competition for nutrients and/ or space, antibiosis, and induction of systemic resistance [1, 4, 10, 11, 15, 16]. Moreover, *Trichoderma* species also possess ability to promote plant growth and soil remediation activity through production of solubilizing enzymes, and phytohormones [3].

*Trichoderma* spp. produces three kinds of propagules: hyphae, chlamydo spores, and conidia [13]. Chlamydo spores and conidia have been commonly used as the active ingredients in most *Trichoderma* spp. based products [5, 6, 8] due to reproduce well in culture. *Trichoderma* sp is multiplied by solid and liquid fermentation methods [14]. However, solid substrate fermentation is the most common method for *Trichoderma* mass-scale production for commercial use because of low cost of bedding materials with high yielding and environmental safe. The success of the biocontrol agent depends much on the establishment of the product, the formulation and delivery system.

The current research aims at isolating the indigenous *Trichoderma* spp. and designing of solid substrate fermentation to optimize inoculum production using easily available and low cost agricultural residues combination.

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## 2. Materials and Methods

### 2.1. Isolation of native antagonistic *Trichoderma* spp. from plant roots

Root samples were collected from the root zone area of healthy bananas on the farm in Ba Thuoc district, Thanh Hoa province, Vietnam. The root samples were washed under tap water to remove bulk soil and cut into pieces of approximately 1.5 cm in lengths with a sterilized knife. *Trichoderma* spp. was isolated from roots pieces using the potato dextrose agar (PDA) amended with streptomycin (1 g/L). The cultures were incubated at room temperature (26°C) for 7 days, at which time colonies can be subcultured onto new plates to obtain pure cultures.

### 2.2. Isolation of native antagonistic *Trichoderma* spp. from rhizosphere soil samples

15g of rhizosphere soil samples around the roots soil were collected from rhizosphere of healthy plants in Ba Thuoc district, Thanh Hoa province, Vietnam. The samples were stored at 4-8°C until ready for processing. Add 15 g soil sample to 9 mL sterilized distilled water (SDW) in universal bottles. The samples were shook for 10 min at maximum speed and then leave to stand for 10 min. Dilute 100, 1000, and 10 000 fold and plate 1 mL onto PDA plates amended with streptomycin (1 g/L) for each dilution. Petri plates were sealed and incubated at room temperature (26°C) for 7 days, at that time colonies can be subcultured onto new plates to obtain pure cultures.

### 2.3. Antagonistic activity of *Trichoderma* isolates

Isolates of *Trichoderma* were tested for their inhibitory activity against soil born pathogen *Sclerotium rolfsii* and *Rhizoctonia solanin* by using the dual culture technique described by Morton and Stroube (1955). Each petri-dish (9 cm) containing PDA was inoculated with two 5 mm diameter mycelial discs at the same time. Plates were incubated at room temperature (25°C ± 2) for 7 days. The experiment was replicated three times and percentage of growth inhibition was calculated by the following formula:

Inhibition % = (C-T)/C x 100. Where,

C: growth of the colony (*S. rolfsii*, *R. solani*) in control plates (mm)

T: growth of the colony (*S. rolfsii*, *R. solani*) in treated plates (mm)

The experimental design was used a completely randomized with four petri dishes for each isolate. This experiment was carried out at least twice.

### 2.4. Mass production of *Trichoderma* inoculum on rice (a solid state fermentation)

1. Soak brown rice overnight in water (16 hours), wash then rinse the rice with tap water and drain well. Weight 800 g of the rice and place in a 25 x 35 cm autoclave bag, add 100 mL tap water and mix thoroughly. Roll up the bag loosely, leaving enough space for evaporation of water during autoclaving.

2. Place the bags of rice in an autoclave, sterilize at 121°C, 1.2 atm for 25 min. The bags are cooled to 40-45°C.

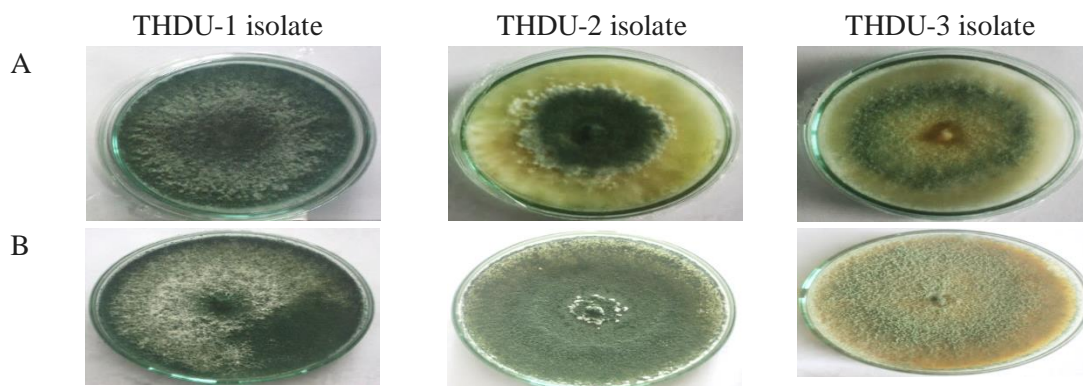
3. Inoculate the sterilized bags of rice with *Trichoderma* cultured on PDA medium for 4-5 days, leaving a slightly opening.

4. Incubate at room temperature (25 - 30°C) close to a window for exposure to nature lighting for 7 days and mix vigorously every day to avoid clumping.
5. Dispense the inoculated bags into plastic containers covered with sterile paper and incubates at room temperature (25 - 30°C) until profuse condiation occurs (about 2 - 3 days).
6. Place the plastic containers into a 40°C incubator for overnight drying (16 - 24 h).
7. The dried substrates are ground to a fine powder.
8. Conidia are recovered with sterile distilled water (SDW), mixing by vortex at low rpm and three times dilution in tube, then counted with a hemocytometer in an optic microspore (40X).
9. The powder was mixed with rice bran and talc powder in 3:1 in order to adjust the number of conidia production after incubation to  $1 \times 10^9$  conidia/g.
10. The finally processed products were placed in a zip-lock plastic bag and sealed.

### 3. Results and discussion

#### 3.1. Morphological characterization

Based on the observation of the colony, conidia, phialides, colony texture, chalmyspore, conidiophore morphology the isolates were confirmed to be *Trichoderma*. The morphological characters were described in Table 1.



**Figure 1.** Colony growth of different isolates of *Trichoderma* on PDA medium at 4<sup>th</sup> (A) and 7<sup>th</sup> (B) day after inoculation.

**Table 1.** Morphological descriptions of *Trichoderma* isolates (Figure 1)

Isolates	THDU-1	THDU-2	THDU-3
Colonies grown on PDA at 28 °C ± 2 for 5 day	Form one concentric rings near the inoculum zone with a dense conidial production, with white aerial mycelium toward the green ducer.	Grow rapidly produce an intense diffusing yellow pigment and green conidia as the tend to form on the center of the plate.	Form one concentric ring with green conidial production in mature colonies. The mycelium is initially smooth, watery white color and sparse, until floccose aerial



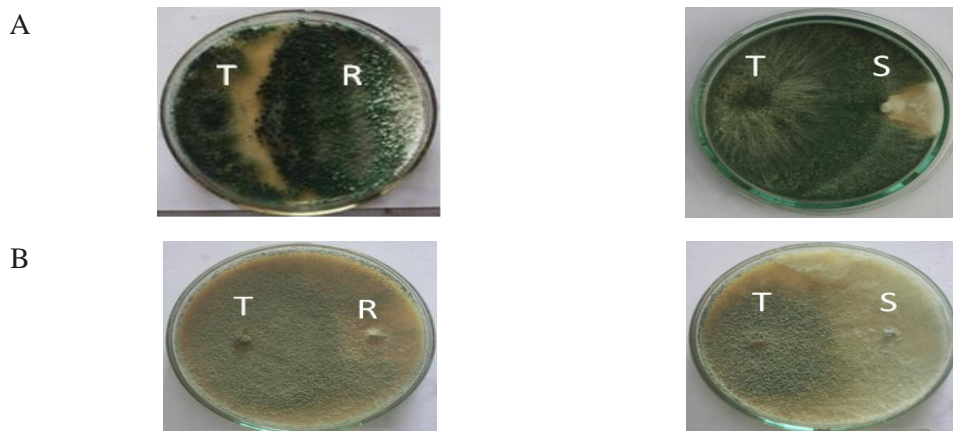
		Two concentric rings, one near the margin and the other around the inoculum point.	mycelium has produced.
Colony reverse	Creamy in color	Pale yellowish	Dull yellowish
Pigment on PDA plate	Not observed	Pale yellowish	Pale yellowish-green
Aerial mycelium	Yes	Not forming	Yes
Odor	Slightly sweet coconut odor	No distinctive odor	Indistinct sweet coconut odor produced

### 3.2. Antagonistic activities of *Trichoderma isolates*

**Table 2.** Antagonistic potential of *Trichoderma isolates* against *S. rolfsii* and *R. solani*

Isolate name	Mycelial growth inhibition (%) at 3 dpi	
	<i>S. rolfsii</i>	<i>R. solani</i>
THDU-1	91.5	95.5
THDU-2	45.3	71.4
THDU-3	95.8	96.7

The antagonistic capabilities of *Trichoderma* isolates were assessed by the inhibition of *S. rolfsii* and *R. solani* growth using the dual culture test. The results showed that all *Trichoderma* isolates caused significant reduction in the mycelial growth of both *S. rolfsii* and *R. solani* (Figure 2). The highest inhibitory activity obtained from isolates THDU-1 and THDU-3. The isolate THDU-2 showed the lowest inhibition effect (45.3%) against *S. rolfsii* and the moderate inhibition effect against *R. solani* (71.4%) compared to control treatment (Table 2).



**Figure 2.** Antagonistic activity (dual culture assay) of *Trichoderma isolates* (T) against *Sclerotium rolfsii* (S) and *Rhizoctonia solani* (R) at 6<sup>th</sup> day incubated at 26°C.

A: THDU-1 isolate; B: THDU-3 isolate

### 3.3. Mass production of *Trichoderma* isolates on rice substrate

**Table 3.** Number of conidia from *Trichoderma* isolates incubated on rice substrate

Isolates	Number of survived conidia during incubation times (days)			
	3	5	9	11
THDU-1	-	$2.3 \times 10^4$	$4.3 \times 10^8$	$5.7 \times 10^9$
THDU-2	-	$3.2 \times 10^4$	$3.8 \times 10^8$	$5.3 \times 10^9$
THDU-3	-	$2.5 \times 10^3$	$1.5 \times 10^8$	$3.6 \times 10^9$

Note: None of conidia observed

Rice was used as substrate for mass multiplication of *Trichoderma* isolates. The number of viable conidia in per gram after 11 days incubation was obtained higher than  $3 \times 10^9$  conidia/gram, indicating the substrate was potential media for the large-scale production of the fungi (Table 3 and Figure 3).



**Figure 3.** Mass production of THDU-1 isolate on rice media

## 4. Conclusion

Our study shows that all *Trichoderma* isolates exhibited growth inhibition of plant pathogen *R. sonali* as well as *S. rolfsii*, indicating that *Trichoderma* isolates could be potential biological control agents against soil-borne diseases. We also proposed a protocol of *Trichoderma* mass production using rice substrate which has generated high conidia yield ( $\geq 3 \times 10^9$  conidia/g).

### ACKNOWLEDGMENTS

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## References

- [1] Calistru C, McLean M, Berjak P (1997), In vitro studies on the potential for biological control of *Aspergillus flavus* and *Fusarium moniliforme* by *Trichoderma* species, A study of the production of extracellular metabolites by *Trichoderma* species. *Mycopathologia* 137:115-124.
- [2] Chet, I., & Inbar, J. (1994), Biological control of fungal pathogens, *Applied Biochemistry and Biotechnology*, 48: 37-43.
- [3] Doni F, Anizan I, Che Radziah CMZ, Salman AH, Rodzihan MH, Wan Mohtar WY (2014), Enhancement of rice seed germination and vigour by *Trichoderma* spp, *Res J App Sci Eng Technol* 7(21): (in press).

- [4] Druzhinina IS, Seidl-Seiboth V, Herrera- Estrella A, Horwitz BA, Kenerley CM, Monte E, Mukherjee PK, Zeilinger S, Grigoriev IV, Kubicek CP (2011), Trichoderma: the genomics of opportunistic success, *Nat Rev Microbiol*, 9:749-759.
- [5] Eyal, J., Baker, C.P., Reeder, J.D., Devane, W.E., Lumsden, R.D., (1997), Large-scale production of chlamydospores of *Gliocladium virens* strain GL-21 in submerged culture, *Journal of Industrial Microbiology & Biotechnology*, 19, 163-168.
- [6] Harman, G.E., Jin, X., Stasz, T.E., Peruzzotti, G., Leopold, A.C., Taylor, A.G., (1991), Production of conidial biomass of *Trichoderma harzianum* for biological control. *Biological Control*, 1, 23-28.
- [7] Harman, G.E., Howell, C.R., Viterbo, A., Chet, I., & Lorito, M. (2004), *Trichoderma* species opportunistic, avirulent plant symbionts, *Nature Reviews, Microbiology* 2: 43-56.
- [8] Jin, X., Harman, G.E., Taylor, A.G., (1991), Conidial biomass and desiccation tolerance of *Trichoderma harzianum* produced at different medium water potentials. *Biological Control*, 1, 237-243.
- [9] Kubicek, C. P., Mach, R. L., Peterbauer, C. K. Lorito, M. (2001), Trichoderma: from genes to biocontrol, *J. Plant Pathol*, 83, 11-23.
- [10] Mukherjee PK, Buensanteai N, Moran-Diez ME, Druzhinina IS, Kenerley CM (2012) Functional analysis of non-ribosomal peptide synthetases (NRPSs) in *Trichoderma virens* reveals a polyketide synthase (PKS)/NRPS hybrid enzyme involved in the induced systemic resistance response in maize, *Microbiology*, 158:155-165.
- [11] Mukherjee PK, Horwitz BA, Herrera-Estrella A, Schmoll M, Kenerley CM (2013), Trichoderma research in the genome era, *Annu Rev Phytopathol*, 51:105-129.
- [12] Morton DT, Strube NH (1955), Antagonistic and stimulatory effect of microorganism upon *Sclerotium rolfsii*, *Phytopathology*, 45:419-420
- [13] Papavizas, G.C., (1985), Trichoderma and Gliocladium: Biology, ecology, and potential for biocontrol, *Annual Review of Phytopathology*, 23, 23-54.
- [14] Panahina, G., K. Rahnama and M. Jafari, (2012), Mass production of Trichoderma spp and application, *International Research Journal of Applied and Basic Science*, 3(2): 292-298.
- [15] Vinale F, Flematti G, Sivasithamparam K, Lorito M, Marra R, Skelton BW, Ghisalberti EL (2009), Harzianic acid, an antifungal and plant growth promoting metabolite from *Trichoderma harzianum*, *J Nat Prod*, 72:2032-2035.
- [16] Vinale F, Ghisalberti EL, Sivasithamparam K, Marra R, Ritieni A, Ferracane R, Woo S, Lorito M (2009), Factors affecting the production of *Trichoderma harzianum* secondary metabolites during the interaction with different plant pathogens, *Lett Appl Microbiol*, 48:705-711.

# FRÉCHET SUBDIFFERENTIALS OF THE MINIMUM TIME FUNCTION AT POINTS IN THE TARGET

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**Abstract:** *We derive formulas for computing the Fréchet subdifferential and Fréchet singular differential at points in the target of the minimum time function associated with a system governed by differential inclusions.*

**Keywords:** *Minimum time function, Fréchet subdifferentials, differential inclusions.*

## 1. Introduction and Preliminaries

We consider the following differential inclusion

$$\begin{cases} x'(t) \in F(x(t)), \\ x(0) = x_0 \in \mathbb{R}^n \end{cases} \quad \text{a.e. } t \in [0, \tau] \quad (1.1)$$

for some  $\tau > 0$ , where  $F: \mathbb{R}^n \rightarrow \mathbb{R}^n$  is a multifunction satisfying the following standard conditions:

(F1)  $F(x)$  is nonempty, convex, and compact for each  $x \in \mathbb{R}^n$ .

(F2)  $F$  is locally Lipschitz, i.e. for each compact set  $K \subset \mathbb{R}^n$ , there exists a constant  $L > 0$  such that

$$F(x) \subset F(y) + L \|y - x\| \overline{IB}, \text{ for all } x, y \in K.$$

(F3) there exists  $\gamma > 0$  such that  $\max\{\|v\|: v \in F(x)\} \leq \gamma(1 + \|x\|)$ , for all  $x \in \mathbb{R}^n$ .

A solution of (1.1) is an absolutely continuous function  $x(\cdot)$  defined on  $[0, \tau]$  satisfying (1.1) with the initial value  $x(0) = x_0$ . We also say that  $x(\cdot)$  is a trajectory of  $F$  starting at  $x_0$ . Under the above assumptions on  $F$ , if  $x(\cdot)$  is a trajectory of  $F$  defined on  $[0, \tau]$  then there exists a constant  $M > 0$  such that  $\|x(t) - x_0\| \leq Mt$  for all  $t \in [0, \tau]$ . Without loss of generality, we fix the constant  $M$  for all trajectories and for all  $\tau > 0$  considered in this paper. We next recall a result regarding  $C^1$  trajectories of  $F$ .

**Theorem 1.1.** (See, e.g., [21] and pages 115-117 in [1]). *Assume (F1)-(F3). Let  $E \subset \mathbb{R}^N$  be compact. Then there exists  $\tau > 0$  such that associated to every  $x \in E$  and*

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$v \in F(x)$  is a trajectory  $x(\cdot)$  defined on  $[0, \tau]$  with  $x'(0) = v$ . Moreover, we have  $\|x'(t) - v\| \leq LMt$  for all  $t \in [0, \tau]$ .

We assume that a closed subset  $K$  of  $\mathbb{R}^n$  is given which is called the target. The minimum time function  $T : \mathbb{R}^n \rightarrow [0, +\infty]$  associated with the differential inclusion (1.1) to the target  $K$  is defined as follows. If  $x \notin K$  then

$$T(x) := \inf \{t > 0 : \exists x(\cdot) \text{ satisfying (1.1) with } x(0) = x \text{ and } x(t) \in K\} \tag{1.2}$$

If there is no trajectory of  $F$  starting at  $x$  can reach  $K$ , then. If  $x \in K$  then we set  $T(x) = 0$ . It is well-known that, under assumptions (F1) - (F3), the infimum in (1.2) is attained and the minimum time function  $T$  is lower semicontinuous [21].

The minimum time function is an important optimal value function of optimal control theory. This function has been widely studied since the beginning stages of optimal control theory [2, 3, 4, 5, 6, 7, 8, 9, 12, 16, 21]. In general, the minimum time function is not differentiable. Generalized differentiations of the minimum time function and their applications have been investigated by several researchers [11, 13, 14, 15, 18] and references therein). The aim of this paper is to present formulas for computing the Fréchet subdifferential and Fréchet singular subdifferential of the minimum time function at points in the target. Our results generalize the corresponding results in [17,19].

The rest of this section is devoted to some basic concepts of nonsmooth analysis. Standard references are in [10, 20]. We denote by  $\|\cdot\|$  the Euclidean norm in  $\mathbb{R}^n$ , by  $\langle \cdot, \cdot \rangle$  the inner product. We also denote by  $B(x, r)$  the open ball of radius  $r > 0$  centered at  $x$  and  $IB = B(0,1)$ .

Let  $S \subset \mathbb{R}^n$  be a closed set and let  $x \in S$ . The Fréchet normal cone to  $S$  at  $x$ , written  $\hat{N}_S(x)$ , is the set

$$\hat{N}_S(x) := \left\{ \zeta \in \mathbb{R}^n : \limsup_{y \in S, y \rightarrow x} \frac{\langle \zeta, y - x \rangle}{\|y - x\|} \leq 0 \right\}.$$

Elements in  $\hat{N}_S(x)$  are called Fréchet normals to  $S$  at  $x$ . In other words,  $\zeta \in \hat{N}_S(x)$  if and only if for any  $\varepsilon > 0$ , there exists  $\delta > 0$  such that  $\langle \zeta, y - x \rangle \leq \varepsilon \|y - x\|$ ,  $\forall y \in B(x, \delta)$ .

Let  $f : \mathbb{R}^n \rightarrow \mathbb{R} \cup \{+\infty\}$  be an extended real-value function. The effective domain of  $f$  is the set  $dom(f) := \{x \in \mathbb{R}^n : f(x) < +\infty\}$  and the epigraph of  $f$  is the set

$$epi(f) := \{(x, \alpha) \in \mathbb{R}^n \times \mathbb{R} : x \in dom(f), \alpha \geq f(x)\}.$$

Let  $x \in dom(f)$ . The Fréchet subdifferential of  $f$  at  $x$  is the set

$$\hat{\partial} f(x) := \left\{ \zeta \in \mathbb{R}^n : \liminf_{y \rightarrow x} \frac{f(y) - f(x) - \langle \zeta, y - x \rangle}{\|y - x\|} \geq 0 \right\}$$

In other words,  $\zeta \in \hat{\partial} f(x)$  if and only if for any  $\varepsilon > 0$ , there exists  $\delta > 0$  such that  $\langle \zeta, y - x \rangle \leq f(y) - f(x) + \varepsilon \|y - x\|$ ,  $\forall y \in B(x, \delta)$

The Fréchet subdifferential of  $f$  at  $x$  can also be defined as follows:

$$\hat{\partial} f(x) = \left\{ \zeta \in \mathbb{R}^n : (\zeta, -1) \in \hat{N}_{epi(f)}(x, f(x)) \right\}$$

Elements in  $\hat{\partial} f(x)$  are called *Fréchet subgradients* of  $f$  at  $x$

The *Fréchet singular subdifferential* of  $f$  at  $x$  is the set

$$\hat{\partial}^\infty f(x) := \left\{ \zeta \in \mathbb{R}^n : (\zeta, 0) \in \hat{N}_{epi(f)}(x, f(x)) \right\}$$

Elements in  $\hat{\partial}^\infty f(x)$  are called *Fréchet singular subgradients* of  $f$  at  $x$ . In other words,  $\zeta \in \hat{\partial}^\infty f(x)$  if and only if for any  $\varepsilon > 0$ , there exists  $\delta > 0$  such that

$$\langle \zeta, y - x \rangle \leq \varepsilon (\|y - x\| + |\beta - f(x)|), \quad \forall y \in B(x, \delta), (y, \beta) \in epi(f)$$

## 2. Fréchet Subdifferentials of the minimum time function

This section presents the main results of this paper. In the next theorem, we provide a formula for computing the Fréchet subdifferential of the minimum time function at point in the target. This result generalizes [17, Theorem 4.1]. Note that the result in [17, Theorem 4.1] is for linear control system. Here, we prove the result for a more general setting.

**Theorem 2.1.** Assume that the multifunction  $F$  satisfies (F1)-(F3). Let  $x_0 \in K$ . Then

$$\hat{\partial} T(x_0) = \hat{N}_K(x_0) \cap \left\{ \zeta \in \mathbb{R}^n : h(x_0, \zeta) \geq -1 \right\} \tag{1.3}$$

**Proof.** Assume that  $\zeta \in \hat{\partial} T(x_0)$ . Then, for any  $\varepsilon > 0$ , there exists  $\eta > 0$  such that

$$T(y) - \langle \zeta, y - x_0 \rangle \geq -\varepsilon \|y - x_0\|, \quad \forall y \in B(x_0, \eta). \tag{1.4}$$

Since  $T(x) = 0$  whenever  $x \in K$ , it follows from (2.2) that

$$\langle \zeta, y - x_0 \rangle \leq \varepsilon \|y - x_0\|, \quad \forall y \in K \cap B(x_0, \eta)$$

Hence,  $\zeta \in \hat{N}_K(x_0)$ .

Since  $F(x_0)$  is compact, there exists  $w \in F(x_0)$  such that

$$\langle \zeta, w \rangle = \min_{v \in F(x_0)} \langle \zeta, v \rangle = h(x_0, \zeta)$$

By theorem 1.1, there exists a  $C^1$  trajectory  $y(\cdot)$  of  $-F$  on  $[0, T]$  for some  $T > 0$  satisfying  $y(0) = x_0$ ,  $\dot{y}(0) = -w$  and  $\|y(t) - x_0\| \leq Mt$  for all  $t \in [0, T]$ .

There are two cases needed to consider.

**Case 1.** There exists  $\delta > 0$  such that  $y(t) \in K \cap B(x_0, \eta)$  for all  $t \in [0, \delta]$ . Plugging  $y := y(t)$  with  $t \in [0, \delta]$  into (1.4), we have

$$\langle \zeta, y(t) - x_0 \rangle \leq \varepsilon \|y(t) - x_0\| \leq M\varepsilon t.$$

Equivalently,

$$\left\langle \zeta, \frac{y(t) - x_0}{t} \right\rangle \leq M\varepsilon$$

Letting  $t \rightarrow 0+$ , we get  $\langle \zeta, y'(0) \rangle \leq M\varepsilon$ , i.e.,  $\langle \zeta, -w \rangle \leq M\varepsilon$ . Since  $\varepsilon > 0$  is arbitrary,  $h(\zeta, x_0) = \langle \zeta, w \rangle \geq 0$ .

**Case 2.** There exists  $\delta > 0$  such that  $y(t) \notin K$  for all  $t \in [0, \delta]$ . Fix  $t \in [0, \delta]$  such that  $y(s) \in B(x_0, \eta)$  for all  $s \in [0, t]$ . Set  $x(s) = y(t - s)$ ,  $s \in [0, t]$ . Then  $x(\cdot)$  is a trajectory of  $F$  with  $x(t) = x_0$ . By the principle of optimality, for all  $s \in [0, t]$ ,

$$T(y(s)) \leq T(y(0)) + s = T(x_0) + s = s.$$

In (1.4), we take  $y := y(s)$  with  $s \in [0, t]$ ,

$$T(y(s)) - \langle \zeta, y(s) - x_0 \rangle \geq -\varepsilon \|y(s) - x_0\| \geq -M\varepsilon s.$$

Equivalently,  $s - \langle \zeta, y(s) - x_0 \rangle \geq -M\varepsilon s$  which implies that

$$\left\langle \zeta, -\frac{y(s) - x_0}{s} \right\rangle \geq -1 - M\varepsilon.$$

Let  $s \rightarrow 0+$ , we get  $\langle \zeta, -y'(0) \rangle \geq -1 - M\varepsilon$ .

Since  $\varepsilon > 0$  is arbitrary,  $h(x_0, \zeta) = \langle \zeta, w \rangle \geq -1$ .

Assume now that  $\zeta \in \hat{N}_K(x_0)$  with  $h(x_0, \zeta) \geq -1$ . We will show that  $\zeta \in \hat{\partial}T(x_0)$ , i.e., for any  $\varepsilon > 0$ , there exists  $\eta > 0$  such that

$$T(y) - \langle \zeta, y - x_0 \rangle \geq -\varepsilon \|y - x_0\|, \quad \forall y \in B(x_0, \eta). \tag{1.5}$$

We may assume that  $\zeta \neq 0$ . Set  $c = M\|\zeta\| + 1$ . For  $\varepsilon > 0$ , let  $\varepsilon_0 \in (0, \varepsilon/c)$ . Since  $\zeta \in \hat{N}_K(x_0)$ , there exists  $\eta_0 > 0$  such that

$$\langle \zeta, y - x_0 \rangle \leq \varepsilon_0 \|y - x_0\|, \quad \forall y \in K \cap B(x_0, \eta_0).$$

Since  $\varepsilon_0 < \varepsilon$  and  $T(x) = 0$  for all  $x \in K$ , (1.3) holds for any  $y \in K \cap B(x_0, \eta_0)$ .

$$\text{Set now } \eta := \min \left\{ \frac{\eta_0}{c}, \frac{\varepsilon - c\varepsilon_0}{cL\|\zeta\|^2}, 1 \right\}.$$

It is enough to show that (1.5) holds for all  $y \in B(x_0, \eta) \setminus K$ . Assume to the contrary that there exists  $y_0 \notin K$  such that  $\|y_0 - x_0\| < \eta$  and

$$T(y_0) < \langle \zeta, y_0 - x_0 \rangle - \varepsilon \|y_0 - x_0\|. \tag{1.6}$$

It follows from (1.6) and the Cauchy-Schwarz inequality that

$$T(y_0) \leq \|\zeta\| \cdot \|y_0 - x_0\| < \infty. \tag{1.7}$$

Set  $T_1 := T(y_0)$  and let  $x(\cdot)$  be an optimal trajectory for  $y_0$ . Then  $y_1 := x(T_1) \in K$ .

We have, for all  $t \in [0; T_1]$ , that

$$\begin{aligned} \|x(t) - x_0\| &\leq \|x(t) - y_0\| + \|y_0 - x_0\| \\ &\leq Mt + \|y_0 - x_0\| \\ &\leq (M\|\zeta\| + 1)\|y_0 - x_0\| = c\|y_0 - x_0\|. \end{aligned} \tag{1.8}$$

In particular,  $\|y_1 - x_0\| \leq c\|y_0 - x_0\| < \eta_0$ , i.e.,  $y_1 \in K \cap B(x_0, \eta_0)$ . Thus,

$$\langle \zeta, y_1 - x_0 \rangle \leq \varepsilon_0 \|y_1 - x_0\| \leq \varepsilon_0 c \|y_0 - x_0\|. \tag{1.9}$$

Let  $y(\cdot)$  be a measurable function which is the projection of  $x'(\cdot)$  on the set  $F(x_0)$  restricted to  $[0; T_1]$ . Since  $F$  is locally Lipschitz,

$$\|y(t) - \dot{x}(t)\| \leq L\|x(0) - x(t)\| \leq LMt + L\|y_0 - x_0\| \quad \text{a.e. } t \in [0, T_1] \tag{1.10}$$

Using (1.7) - (1.10) and having in mind that  $h(x_0, \zeta) \geq -1$ , one has

$$\begin{aligned} T(y_0) - \langle \zeta, y_0 - x_0 \rangle &= T_1 - \langle \zeta, y_0 - y_1 \rangle - \langle \zeta, y_1 - x_0 \rangle \\ &= T_1 + \int_0^{T_1} \langle \zeta, x'(t) \rangle dt - \langle \zeta, y_1 - x_0 \rangle \\ &= T_1 + \int_0^{T_1} \langle \zeta, y(t) \rangle dt + \int_0^{T_1} \langle \zeta, x'(t) - y(t) \rangle dt - \langle \zeta, y_1 - x_0 \rangle \\ &\geq T_1 + \int_0^{T_1} h(x_0, \zeta) dt - \|\zeta\| \int_0^{T_1} \|x'(t) - y(t)\| dt - \varepsilon_0 c \|y_0 - x_0\| \\ &\geq -L\|\zeta\| (MT_1 + \|y_0 - x_0\|) T_1 - \varepsilon_0 c \|y_0 - x_0\| \\ &\geq -L\|\zeta\| (M\|\zeta\| + 1) \|y_0 - x_0\| T_1 - \varepsilon_0 c \|y_0 - x_0\| \\ &\geq -cL\|\zeta\|^2 \|y_0 - x_0\|^2 - \varepsilon_0 c \|y_0 - x_0\| \\ &\geq -\varepsilon_0 \|y_0 - x_0\|. \end{aligned}$$



which contradicts to (1.6). This ends the proof.

In the following theorem, we present a formula for computing the Fréchet singular differential of the minimum time function at point in the target. This result generalizes [19, Theorem 3.4]. Note that the result in [19, Theorem 3.4] is for the bilateral minimum time function - a special case of the general minimum time function considered in this paper.

**Theorem 2.2.** Assume that the multifunction  $F$  satisfies (F1)-(F3). Let  $x_0 \in K$ .

Then

$$\hat{\partial}^\infty T(x_0) = \hat{N}_K(x_0) \cap \{\zeta \in \mathbb{R}^n : h(x_0, \zeta) \geq 0\}. \tag{1.11}$$

**Proof.** Let  $\zeta \in \hat{\partial}^\infty T(x_0)$ . Then, for any  $\varepsilon > 0$ , there exists  $\eta > 0$  such that

$$\langle \zeta, y - x_0 \rangle \leq \varepsilon (\|y - x_0\| + \beta), \quad \forall y \in B(x_0, \eta), \beta \geq T(y). \tag{1.12}$$

Taking  $y \in B(x_0, \eta) \cap K$  and  $\beta = T(y) = 0$  in (1.12), we have

$$\langle \zeta, y - x_0 \rangle \leq \varepsilon \|y - x_0\|.$$

It follows that  $\zeta \in \hat{N}_K(x_0)$ . We are now going to show that  $h(x_0, \zeta) \geq 0$ . Let  $w \in F(x_0)$  be such that  $\langle \zeta, w \rangle = \min_{v \in F(x_0)} \langle \zeta, v \rangle = h(x_0, \zeta)$ .

By Theorem 1.1, there exists  $T > 0$  and a  $C^1$  trajectory  $y(\cdot)$  on  $[0, T]$  of  $-F$  satisfying  $y(0) = x_0, y'(0) = -w$  and  $\|y(t) - x_0\| \leq Mt$  for all  $t \in [0, T]$ .

There are two possible cases.

**Case 1.** There exists  $\delta > 0$  such that  $y(t) \in K \cap B(x_0, \eta)$  for all  $t \in [0, \delta]$ . Plugging  $y := y(t)$  and  $\beta := T(y) = 0$  with  $t \in [0, \delta]$  into (1.12), we have

$$\langle \zeta, y(t) - x_0 \rangle \leq \varepsilon \|y(t) - x_0\| \leq M\varepsilon t,$$

equivalently, 
$$\left\langle \zeta, \frac{y(t) - x_0}{t} \right\rangle \leq M\varepsilon.$$

Letting  $t \rightarrow 0+$ , we get  $\langle \zeta, -w \rangle = \langle \zeta, y'(0) \rangle \leq M\varepsilon$  which implies that  $h(\zeta, x_0) = \langle \zeta, w \rangle \geq 0$  as  $\varepsilon > 0$  is arbitrary.

**Case 2.** There exists  $\delta > 0$  such that  $y(t) \notin K$  for all  $t \in [0, \delta]$ . Fix  $t \in [0, \delta]$  such that  $y(s) \in B(x_0, \eta)$  for all  $s \in [0, t]$ . Set  $x(s) = y(t - s), s \in [0, t]$ . Then  $x(\cdot)$  is a trajectory of  $F$  with  $x(t) = x_0$ .

By the principle of optimality,  $T(y(s)) \leq T(y(0)) + s = T(x_0) + s = s$  for all  $s \in [0, t]$

In (1.4), taking  $y := y(s)$  and  $\beta = s \geq T(y(s))$  with  $s \in [0, t]$ , we have

$$\langle \zeta, y(s) - x_0 \rangle \leq \varepsilon (\|y(t) - x_0\| + s) \leq \varepsilon(M + 1)s.$$

Equivalently,  $\left\langle \zeta, \frac{y(s) - x_0}{s} \right\rangle \geq \varepsilon(M + 1)$ .

Let  $s \rightarrow 0+$ , we get  $\langle \zeta, y'(0) \rangle \leq \varepsilon(M + 1)$  which yields  $h(x_0, \zeta) = \langle \zeta, w \rangle \geq 0$ .

Now, let  $\zeta \in \hat{N}_K(x_0)$  be such that  $h(x_0, \zeta) \geq 0$ . We prove that  $\zeta \in \hat{\partial}^\infty T(x_0)$ .

Assume that  $\zeta \notin \hat{\partial}^\infty T(x_0)$ . Then, there exists a constant  $C > 0$  and sequences  $\{y_n\} \subset \text{dom}(T)$ ,  $\{\beta_n\} \subset [0, \infty)$  such that  $y_n \rightarrow x_0$  and for all  $n$  that  $y_n \neq x_0$ ,  $\beta_n \geq T(y_n)$ ,

$$\langle \zeta, y_n - x_0 \rangle > C(\|y_n - x_0\| + \beta_n).$$

Hence,  $\langle \zeta, y_n - x_0 \rangle > C(\|y_n - x_0\| + T(y_n))$ ,  $\forall n$ . (1.13)

Set  $T_n := T(y_n)$  for each  $n$ . It follows from (1.13) that

$$T_n \leq \frac{1}{C} \|\zeta\| \|y_n - x_0\| < \infty.$$

Moreover, since  $\zeta \in \hat{N}_K(x_0)$ , by (1.13), we may assume that  $y_n \notin K$ , i.e.,  $T_n > 0$  for all  $n$ . For each  $n$ , let  $x_n(\cdot)$  be an optimal trajectory for  $y_n$ . Set  $z_n = x_n(T_n)$ . Then  $z_n \in K$ .

We have, for all  $t \in [0, T_n]$ , that

$$\|x_n(t) - x_0\| \leq \|x_n(t) - y_n\| + \|y_n - x_0\| \leq MT_n + \|y_n - x_0\|.$$

In particular,  $\|z_n - x_0\| \leq MT_n + \|y_n - x_0\| \leq \left(\frac{M}{C} \|\zeta\| + 1\right) \|y_n - x_0\|$ ,

which implies that  $z_n \rightarrow x_0$  as  $n \rightarrow \infty$ . Since  $\zeta \in \hat{N}_K(x_0)$ , for any  $\varepsilon > 0$  and for  $n$  sufficiently large, one has  $\langle \zeta, z_n - x_0 \rangle \leq \varepsilon \|z_n - x_0\| \leq \varepsilon (MT_n + \|y_n - x_0\|)$ .

For each  $n$ , let  $a_n(\cdot)$  be the projection of  $x'_n(\cdot)$  on  $F(x_0)$  restricted on  $[0, T_n]$ . By Lipschitz continuity of  $F$ , one has

$$\|a_n(t) - x'_n(t)\| \leq L \|x_n(t) - x_0\| \leq LMT_n + L \|y_n - x_0\|.$$

For  $n$  sufficiently large,

$$\begin{aligned} C(\|y_n - x_0\| + T_n) &< \langle \zeta, y_n - x_0 \rangle \\ &= \langle \zeta, y_n - z_n \rangle + \langle \zeta, z_n - x_0 \rangle \\ &= -\int_0^{T_n} \langle \zeta, x'(t) \rangle dt + \langle \zeta, z_n - x_0 \rangle \\ &= \int_0^{T_n} \langle \zeta, a_n(t) - x'_n(t) \rangle dt - \int_0^{T_n} \langle \zeta, a_n(t) \rangle dt + \langle \zeta, z_n - x_0 \rangle \end{aligned}$$

$$\begin{aligned} &\leq \|\zeta\| \int_0^{T_n} \|a_n(t) - x'_n(t)\| dt + \langle \zeta, z_n - x_0 \rangle \\ &\leq L \|\zeta\| (MT_n + \|y_n - x_0\|) T_n + \varepsilon (MT_n + \|y_n - x_0\|) \\ &\leq C_0 (T_n + \varepsilon) (\|y_n - x_0\| + T_n), \end{aligned}$$

for some constant  $C_0 > 0$ . This yields  $C < C_0(T_n + \varepsilon)$ . Letting  $n \rightarrow \infty$  and then letting  $\varepsilon \rightarrow 0+$  in both sides of the latter inequality, we get  $C \leq 0$ . This contradiction ends the proof.

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### References

- [1] J.-P. Aubin, A. Cellina (1984), *Differential Inclusion*, Springer-Varlag, Berlin.
- [2] P. Cannarsa, H. Frankowska, C. Sinestrari (2000), Optimality conditions and synthesis for the minimum time problem, *Set-Valued Anal*, 8, 127-148.
- [3] P. Cannarsa, A. Marigonda, K.T. Nguyen (2015), Optimality conditions and regularity results for time optimal control problems with differential inclusion, *J. Math. Anal. Appl*, 427, 202-228.
- [4] P. Cannarsa, F. Marino, P.R. Wolenski (2012), Semiconcavity of the minimum time function for differential inclusion, *Discrete Contin. Dyn. Syst. Ser. B*, 19, 187-206.
- [5] P. Cannarsa, F. Marino, P.R. Wolenski (2013), The dual arc inclusion with differential inclusions, *Nonlinear Anal*, 79, 176-189
- [6] P. Cannarsa, Khai T. Nguyen (2011), Exterior sphere condition and time optimal control for differential inclusions, *SIAM J. Control Optim*, 46, 2558-2576.
- [7] P. Cannarsa, C. Sinestrari (1995), Convexity properties of the minimum time function, *Calc. Var. Partial Differential Equations*, 3, 273-298.
- [8] P. Cannarsa, C. Sinestrari (2004), *Semiconcave Functions, Hamilton-Jacobi Equations, and optimal Control*, Birkhauser, Boston.
- [9] P. Cannarsa, Wolenski (2011), Semiconcavity of the value function for a class of differential inclusions, *Discrete Contin. Dyn. Syst.* 29, 453-466.
- [10] F.H. Clarke (1983), *Optimization and Nonsmooth Analysis*, Canad. Math. Soc. Ser. Monogr. Adv. Texts, John Wiley & Sons, New York.
- [11] G. Colombo, A. Marigonda, P.R. Wolenski (2006), *Some new regularity properties for the minimal time function*. *SIAM J. Control Optim*. 44, 2285-2299.
- [12] G. Colombo, Khai T. Nguyen (2010), On the structure of the Minimum Time Function, *SIAM J. Control Optim*, 48, 4776-4814.
- [13] G. Colombo, Khai T. Nguyen, Luong V. Nguyen (2014), Non-Lipschitz points and the SBV regularity of the minimum time function, *Calc. Var. Partial Differential Equations*, 51, 439-463.

- [14] G. Colombo, Luong V. Nguyen (2015), Differentiability properties of the minimum time function for normal linear systems, *J. Math. Anal. Appl.*, 429, 143-174.
- [15] H. Frankowska, Luong V. Nguyen (2015), Local regularity of the minimum time function, *J. Optim. Theory Appl.*, 164, 68-91.
- [16] H. Hermes, J. P. LaSalle (1969), *Functional analysis and time optimal control*, Academic Press, New York-London.
- [17] Y. Jiang, Y. R. He, J. Sun (2011), Subdifferential properties of the minimal time function of linear control systems, *J. Glob. Optim.*, 51, 395-412.
- [18] L.V. Nguyen (2016), Variational analysis and sensitivity relations for the minimum time function, *SIAM J. Control Optim.*, 54, 2235-2258.
- [19] L.V. Nguyen (2017), Variational Analysis for the Bilateral Minimal Time Function, *J. Conv. Anal.*, 24, 1029-1050.
- [20] R. T. Rockafellar, R. J-B. Wets (1998), *Variational Analysis*, Springer, Berlin.
- [21] P. R. Wolenski, Y. Zhuang (1998), Proximal analysis and the minimal time function, *SIAM J. Control Optim.*, 36, 1048-1072.

# ADMISSIBLE INERTIAL MANIFOLDS FOR ABSTRACT NONAUTONOMOUS THERMOELASTIC PLATE SYSTEMS

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**Abstract:** *In this paper, we prove the existence of admissible inertial manifolds for the nonautonomous thermoelastic plate systems*

$$\begin{cases} u_{tt} - \mu A\theta + A^2u &= f(t,u) \\ \theta_t + \eta A\theta + \mu Au_t &= 0 \end{cases}$$

when the partial differential operator  $A$  is positive definite and self-adjoint with a discrete spectrum and the nonlinear term  $f$  satisfies  $\varphi$ -Lipschitz condition.

**Keywords:** *Thermoelastic plate, Lyapunov-Perron method, inertial manifold.*

## 1. Introduction

One of effective approaches to the study of long - time behavior of infinite dimensional dynamical systems is based on the concept of inertial manifolds which was introduced by C. Foias, G. Sell and R. Temam (see [4] and the references therein). These inertial manifolds are finite dimensional Lipschitz ones, attract trajectories at exponential rate. This enables us to reduce the study of infinite dimensional systems to a class of induced finite dimensional ordinary differential equations.

In this paper, on the real separable Hilbert space  $\mathcal{H}$ , we study the existence of admissible inertial manifolds of the nonautonomous thermoelastic plate systems:

$$\begin{cases} u_{tt} - \mu A\theta + A^2u &= f(t,u) \\ \theta_t + \eta A\theta + \mu Au_t &= 0 \end{cases} \quad (1.1)$$

with initial data  $u(0) = u_0, u_t(0) = u_1, \theta(0) = \theta_0$ .

Here,  $\mu, \eta$  are positive constants,  $A$  is a positive definite, self-adjoint operator with a discrete spectrum; i.e., there exists the orthonormal basis  $\{e_k\} \in \mathcal{H}$  such that  $Ae_k = \lambda_k e_k, 0 < \lambda_1 \leq \lambda_2 \leq \dots$ , each with finite multiplicity and  $\lim_{k \rightarrow \infty} \lambda_k = \infty$ .

Futhermore,  $f$  be a  $\varphi$ -Lipschitz function which is defined as in Definition 2.7.

## 2. Admissible inertial manifolds

### 2.1. The fundamental concepts of function spaces and admissibility

Now, we first recall some notions on function spaces and refer to [8] for concrete applications. Denote by  $\mathcal{B}$  the Borel algebra and by  $\lambda$  the Lebesgue measure on  $\mathbb{R}$ . The space  $L_{1,loc}(\mathbb{R})$  of real-valued locally integrable functions on  $\mathbb{R}$  (modulo  $\lambda$ -nullfunctions)

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becomes a Fréchet space for the seminorms  $p_n(f) = \int_{J_n} |f(t)| dt$ , where  $J_n = [n, n+1]$  for each  $n \in \mathbb{Z}$  [8].

**Definition 2.1.** A vector space  $E$  of real-valued Borel-measurable functions on  $\mathbb{R}$  (modulo  $\lambda$ -nullfunctions) is called a *Banach function space* (over  $(\mathbb{R}, \mathcal{B}, \lambda)$ ) if

i)  $E$  is a Banach lattice with respect to the norm  $\|\cdot\|_E$ , i.e.,  $(E, \|\cdot\|_E)$  is a Banach space, and if  $\varphi \in E$ ,  $\psi$  is a real-valued Borel-measurable function such that  $\varphi(\cdot) \leq |\psi(\cdot)|$  ( $\lambda$ -a.e.) then  $\psi \in E$  and  $\|\psi\|_E \leq \|\varphi\|_E$ ,

ii) the characteristic functions  $\chi_A$  belongs to  $E$  for all  $A \in \mathcal{B}$  of finite measure and

$$\sup_{t \in \mathbb{R}} \|\chi_{[t, t+1]}\|_E < \infty, \inf_{t \in \mathbb{R}} \|\chi_{[t, t+1]}\|_E > 0,$$

iii)  $E \hookrightarrow L_{1,loc}(\mathbb{R})$ .

**Definition 2.2.** Let  $E$  be a Banach function space and  $X$  be a Banach space endowed with the norm  $\|\cdot\|$ .

We set  $\mathcal{E} := \mathcal{E}(\mathbb{R}, X) := \{h: \mathbb{R} \rightarrow X \mid h \text{ is strongly measurable and } \|h(\cdot)\| \in E\}$  endowed with the norm  $\|h\|_{\mathcal{E}} := \|\|h(\cdot)\|\|_E$ .

One can easily see that  $\mathcal{E}$  is a Banach space. We call it the *Banach space corresponding to the Banach function space  $E$* . We now recall the notion of admissibility [5, 6].

**Definition 2.3.** The Banach function space  $E$  is called *admissible* if it satisfies

i) there is a constant  $M \geq 1$  such that for every compact interval  $[a, b] \subset \mathbb{R}$ , we have

$$\int_a^b |\varphi(t)| dt \leq \frac{M(b-a)}{\|\chi_{[a,b]}\|_E} \|\varphi\|_E, \tag{1.1}$$

ii) for  $\varphi \in E$  the function

$$\Lambda_1 \varphi(t) = \int_{t-1}^t \varphi(\tau) d\tau \tag{1.2}$$

belongs to  $E$ ,

iii) the space  $E$  is  $T_{\tau}^+$ -invariant and  $T_{\tau}^-$ -invariant where  $T_{\tau}^+$  and  $T_{\tau}^-$  are defined, for  $\tau \in \mathbb{R}$ , by

$$T_{\tau}^+ \varphi(t) := \varphi(t - \tau) \text{ for } t \in \mathbb{R} \tag{1.3}$$

$$T_{\tau}^- \varphi(t) := \varphi(t + \tau) \text{ for } t \in \mathbb{R} \tag{1.4}$$

Moreover, there are constants  $M_1$  and  $M_2$  such that

$$\|T_{\tau}^+\| \leq M_1 \quad \text{and} \quad \|T_{\tau}^-\| \leq M_2 \quad \text{for all } \tau \in \mathbb{R}.$$

We next define the associate spaces of admissible Banach function spaces on  $\mathbb{R}$  as follows.

**Definition 2.4.** Let  $E$  be an admissible Banach function space and denote by  $S(E)$  the unit sphere in  $E$ . Recall that

$$L_1 = \left\{ g : \mathbb{R} \rightarrow \mathbb{R} \mid g \text{ is measurable and } \int_{\mathbb{R}} |g(t)| dt < \infty \right\}$$

Then, we consider the set  $E'$  of all measurable real-valued functions  $\psi$  on  $\mathbb{R}$  such that

$$\varphi\psi \in L_1, \quad \int_{\mathbb{R}} |\varphi(t)\psi(t)| dt \leq k \quad \text{for all } \varphi \in S(E),$$

where  $k$  depends only on  $\psi$ . Then,  $E'$  is a normed space with the norm given by (see [8]):

$$\|\psi\|_{E'} := \sup \left\{ \int_{\mathbb{R}} |\varphi(t)\psi(t)| dt : \varphi \in S(E) \right\} \quad \text{for all } \psi \in E'.$$

We call  $E'$  the *associate space* of  $E$ .

**Remark 2.5.** Let  $E$  be an admissible Banach function space and  $E'$  be its associate space. Then, from [8, Chapter 2] we also have that the following ‘‘Holder's inequality’’ holds

$$\int_{\mathbb{R}} |\varphi(t)\psi(t)| dt \leq \|\varphi\|_E \|\psi\|_{E'} \quad \text{for all } \varphi \in E, \psi \in E'. \tag{1.5}$$

Moreover, throughout this paper we need the following assumption

**Assumption 1.** *The Banach function space  $E$  and its associate space  $E'$  are admissible spaces. Futhermore, for  $\varphi$  be a positive function belonging to  $E$  and any fixed  $\nu > 0$  the function  $h_\nu(\cdot)$  defined by  $h_\nu(t) := \left\| e^{-\nu|t|^{-1}} \varphi(\cdot) \right\|_{E'}$  for  $t \in \mathbb{R}$  belongs to  $E$ .*

**Remark 2.6.** In the concept of admissible spaces we can replace whole line  $\mathbb{R}$  by an interval  $(-\infty, t_0]$ .

**Definition 2.7.** ( $\varphi$ -Lipschitz function). Let  $E$  be an admissible Banach function space on  $\mathbb{R}$  and  $\varphi$  be a positive function belonging to  $E$ . Then, a function  $f : \mathbb{R} \times \mathcal{H} \rightarrow \mathcal{H}$  is said to be  $\varphi$ -Lipschitz if  $f$  satisfies

- i)  $\|f(t, u)\| \leq \varphi(t)(1 + \|u\|)$  for a.e.  $t \in \mathbb{R}$  and for all  $u \in \mathcal{H}$ ,
- ii)  $\|f(t, u_1) - f(t, u_2)\| \leq \varphi(t)\|u_1 - u_2\|$  for a.e.  $t \in \mathbb{R}$  and  $\forall u_1, u_2 \in \mathcal{H}$ .

## 2.2. Abstract thermoelastic problem

First, by putting

$$U = \begin{pmatrix} Au \\ u_t \\ \theta \end{pmatrix}, \quad \mathcal{A} = A \begin{pmatrix} 0 & -1 & 0 \\ 1 & 0 & -\mu \\ 0 & \mu & \eta \end{pmatrix} = A \cdot G, \quad \mathcal{F}(t, U) = \begin{pmatrix} 0 \\ f(t, u) \\ 0 \end{pmatrix}.$$

We can rewrite Equation (1.1) in the form

$$\frac{dU}{dt} + \mathcal{A}U = \mathcal{F}(t, U), \quad t \geq t_0 \tag{1.6}$$

with initial data  $U(t_0) = U_0$ .

The characteristic polynomial  $\chi(z)$  of  $G$  has the form  $\chi(z) = z^3 - \eta z^2 + (1 + \mu^2)z - \eta$ .

One can see that the equation  $\chi(z) = 0$  has the simple root  $z_1$  and two other roots are complex  $\bar{z}_2 = z_3$  such that

$$0 < z_1 < \eta, \quad z_2 + z_3 = \eta - z_1, \quad z_2 - z_3 = i \cdot \left( \frac{4\eta}{z_1} - (\eta - z_1)^2 \right)^{1/2}$$

if  $\frac{1}{3} < \rho_1 \leq \frac{1 + \mu^2}{\eta^2} \leq \rho_2 < \infty$ , here  $\rho_1, \rho_2$  are constants.

Moreover, there exists positive constants  $c_1, c_2$  depending on  $\rho_1, \rho_2$  and  $\eta_0$  such that for any  $\eta \geq \eta_0 > 0$  we have

$$c_1 \leq z_1 \eta \leq c_2, \quad 1 - \frac{c_2}{\eta^2} \leq \frac{z_2 + z_3}{\eta} < 1, \quad c_1 \leq \frac{|z_2 - z_3|}{\eta} \leq c_2.$$

In order to diagonalize the matrix operator, we introduce new variables

$$y_1 = \frac{\mu\theta - (1 - z_2 z_3)Au + (z_2 + z_3)u_t}{(z_1 - z_2)(z_1 - z_3)}$$

$$y_2 = \frac{\mu\theta - (1 - z_1 z_3)Au + (z_1 + z_3)u_t}{(z_2 - z_1)(z_2 - z_3)}$$

$$y_3 = \frac{\mu\theta - (1 - z_1 z_2)Au + (z_1 + z_2)u_t}{(z_3 - z_1)(z_3 - z_2)}$$

then

$$Au = y_1 + y_2 + y_3$$

$$u_t = -(z_1 y_1 + z_2 y_2 + z_3 y_3)$$

$$\theta = -\frac{1}{\mu} (Au + z_1^2 y_1 + z_2^2 y_2 + z_3^2 y_3).$$

Introducing variables  $w_j$  by formulas  $y_i(t) = w_i(z_1 t)$ , we get

$$\begin{cases} \frac{dw_1}{dt} + Aw_1 &= K_1 f(t, A^{-1}(w_1 + w_2 + w_3)) \\ \frac{dw_2}{dt} + \frac{z_2}{z_1} Aw_2 &= K_2 f(t, A^{-1}(w_1 + w_2 + w_3)) \\ \frac{dw_3}{dt} + \frac{z_3}{z_1} Aw_3 &= K_2 f(t, A^{-1}(w_1 + w_2 + w_3)) \end{cases} \tag{1.7}$$

where  $K_1 = \frac{z_2 + z_3}{z_1(z_1 - z_2)(z_1 - z_3)}$ ,  $K_2 = \frac{z_1 + z_3}{z_1(z_2 - z_1)(z_2 - z_3)}$



and

$$K_3 = \frac{z_1 + z_2}{z_1(z_3 - z_1)(z_3 - z_2)} = \bar{K}_2.$$

Thus, in the space  $\mathbf{H} = \mathbf{H} \times \bar{\mathbf{H}} \times \bar{\mathbf{H}}$  (where  $\bar{\mathbf{H}}$  is complexification of  $\mathcal{H}$ ),  $W = (w_1, w_2, w_3)$  satisfies the equation

$$\frac{dW}{dt} + \mathbf{A}W = \mathbf{F}(t, W), \quad W(t_0) = W_0 = U_0, \tag{1.8}$$

where

$$\mathbf{A} = A \cdot \begin{pmatrix} 1 & 0 & 0 \\ 0 & \frac{z_2}{z_1} & 0 \\ 0 & 0 & \frac{z_3}{z_1} \end{pmatrix}, \quad \mathbf{F}(t, W) = \begin{pmatrix} K_1 \\ K_2 \\ K_3 \end{pmatrix} \cdot f\left(t, A^{-1}(w_1 + w_2 + w_3)\right).$$

From now, without any misunderstanding, we denote the norm on  $\mathbf{H}$  by  $|\cdot|$  and let  $K^2 = K_1^2 + |K_2|^2 + |K_3|^2 = K_1^2 + 2|K_2|^2$  we have

$$|\mathbf{F}(t, W)| \leq \sqrt{3}K\varphi(t)(1 + |W|), \quad |\mathbf{F}(t, W_1) - \mathbf{F}(t, W_2)| \leq \sqrt{3}K\varphi(t)|W_1 - W_2|. \tag{1.9}$$

In the case of infinite-dimensional phase spaces, instead of (1.8), we consider the integral equation

$$W(t) = e^{-(t-s)\mathbf{A}}W(s) + \int_s^t e^{-(t-\xi)\mathbf{A}}\mathbf{F}(\xi, W(\xi))d\xi \text{ for a.e. } t \geq s. \tag{1.10}$$

By a *solution* of equation (1.10) we mean a *strongly measurable* function  $W(\cdot)$  defined on an interval  $J$  with the values in  $\mathcal{H}$  that satisfies (1.10) for  $t, s \in J$ . We note that the solution  $W$  to equation (1.10) is called a *mild solution* of equation (1.8).

**2.3. The existence and uniqueness of solution**

Now, for every pair of integers  $N_1 \geq 0$ , and  $N_2 \geq 0$  we introduce the projections

$$P = \begin{pmatrix} P_{N_1} & 0 & 0 \\ 0 & P_{N_2} & 0 \\ 0 & 0 & P_{N_2} \end{pmatrix}, \quad Q = I - P \tag{1.11}$$

where  $P_N$  is the orthoprojector onto  $\text{span}\{e_k : k = 1, 2, \dots, N\}$  for  $N \geq 1$  and  $P_0 = 0$ .

Putting

$$\lambda^- = \max \left\{ \lambda_{N_1}, \frac{\text{Re}z_2}{z_1} \lambda_{N_2} \right\} \quad \text{and} \quad \lambda^+ = \min \left\{ \lambda_{N_1+1}, \frac{\text{Re}z_2}{z_1} \lambda_{N_2+1} \right\}$$

Throughout this paper, we assume that  $\lambda^- < \lambda^+$ . Since  $\dim P < \infty$ , and  $P$  commutes with  $\mathbf{A}$ , then we have the following dichotomy estimates

$$|e^{t\mathbf{A}} P| \leq e^{\lambda^-|t|} \quad \forall t \in \mathbb{R}; \quad |e^{-t\mathbf{A}} Q| \leq e^{-\lambda^+t} \quad \forall t > 0 \tag{1.12}$$

We now define the *Green function* as follows.

$$\mathcal{G}(t, \tau) = \begin{cases} e^{-(t-\tau)\mathbf{A}} [I - P] & \text{for } t > \tau, \\ -e^{-(t-\tau)\mathbf{A}} P & \text{for } t \leq \tau. \end{cases} \tag{1.13}$$

Then  $\mathcal{G}(t, \tau)$  maps  $\mathbf{H}$  into  $\mathbf{H}$ . Moreover, by dichotomy estimates (1.12) we have

$$e^{\gamma(t-\tau)} |\mathcal{G}(t, \tau)| \leq e^{-\alpha|t-\tau|} \quad \text{for all } t, \tau \in \mathbb{R} \tag{1.14}$$

where  $\alpha := \frac{\lambda^+ - \lambda^-}{2}$  and  $\gamma := \frac{\lambda^+ + \lambda^-}{2}$ .

Now, by Lyapunov - Perron method, we firstly construct the form of the solutions of equation (1.10) in the following Lemma

**Lemma 2.8.** For fixed  $t_0 \in \mathbb{R}$  let  $W(t)$ ,  $t \leq t_0$  be a solution to equation (1.10) such that  $W(t) \in D(\mathbf{A})$  for all  $t \leq t_0$  and the function  $Z(t) = \left| e^{-\gamma(t_0-t)} W(t) \right| \quad \forall t \leq t_0$ , belongs to  $E_{(-\infty, t_0]}$ .

Then, this solution  $W(t)$  satisfies

$$W(t) = e^{-(t-t_0)\mathbf{A}} v_1 + \int_{-\infty}^{t_0} \mathcal{G}(t, \tau) \mathbf{F}(\tau, W(\tau)) d\tau, \quad \forall t \leq t_0 \tag{1.15}$$

where  $v_1 \in P\mathbf{H}$ , and  $\mathcal{G}(t, \tau)$  is the Green's function defined as in (1.13).

Proof. Put

$$Y(t) := \int_{-\infty}^{t_0} \mathcal{G}(t, \tau) \mathbf{F}(\tau, W(\tau)) d\tau \quad \text{for all } t \leq t_0. \tag{1.16}$$

By the definition of  $\mathcal{G}(t, \tau)$ , we have that  $Y(t) \in \mathbf{H}$  for  $t \leq t_0$ .

Using estimates (1.9) and (1.14), for  $t \leq t_0$ , we obtain

$$\begin{aligned} \left| e^{-\gamma(t_0-t)} Y(t) \right| &\leq \sqrt{3}K \int_{-\infty}^{t_0} \left| e^{\gamma(t-\tau)} \mathcal{G}(t, \tau) \right| \varphi(\tau) e^{-\gamma(t_0-\tau)} (1 + |W(\tau)|) d\tau \\ &\leq \sqrt{3}K \int_{-\infty}^{t_0} \left| e^{\gamma(t-\tau)} \mathcal{G}(t, \tau) \right| \varphi(\tau) \left( e^{-\gamma(t_0-\tau)} + |W(\tau)| \right) d\tau. \end{aligned} \tag{1.17}$$

Putting  $V(t) := e^{-\gamma(t_0-t)} + |W(t)|$  for all  $t \leq t_0$ .

We have that the function  $V$  belongs to  $E_{(-\infty, t_0]}$  and

$$\begin{aligned} \int_{-\infty}^{t_0} \left| e^{\gamma(t-\tau)} \mathcal{G}(t, \tau) \right| \varphi(\tau) V(\tau) d\tau &\leq \int_{-\infty}^{t_0} e^{-\alpha|t-\tau|} \varphi(\tau) V(\tau) d\tau \\ &\leq \left\| e^{-\alpha|\cdot|} \varphi(\cdot) \right\|_{E_{(-\infty, t_0]}} \left\| V \right\|_{E_{(-\infty, t_0]}}. \end{aligned} \tag{1.18}$$

Here, we use the Holder's inequality (1.5).

Since  $h_\alpha(t) = \|e^{-\alpha|t-1|}\varphi(\cdot)\|_{E'_{(-\infty,t_0]}}$  belongs to  $E_{(-\infty,t_0]}$ , using the admissibility of  $E_{(-\infty,t_0]}$  we obtain that  $e^{-\gamma(t_0-\cdot)}Y(\cdot) \in \mathcal{E}_{(-\infty,t_0]}$  and  $\|e^{-\gamma(t_0-\cdot)}Y(\cdot)\|_{\mathcal{E}_{(-\infty,t_0]}} \leq \sqrt{3}K \|h_\alpha(\cdot)\|_{E_{(-\infty,0]}} \|V\|_{E_{(-\infty,0]}}$ .

It is obvious that  $Y(\cdot)$  satisfies the integral equation

$$Y(t_0) = e^{-(t_0-t)A}Y(t) + \int_t^{t_0} e^{-(t_0-\tau)A}\mathbf{F}(\tau,W(\tau))d\tau \quad \text{for } t \leq t_0. \tag{1.19}$$

On the other hand,

$$W(t_0) = e^{-(t_0-t)A}W(t) + \int_t^{t_0} e^{-(t_0-\tau)A}\mathbf{F}(\tau,W(\tau))d\tau.$$

Then  $Y(t_0) - W(t_0) = e^{-(t_0-t)A}[Y(t) - W(t)] \in P\mathbf{H}$  and

$$\begin{aligned} W(t) &= e^{-(t-t_0)A}v_1 + Y(t) \\ &= e^{-(t-t_0)A}v_1 + \int_{-\infty}^{t_0} \mathcal{G}(t,\tau)\mathbf{F}(\tau,W(\tau))d\tau \quad \text{for } t \leq t_0. \end{aligned}$$

The proof is completed.

**Lemma 2.9.** Define

$$h_\alpha(t) = \|e^{-\alpha|t-1|}\varphi(\cdot)\|_{E'_{(-\infty,t_0]}}. \tag{1.20}$$

Let  $f : \mathbb{R} \times \mathbf{H} \rightarrow \mathbf{H}$  be  $\varphi$  - Lipschitz such that  $k = \sqrt{3}K \|h_\alpha(\cdot)\|_{E_{(-\infty,t_0]}} < 1$ .

Then, there corresponds to each  $v_1 \in P\mathbf{H}$  one and only one solution  $W(\cdot)$  of equation (1.10) on  $(-\infty,t_0]$  satisfying the condition  $PW(t_0) = v_1$  and  $Z(t) = |e^{-\gamma(t_0-t)}W(t)|$ ,  $t \leq t_0$  belongs to  $E_{(-\infty,t_0]}$  for each  $t_0 \in \mathbb{R}$ .

*Proof.* Denote by  $\mathcal{E}^{\gamma,t_0}$  the space of all functions  $V : (-\infty,t_0] \rightarrow \mathbf{H}$  which is strongly measurable and  $|e^{-\gamma(t_0-\cdot)}V(\cdot)| \in E_{(-\infty,t_0]}$ . Then,  $\mathcal{E}^{\gamma,t_0}$  is a Banach space endowed with the norm

$$\|V\|_\gamma := \left\| |e^{-\gamma(t_0-\cdot)}V(\cdot)| \right\|_{E_{(-\infty,t_0]}}. \tag{1.21}$$

For each  $t_0 \in \mathbb{R}$  and  $v_1 \in P\mathbf{H}$  we will prove that the linear transformation  $T$  defined by

$$(TW)(t) = e^{-(t-t_0)A}v_1 + \int_{-\infty}^{t_0} \mathcal{G}(t,\tau)\mathbf{F}(\tau,W(\tau))d\tau \quad \text{for } t \leq t_0 \tag{1.22}$$

acts from  $\mathcal{E}^{\gamma,t_0}$  into itself and is a contraction.

In fact, for  $W \in \mathcal{E}^{\gamma,t_0}$ , we have that  $|\mathbf{F}(t,W(t))| \leq \sqrt{3}K\varphi(t)(1+|W(t)|)$ .

Therefore, putting  $Y(t) := e^{-(t-t_0)A}v_1 + \int_{-\infty}^{t_0} \mathcal{G}(t,\tau)\mathbf{F}(\tau,W(\tau))d\tau$  for  $t \leq t_0$ , we derive that

$$|e^{-\gamma(t_0-t)}Y(t)| \leq \|v\| + \sqrt{3}Kh_\alpha(t)\|V\|_{E_{(-\infty,t_0]}} \tag{1.23}$$

for all  $t \leq t_0$ , where  $V(t) := e^{-\gamma(t_0-t)}(1+|W(t)|)$ , and  $\|v\| = e^{-\alpha(t_0-t)}\|v_1\|$ .

Since  $e^{-\alpha(t_0-\cdot)}$  and  $h_\alpha(\cdot)$  belong to  $E_{(-\infty, t_0]}$ ,  $Y(\cdot) \in \mathcal{E}^{\gamma, t_0}$  and  $\|Y(\cdot)\|_\gamma \leq \|v\| + k\|V\|_{E_{(-\infty, t_0]}}$ .

Therefore, the linear transformation  $T$  acts from  $\mathcal{E}^{\gamma, t_0}$  to  $\mathcal{E}^{\gamma, t_0}$ .

Now, for  $X, Z \in \mathcal{E}^{\gamma, t_0}$  we estimate

$$\begin{aligned} \left| e^{-\gamma(t_0-t)} [TX(t) - TZ(t)] \right| &\leq \int_{-\infty}^{t_0} \left| e^{-\gamma(t_0-t)} \mathcal{G}(t, \tau) \right| \left\| \mathbf{F}(\tau, X(\tau)) - \mathbf{F}(\tau, Z(\tau)) \right\| d\tau \\ &\leq \sqrt{3}K \int_{-\infty}^{t_0} \left| e^{-\gamma(t_0-t)} \mathcal{G}(t, \tau) \right| \varphi(\tau) e^{-\gamma(t_0-\tau)} |X(\tau) - Z(\tau)| d\tau. \end{aligned}$$

Again, using (1.18) we derive

$$\|TX(\cdot) - TZ(\cdot)\|_\gamma \leq k \|X(\cdot) - Z(\cdot)\|_\gamma.$$

Hence, since  $k < 1$ , we obtain that  $T : \mathcal{E}^{\gamma, t_0} \rightarrow \mathcal{E}^{\gamma, t_0}$  is a contraction. Thus, there exists a unique  $W(\cdot) \in \mathcal{E}^{\gamma, t_0}$  such that  $TW = W$ . By definition of  $T$  we have that  $W(\cdot)$  is the unique solution in  $\mathcal{E}^{\gamma, t_0}$  of equation (1.10) for  $t \leq t_0$ .

By Lemma 2.9 we proved the existence and uniqueness of solution to Equation (1.10) belongs to  $\mathcal{E}^{\gamma, t_0}$  for  $t \leq t_0$ . Furthermore, by Lemma 2.8 this solution can be written in the form of (1.15) which is called *Lyapunov-Perron equation*.

#### 2.4. The existence of admissible inertial manifold

Now, we make precisely the notion of admissible inertial manifolds for solutions to integral equation (1.10) in the following definition.

**Definition 2.10.** Let  $E$  be an admissible function space,  $\mathcal{E}$  be a Banach space corresponding to  $E$ . An *admissible inertial manifold* of  $\mathcal{E}$ -class for Equation (1.10) is a collection of Lipschitz surfaces  $\mathbb{M} = \{\mathcal{M}_t\}_{t \in \mathbb{R}}$  in  $\mathbf{H}$  such that each  $\mathcal{M}_t$  is the graph of a Lipschitz function  $\Phi_t : \mathbf{PH} \rightarrow (I - P)\mathbf{H}$ , i.e.,

$$\mathcal{M}_t = \{U + \Phi_t U : U \in \mathbf{PH}\} \quad \text{for } t \in \mathbb{R} \tag{1.24}$$

and the following conditions are satisfied:

i) The Lipschitz constants of  $\Phi_t$  are independent of  $t$ , i.e. there exists a constant  $C$  independent of  $t$  such that

$$\|\Phi_t W_1 - \Phi_t W_2\| \leq C \|W_1 - W_2\| \quad \text{for all } t \in \mathbb{R} \text{ and } W_1, W_2 \in \mathbf{PH}. \tag{1.25}$$

ii) There exists  $\gamma > 0$  such that to each  $W_0 \in \mathcal{M}_{t_0}$  there corresponds one and only one solution  $W(t)$  to (1.10) on  $(-\infty, t_0]$  satisfying that  $W(t_0) = W_0$  and the function

$$V(t) = e^{-\gamma(t_0-t)} W(t) \tag{1.26}$$

belongs to  $\mathcal{E}_{(-\infty, t_0]}$  for each  $t_0 \in \mathbb{R}$ .

iii)  $\{\mathcal{M}_t\}_{t \in \mathbb{R}}$  is positively invariant under (1.10), i.e., if a solution  $W(t)$ ,  $t \geq s$  of (1.10) satisfies  $W_s \in \mathcal{M}_s$ , then we have that  $W(t) \in \mathcal{M}_t$  for  $t \geq s$ .

iv)  $\{\mathcal{M}_t\}_{t \in \mathbb{R}}$  exponentially attracts all the solutions to (1.10), i.e., for any solution  $W(\cdot)$  of (1.10) and any fixed  $s \in \mathbb{R}$ , there is a positive constant  $H$  such that

$$\text{dist}_{\mathbf{H}}(W(t), \mathcal{M}_t) \leq H e^{-\gamma(t-s)} \quad \text{for } t \geq s, \tag{1.27}$$

where  $\gamma$  is the same constant as the one in (1.26), and  $\text{dist}_{\mathbf{H}}$  denotes the Hausdorff semi-distance generated by the norm in  $\mathbf{H}$ .

Then, the existence of admissible inertial manifold is state in the following theorem.

**Theorem 2.11.** Equation (1.10) has an admissible inertial manifold if

$$k = \sqrt{3}K \|h_\alpha(\cdot)\|_{E_{(-\infty, t_0]}} < 1 \tag{1.28}$$

$$\text{and } \frac{k\sqrt{3}KM_2}{(1-k)(1-e^{-\alpha})} \|\Lambda_1 \varphi\|_\infty + k < 1, \tag{1.29}$$

where  $h_\alpha$  is given by (1.20) and  $M_2$  is defined in Definition 2.3.

*Proof.* Firstly, Lemma 2.9 allows us to define a collection of surfaces  $\{\mathcal{M}_{t_0}\}_{t_0 \in \mathbb{R}}$  by

$$\mathcal{M}_{t_0} := \{V + \Phi_{t_0} V \mid V \in \mathcal{PH}\}$$

here  $\Phi_{t_0} : \mathcal{PH} \rightarrow (I - P)\mathbf{H}$  is defined by

$$\Phi_{t_0}(V) = \int_{-\infty}^{t_0} e^{-(t_0-\tau)A} (I - P) \mathbf{F}(\tau, W(\tau)) d\tau = (I - P)W(t_0), \tag{1.30}$$

where  $W(\cdot)$  is the unique solution in  $\mathcal{E}^{\gamma, t_0}$  of equation (1.10) satisfying that  $PW(t_0) = V$  (note that the existence and uniqueness of  $W$  is proved in Lemma 2.9).

Then,  $\Phi_{t_0}$  is Lipschitz continuous with Lipschitz constant independent of  $t_0$ . Indeed, for  $V_1$  and  $V_2$  belonging to  $\mathcal{PH}$  we have

$$\begin{aligned} |\Phi_{t_0}(V_1) - \Phi_{t_0}(V_2)| &\leq \int_{-\infty}^{t_0} |e^{-(t_0-s)A} (I - P)| |\mathbf{F}(s, W_1(s)) - \mathbf{F}(s, W_2(s))| ds \\ &= \int_{-\infty}^{t_0} |\mathcal{G}(t_0, s)| |\mathbf{F}(s, W_1(s)) - \mathbf{F}(s, W_2(s))| ds \\ &\leq \sqrt{3}K \int_{-\infty}^{t_0} |e^{\gamma(t_0-s)} \mathcal{G}(t_0, s)| |\varphi(s)| e^{-\gamma(t_0-s)} |W_1(s) - W_2(s)| ds \\ &\leq k |W_1(\cdot) - W_2(\cdot)|_\gamma. \end{aligned} \tag{1.31}$$

We now estimate  $|W_1(\cdot) - W_2(\cdot)|_\gamma$ . Since  $W_i(\cdot)$  is the unique solution in  $\mathcal{E}^{\gamma, t_0}$  of equation (1.10) on  $(-\infty, t_0]$  satisfying  $PW_i(t_0) = V_i$  with  $i=1, 2$ , respectively, we have that

$$\begin{aligned} |e^{-\gamma(t_0-t)} (W_1(t) - W_2(t))| &= \left| e^{-\gamma(t_0-t)} \left( e^{-(t-t_0)A} (V_1 - V_2) + \int_{-\infty}^{t_0} \mathcal{G}(t, \tau) [\mathbf{F}(\tau, W_1(\tau)) - \mathbf{F}(\tau, W_2(\tau))] d\tau \right) \right| \\ &\leq |V_1 - V_2| + k |W_1(\cdot) - W_2(\cdot)|_\gamma \quad \text{for all } t \leq t_0. \end{aligned}$$

Hence, we obtain  $|W_1(\cdot) - W_2(\cdot)|_\gamma \leq |V_1 - V_2| + k |W_1(\cdot) - W_2(\cdot)|_\gamma$ .

Therefore, since  $k < 1$  we get  $|W_1(\cdot) - W_2(\cdot)|_\gamma \leq \frac{1}{1-k} |V_1 - V_2|$ .

Substituting this inequality to (1.31) we obtain  $|\Phi_{t_0}(V_1) - \Phi_{t_0}(V_2)| \leq \frac{k}{1-k} |V_1 - V_2|$ ,

yielding that  $\Phi_{t_0}$  is Lipschitz continuous with the Lipschitz constant  $C := \frac{k}{1-k}$  independent

of  $t_0$ . We thus obtain the property (i) in Definition 2.10 of the Admissible Inertial Manifold.

Secondly, The property (ii) of the Admissible Inertial Manifold is obvious.

Thirdly, We now prove the property (iii) of admissible inertial manifold.

To do this, let  $W(\cdot)$  be a solution to equation (1.10) satisfying  $W(s) = W_s \in \mathcal{M}_s$ , i.e.,

$$W(s) = PW(s) + \Phi_s(PW(s)).$$

Then, we fix an arbitrary number  $t_0 \in [s, \infty)$  and define a function  $U$  on  $(-\infty, t_0]$  by

$$U(t) = \begin{cases} W(t) & \text{if } t \in [s, t_0], \\ V(t) & \text{if } t \in (-\infty, s] \end{cases}$$

Where  $V$  is the unique solution in  $\mathcal{E}^{\gamma, t_0}$  of equation (1.10) satisfying  $V(s) = W(s) \in \mathcal{M}_s$ .

Then, using equation (1.10) and (1.30) we obtain

$$\begin{aligned} U(t) &= e^{-(t-s)A} (PW(s) + \Phi_s(PW(s))) + \int_s^t e^{-(t-\tau)A} \mathbf{F}(\tau, U(\tau)) d\tau \quad (1.32) \\ &= e^{-(t-s)A} (PW(s)) + \int_{-\infty}^t e^{-(t-\tau)A} (I - P) \mathbf{F}(\tau, U(\tau)) d\tau \\ &\quad + \int_s^t e^{-(t-\tau)A} P \mathbf{F}(\tau, U(\tau)) d\tau \quad \text{for } s \leq t \leq t_0. \end{aligned}$$

Obviously, equation (1.32) also remains true for  $t \in (-\infty, s]$ .

Now, in equation (1.32) setting  $t = t_0$  and applying the projection  $P$  we obtain

$$PU(t_0) = e^{-(t_0-s)A} (PW(s)) + \int_s^{t_0} e^{-(t_0-\tau)A} P \mathbf{F}(\tau, U(\tau)) d\tau \quad \text{for } s \leq t_0.$$

It follows from the above equation that

$$\begin{aligned} PW(s) &= e^{(t_0-s)A} (PW(t_0)) - \int_s^{t_0} e^{(t_0-s)A} e^{-(t_0-\tau)A} P \mathbf{F}(\tau, U(\tau)) d\tau \quad (1.33) \\ &= e^{-(s-t_0)A} (PW(t_0)) - \int_s^{t_0} e^{-(s-\tau)A} P \mathbf{F}(\tau, U(\tau)) d\tau \quad \text{for } s \leq t_0. \end{aligned}$$

Substituting this form of  $PU(s)$  to equation (1.32) we obtain

$$U(t) = e^{-(t-t_0)A} PW(t_0) + \int_{-\infty}^{t_0} \mathcal{G}(t, \tau) \mathbf{F}(\tau, U(\tau)) d\tau \quad \text{for } t \leq t_0. \quad (1.34)$$

Therefore,  $W(t_0) = U(t_0) = PW(t_0) + \Phi_{t_0}(PW(t_0))$  for all  $t_0 \geq s$ .

Finally, We prove the property (iv) of Definition 2.10. To do this, we will prove that for any solution  $W(\cdot)$  to equation (1.10) and any  $s \in \mathbb{R}$  there is a solution  $W^*(\cdot)$  of such that  $W^*(t) \in \mathcal{M}_s$  for  $t \geq s$  and

$$|W(t) - W^*(t)| \leq \frac{\eta}{1-L} e^{-\gamma(t-s)} \quad \text{for all } t \geq s, \text{ and some constant } \eta, \tag{1.35}$$

where

$$L := \frac{kN_2}{(1-k)(1-e^{-\alpha})} \|\Lambda_1 \varphi\|_\infty + k < 1$$

is given as in (1.29). The solution  $W^*(\cdot)$  is called an *induced trajectory*.

We will find the induced trajectory in the form  $W^*(t) = W(t) + U(t)$  with

$$\|U\|_{s,+} = \text{esssup}_{t \geq s} e^{\gamma(t-s)} |U(t)| < \infty. \tag{1.36}$$

Substituting  $W^*(\cdot)$  into (2.10) we obtain that  $W^*(\cdot)$  is a solution to (1.10) for  $t \geq s$  if and only if  $U(\cdot)$  is a solution to the equation

$$U(t) = e^{-(t-s)A} U(s) + \int_s^t e^{-(t-\xi)A} [\mathbf{F}(\xi, W(\xi) + U(\xi)) - \mathbf{F}(\xi, W(\xi))] d\xi. \tag{1.37}$$

For the sake of simplicity in the presentation, we put

$$F(t, U) = \mathbf{F}(t, W + U) - \mathbf{F}(t, W)$$

and set

$$L_\infty^{s,+} = \left\{ V : [s, \infty) \rightarrow \mathbf{H} \mid V \text{ is strongly measurable and } \text{esssup}_{t \geq s} e^{\gamma(t-s)} |V(t)| < \infty \right\}$$

endowed with the norm  $\|\cdot\|_{s,+}$  defined as in (1.36).

Then, by the same way as in Lemma 2.8, we can prove that a function  $U(\cdot) \in L_\infty^{s,+}$  is a solution to (1.37) if and only if it satisfies

$$U(t) = e^{-(t-s)A} X_0 + \int_s^\infty \mathcal{G}(t, \tau) F(\tau, U(\tau)) d\tau \quad \text{for } t \geq s \text{ and some } X_0 \in (I - P)\mathbf{H}. \tag{1.38}$$

Here, the value  $X_0 \in (I - P)\mathbf{H}$  is chosen such that  $W^*(s) = W(s) + U(s) \in \mathcal{M}_s$ , i.e.,

$$(I - P)(W(s) - U(s)) = \Phi_s(P(W(s) + U(s))).$$

From (1.38) it follows that

$$U(s) = X_0 - \int_s^\infty e^{-(s-\tau)A} P F(\tau, U(\tau)) d\tau. \tag{1.39}$$

Hence

$$P(W(s) + U(s)) = P W(s) - \int_s^\infty e^{-(s-\tau)A} P F(\tau, U(\tau)) d\tau,$$

and therefore

$$X_0 = (I - P)U(s) = -(I - P)W(s) + \Phi_s \left( P W(s) - \int_s^\infty e^{-(s-\tau)A} P F(\tau, U(\tau)) d\tau \right). \tag{1.40}$$

Substituting this form of  $X_0$  into (1.38) we obtain

$$U(t) = e^{-(t-s)A} \left[ -(I-P)W(s) + \Phi_s \left( PW(s) - \int_s^\infty e^{-(s-\tau)A} PF(\tau, U(\tau)) d\tau \right) \right] \quad (1.41)$$

$$+ \int_s^\infty \mathcal{G}(t, \tau) F(\tau, U(\tau)) d\tau \quad \text{for } t \geq s.$$

What we have to do now to prove the existence of  $W^*$  satisfying (1.35) is to prove that equation (1.41) has a solution  $U(\cdot) \in L_\infty^{s,+}$ .

To do this we will prove that the linear transformation  $T$  defined by

$$(TX)(t) = e^{-(t-s)A} \left[ -(I-P)W(s) + \Phi_s \left( PW(s) - \int_s^\infty e^{-(s-\tau)A} PIF(\tau, X(\tau)) d\tau \right) \right]$$

$$+ \int_s^\infty \mathcal{G}(t, \tau) \mathcal{F}(\tau, X(\tau)) d\tau \quad \text{for } t \geq s,$$

acts from  $L_\infty^{s,+}$  into itself and is a contraction.

Indeed, for  $X(\cdot) \in L_\infty^{s,+}$ , we have that  $|F(t, X(t))| \leq \sqrt{3}K\varphi(t)|X(t)|$ , therefore, by putting

$$q(X) := -(I-P)W(s) + \Phi_s \left( PW(s) - \int_s^\infty e^{-(s-\tau)A} PF(\tau, X(\tau)) d\tau \right),$$

we can estimate

$$e^{\gamma(t-s)} |(TX)(t)| \leq e^{\gamma(t-s)} |e^{-(t-s)A} q(X)| + \sqrt{3}K \int_s^\infty |e^{\gamma(t-\tau)} \mathcal{G}(t, \tau) \varphi(\tau) e^{\gamma(\tau-s)} |X(\tau)| d\tau \quad (1.42)$$

$$\leq \|e^{\gamma(t-s)} e^{-(t-s)A} q(X)\| + \sqrt{3}K \int_s^\infty |e^{\gamma(t-\tau)} \mathcal{G}(t, \tau) \varphi(\tau) d\tau| \|X(\cdot)\|_{s,+}.$$

Using Lipschitz property of  $\Phi_s$  and for  $t \geq s$  we now estimate the first term in the right-hand side of the last formula as follows.

$$\begin{aligned} |e^{\gamma(t-s)} e^{-(t-s)A} q(X)| &\leq |e^{\gamma(t-s)} e^{-(t-s)A} (-(I-P)W(s) + \Phi_s(PW(s)))| + \\ &\quad + |e^{\gamma(t-s)} e^{-(t-s)A} (q(X) + (I-P)W(s) - \Phi_s(PW(s)))| \\ &\leq e^{(\gamma-\lambda^+)(t-s)} (|(-(I-P)W(s) + \Phi_s(PW(s)))| + \\ &\quad + |(q(X) + (I-P)W(s) - \Phi_s(PW(s)))|) \\ &\leq \eta + |(q(X) + (I-P)W(s) - \Phi_s(PW(s)))| \\ &\leq \eta + \left| \Phi_s \left( PW(s) - \int_s^\infty e^{-(s-\tau)A} PF(\tau, X(\tau)) d\tau \right) - \Phi_s(PW(s)) \right| \\ &\leq \eta + \frac{k}{1-k} \left| \int_s^\infty e^{-(s-\tau)A} PF(\tau, X(\tau)) d\tau \right| \\ &\leq \eta + \frac{k\sqrt{3}K}{1-k} \int_s^\infty e^{-\alpha(\tau-s)} \varphi(\tau) |e^{\gamma(\tau-s)} X(\tau)| d\tau \\ &\leq \eta + \left[ \frac{k\sqrt{3}KM_2}{(1-k)(1-e^{-\alpha})} \mathbf{i} \Lambda_1 \varphi \mathbf{\Gamma}_\infty \right] \|X(\cdot)\|_{s,+}. \end{aligned}$$



Substituting these estimates to (1.42) we obtain  $TX \in L_\infty^{s,+}$  and

$$\|TX\|_{s,+} \leq \eta + \left[ \frac{k\sqrt{3}KM_2}{(1-k)(1-e^{-\alpha})} \|\Lambda_1\phi\|_\infty + k \right] \|X(\cdot)\|_{s,+}. \tag{1.43}$$

Therefore, the linear transformation  $T$  acts from  $L_\infty^{s,+}$  to  $L_\infty^{s,+}$ .

Now, using the fact that  $|F(t,U_1) - F(t,U_2)| \leq \sqrt{3}K\varphi(t)|U_1 - U_2|$

and for  $X, Z \in L_\infty^{s,+}$  we now estimate

$$\begin{aligned} |e^{\gamma(t-s)}(TX(t) - TZ(t))| &\leq \frac{k}{1-k} \left| \int_s^\infty e^{-(s-\tau)\Lambda} P(F(\tau, X(\tau)) - F(\tau, Z(\tau))) d\tau \right| \\ &\quad + \int_s^\infty |e^{\gamma(t-s)} \mathcal{G}(t, \tau)| |F(\tau, X(\tau)) - F(\tau, Z(\tau))| d\tau \\ &\leq \frac{k\sqrt{3}K}{1-k} \int_s^\infty e^{-\alpha(\tau-s)} \varphi(\tau) |e^{\gamma(\tau-s)} [X(\tau) - Z(\tau)]| d\tau \\ &\quad + \sqrt{3}K \int_s^\infty |e^{\gamma(t-\tau)} \mathcal{G}(t, \tau)| \varphi(\tau) e^{\gamma(\tau-s)} |X(\tau) - Z(\tau)| d\tau \\ &\leq \left[ \frac{k\sqrt{3}KM_2}{(1-k)(1-e^{-\alpha})} \|\Lambda_1\phi\|_\infty + k \right] \|X(\cdot) - Z(\cdot)\|_{s,+} \quad \text{for all } t \geq s. \end{aligned}$$

Therefore,  $\|TX(\cdot) - TZ(\cdot)\|_{s,+} \leq \left[ \frac{k\sqrt{3}KM_2}{(1-k)(1-e^{-\alpha})} \|\Lambda_1\phi\|_\infty + k \right] \|X(\cdot) - Z(\cdot)\|_{s,+}$ .

Hence, if  $\frac{k\sqrt{3}KM_2}{(1-k)(1-e^{-\alpha})} \|\Lambda_1\phi\|_\infty + k < 1$  then we obtain that  $T : L_\infty^{s,+} \rightarrow L_\infty^{s,+}$  is a

contraction. Thus, there exists a unique  $U(\cdot) \in L_\infty^{s,+}$  such that  $TU = U$ .

By the definition of  $T$  we have that  $U(\cdot)$  is the unique solution in  $L_\infty^{s,+}$  of equation (1.41) for  $t \geq s$ . Also, using (1.43) we have

$$\|U(\cdot)\|_{s,+} \leq \frac{\eta}{1-L}.$$

Furthermore, by determination of  $U$  we obtain the existence of the solution  $W^* = W + U$  to equation (1.10) such that  $W^*(t) \in \mathcal{M}_t$  for  $t \geq s$ , and  $W^*$  satisfies the

inequality (1.35) yielding that  $|W^*(t) - W(t)| = |U(t)| \leq \frac{\eta}{1-L} e^{-\gamma(t-s)}$  for all  $t \geq s$ .

Putting  $H := \frac{\eta}{1-L}$  it follows from the latter inequality that

$$\text{dist}_{\mathbb{H}}(W(t), \mathcal{M}_t) \leq He^{-\gamma(t-s)} \quad \text{for all } t \geq s.$$

Therefore,  $\{\mathcal{M}_t\}_{t \in \mathbb{R}}$  exponentially attracts every solution  $W(\cdot)$  of integral equation (1.10).

## References

- [1] I.D. Chueshov (2002), Introduction to the Theory of Infinite-Dimensional Dissipative Systems , ACTA Scientific Publishing House.
- [2] I. D. Chueshov, I. Lasiecka (2010), Von Karman Evolution Equations: Well-posedness and long-time dynamics, Springer.
- [3] P. Constantin, C. Foias, B. Nicolaenko, R. Temam (1989), Integral Manifolds and Inertial Manifolds for Dissipative Partial Differential Equations, Springer-Verlag New York.
- [4] C. Foias, G.R. Sell, R. Temam , Variétés inertielles des équations différentielles dissipatives, Comptes Rendus de l'Académie des Sciences - Series I - Mathematics, 301, 139-142.
- [5] N.T. Huy (2006), Exponential dichotomy of evolution equations and admissibility of function spaces on a half-line, *Journal of Functional Analysis*, 235, 330-354.
- [6] N.T. Huy (2012), Inertial manifolds for semi-linear parabolic equations in admissible function spaces, *Journal of Mathematical Analysis and Applications*, 386, 894-909.
- [7] J. Lindenstrauss, L. Tzafriri (1979), Classical Banach Spaces II: Function Spaces, Springer-Verlag, Berlin.
- [8] J.L. Massera, J.J. Schaffer (1966), Linear Differential Equations and Function Spaces, Academic Press, New York.
- [9] G.R. Sell, Y. You (2002), Dynamics of Evolutionary Equations, *Applied Mathematical Sciences*, Springer-Verlag, vol.143.
- [10] R. Temam (1988), Infinite-Dimensional Dynamical Systems in Mechanics and Physics, Springer-Verlag, New York.

# CREATING WORKING MOTIVATION FOR CIVIL SERVANTS AT THANH HOA TAX DEPARTMENT

Le Thi Nuong, Le Quang Hieu, Nguyen Thi Loan

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**Abstract:** *Creating motivation and long-term commitment of civil servants will increase operational efficiency of the organization, while saving time and costs due to the need to hire new staff. Creating work motivation is an issue that every agency, organization or business needs to pay attention. In this study, the authors assess the working motivation of Thanh Hoa Tax Department by collecting secondary and preliminary data from the Department. The study used questionnaire to survey 335 civil servants at Thanh Hoa Tax Department and used descriptive statistical methods to analyze the primary data. Survey results show that there is still a small part (about 15%) of civil servants not satisfied with the motivational methods applied at the Department. Based on the reality, the authors offer solutions and recommendations to increase working motivation for civil servants of Thanh Hoa Tax Department in the near future.*

**Keywords:** *Civil servants, working motivation, Thanh Hoa Tax Department.*

## 1. Introduction

Human resources are always considered as an important factor, which plays a decisive role in the success of any organization. In order to achieve the goals set out by each agency, the organization need to know how to use and maximize the current human resources. Working motivation plays an extremely important role in improving productivity and working efficiency of individuals and organizations. The most important purpose of motivation is the rational use of labor resources, the effective exploitation of human resources in order to continuously improve the operational efficiency of organizations. Increasing working motivation will encourage individuals to work hard and improving working efficiency. Thus, it can be said that using labor resources effectively and motivating employees is extremely necessary and brings practical meaning to agencies and units.

Being aware of the influence of creating motivation for the stability and sustainable development of the organization, Thanh Hoa Tax Department has paid more and more attention to activities to motivate civil servants and create conditions for civil servants to take the initiative in creativity and promote their forte. However, through practical work and evaluation of civil servants working in the Tax Department of Thanh Hoa province, it is realized that the motivational work still has certain shortcomings and limitations from which employees have not really tried with all their efforts for work, some civil servants also tend to be bored and frustrated with difficulties. Stemming from the above requirements, the authors

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choose the topic “*Creating motivation for civil servants in Thanh Hoa Tax Department*” to analyze the situation and propose solutions to improve working motivation at Thanh Hoa Tax Department in the near future.

**2. Overview of Human Resources of Thanh Hoa Tax Department.**

Thanh Hoa Tax Department was established under Decision No.314/ TC/ QD-TCCB of the Minister of Finance on August 21, 1990, the Tax Department of Thanh Hoa province was established on the basis of merging 03 organizations: Department of Industry and Trade Tax; State Revenue Department; Agriculture Tax Department.

The Department of Taxation performs its duties and powers in accordance with the Law on Tax Administration, the Tax Laws and other relevant laws.

According to the Ministry of Finance's current regulations, the Tax Department of Thanh Hoa province has 11 units, *offices* and 14 *District-level Tax Department* under the Tax Department, with a total of 1063 civil servants.

*Table 1. Labor situation at the Thanh Hoa Tax Department by gender and education from 2017 - 2019*

Norm	2017		2018		2019		2018/2017		2019/2018	
	Number (People)	Percent (%)	Number (People)	Percent (%)	Number (People)	Percent (%)	+/-	%	+/-	%
<b>1. By gender</b>										
Male	788	68,1	736	66	687	64,6	-51	-6,5	-49	-6,6
Female	369	31,9	378	34	376	35,4	9	2,4	- 2	-0.6
<b>2. By education</b>										
Post-graduate	93	8	112	10	128	12	19	20,4	16	14
Bachelor	838	72,4	825	74,1	787	74	-13	-1,6	-38	-4,7
College, Intermediate	222	19,1	174	15,6	145	13,6	-48	-21,6	-29	-17
Primary	4	0,5	3	0,3	3	0,4	-1	-25,0	0	0
<b>Total</b>	<b>1157</b>	<b>100</b>	<b>1114</b>	<b>100</b>	<b>1063</b>	<b>100</b>	<b>-43</b>	<b>-3,7</b>	<b>-51</b>	<b>-4,6</b>

*Source: Office of Organization and Personnel, Thanh Hoa Tax Department*

According to the statistics in Table 1, the number of human resources of Thanh Hoa Tax Department tends to decrease in the period 2017-2019 due to the large increase in the number of retired civil servants every year, meanwhile the annual quota of civil servant recruitment is very low. Human resources of Thanh Hoa Tax Department tend to decrease gradually; in 2019 it is 51 people lower than in 2018. The quality of human resources of the Department of Taxation has been improved considerably in terms of education, knowledge in both theory and expertise. The number of post-graduate civil servants in 2019 increased compared to 2018, the number of civil servants with university degrees decreased by 38 because civil servants with university degrees attended post-graduate courses and have been awarded a Master's degree.

### 3. Situation of working motivating for civil servants at Thanh Hoa Tax Department

#### 3.1. Creating motivation for civil servants in the Thanh Hoa Tax Department with material factors

##### 3.1.1. Motivation through wage tools

In the period of 2017 - 2019, Thanh Hoa Tax Department strictly implemented the payment of salaries for civil servants with the salary policy and specific regime of additional salary of the tax industry (coefficient 0.8) somewhat enough to cover daily essential activities, with a high average income compared to the common ground of the administrative and civil service bureaucracy.

**Table 2.** Average salary of civil servants working in the Tax Department of Thanh Hoa province

Calculation unit: VND

TT	Year	Average salary of civil servants/month
	2017	8.610.000
	2018	9.290.902
	2019	9.727.520

Source: Office of Organization and Personnel, Thanh Hoa Tax Department

Through the data table above, we observe that the basic salary of tax officials is in accordance with the provisions of the State. However, this salary only meets a part of daily necessities of civil servants. In general, the salary level of civil servants is still low, so the salary has not really motivated civil servants.

##### 3.1.2. Creating working motivation by bonuses

In order to encourage the motivation to work for civil servants, the Tax Department of Thanh Hoa province has made periodic rewards for civil servants as follows:

Bonuses are divided into 02 categories:

Regular bonuses: Based on the degree of completion of tasks and the results of quarterly emulation points. Regular bonuses are calculated according to the employee's salary coefficient and are paid every 6 months.

**Table 3.** Regular bonuses

Bonus content of the year	Reward level
Successfully completing the task	100% of the actual 1/2 month salary, wages, salary allowances.
Well completed the task	80% of the actual 1/2 month salary, wages, salary allowances.
Complete mission	60 % of the actual 1/2 month salary, wages, salary allowances.

Source: Office of Organization and Personnel, Thanh Hoa Tax Department

Irregular bonuses: Based on the results from the report of the Organization, individuals with outstanding achievements in completing the assigned tasks are rewarded with a maximum of 1,000,000 VND/ time/ person.

The timely rewards have encouraged the enthusiasm to work and continue to strive to better fulfill the tasks.

*3.1.3. Creating work motivation through allowance tools*

Currently, the tax industry is applying 7 types of position allowances for civil servants such as seniority allowances, positions, official duties, chief accountant, cashier and other allowances to ensure fairness in relative income in accordance with conditions and responsibilities to the job. The Department of Taxation has saved regular expenses in the budget allocated by the General Department of Taxation so that the public employees can pay maximum allowances in holidays to motivate employees.

**3.2. Situation of working motivation for civil servants at Thanh Hoa Tax Department through spiritual encouragement**

*3.2.1. Creating motivation to work through the environment and working conditions*

With the model of the office system under the tax reform and modernization program for the period of 2017 - 2019, the Tax Department of Thanh Hoa province achieved good results such as building, repairing and renovating working offices for a number of units. In order to create favorable conditions for accommodation and accommodation for remote officials and public servants, rotating from the province to the district and vice versa within the branch, at the Office of Tax Department and Sub-departments of Taxation arranged shared kitchen to serve breakfast and lunch for civil servants.

In addition, in order to create a more effective working environment, the tax industry is constantly interested in and creates favorable conditions for unions, Youth Union, Veteran, etc. such as actively and effectively participating in emulation movements of superior organizations as well as cultural and sports activities organized by the industry; always motivating civil servants and employees to contribute to the development of the industry.

*3.2.2. Motivation through training and development*

In the period of 2017 - 2019, Thanh Hoa Tax Department always paid attention to creating favorable conditions to encourage civil servants to study and improve their qualifications, such as payment of expenses, documents, articles and other conditions in study, besides arranging work in a reasonable time to ensure that civil servants can both participate in studying and working effectively. The total number of times attended training in the years from 2017 to 2019 were 3654, 1473 and 1325 respectively.

**Table 4. Contents of some annual training**

No.	Contents of training	Number of attendance			Total
		2017	2018	2019	
1	Post graduate	28	24	25	77
2	Bachelors	1			1
3	High-level political theory	3	3	4	10

4	Intermediate political theory		77	1	78
5	Main experts			7	7
6	Expert			5	5
7	Computer tax management applications	2185	1217	970	4372
8	Intermediate Tax Inspector		19	5	24
9	Tax Inspector	50	35	13	98
10	Tax Principal Examiner	4	1	1	6
11	Fostering leaders at department and branch levels.	92	38		130

Source: Office of Organization and Personnel, Thanh Hoa Tax Department

### 3.2.3. Creating work motivation through creating career advancement opportunities

*Creating motivation through planning:* the number of civil servants planned to be leaders of Thanh Hoa Tax Department is 510 people, accounting for 48% of the total number of civil servants present to date 12/31/2019. Planning work is done publicly, transparently, in accordance with that regulation, which is a great motivation for civil servants to strive to fulfill their assigned tasks and study hard, improving professional qualifications, practicing moral qualities, criteria for political theory to meet the conditions for appointment criteria when agencies have needs.

*Motivation to work through appointment:* the number of appointed civil servants of Thanh Hoa Tax Department is very limited compared to the number of planned civil servants. In 2017, 41 civil servants were appointed. In 2018, appointing 01 Director of the Department, and in 2019, not appointing a new civil servant to the leadership position, reasons: Following the guidance of the General Department of Taxation in Official Letter No.1394/ TCT-TCCB dated April 19/2018 about the orientation work for the tax sector in 2019 changed the organizational structure towards reducing the number of units at the Department of Taxation so to ensure the stability of organization and personnel at the units.

### 3.2.4. Creating work motivation through evaluation of work performance

In order to have a basis for assessing the results of the civil servant's annual work performance, Thanh Hoa Department of Taxation issued Decision No. 2398 / QD-CT dated July 19, 2017, issuing regulations on emulation scoring for individuals of each official and employee. Based on the stipulations, the tax departments and sub-departments quarterly perform emulation grading according to 4 levels: (1) Successfully fulfilling the tasks- rated A; (2) Complete the task well - Rank B; (3) Complete the tasks - rank C and (4) Do not complete the tasks of category D. However, when conducting the evaluation of the results of year-end civil servants classification, the Decree No. 56/2015/ ND-CP dated June 9, 2015 of the Government, which is divided into 4 levels: (1) Successfully completing the task; (2) Completing the task well; (3) Completing the task with limited capacity and (4) Not completing the task. Therefore, it is difficult to distinguish between task completion and task completion which is still limited in capacity causing inadequacies in determining the evaluation level.

According to the quarterly scorecard of the Tax Department, the organization used the same form to evaluate working efficiency for all civil servants (including both leaders and staff); the evaluation criterias remain so common and have not been classified for each target group, so the scoring is sometimes not close to reality.

3.2.5. *Motivation through emulation movements*

Recognizing the importance of the emulation movement to successfully accomplish the assigned tasks, this is also the motivation to motivate enthusiastic civil servant to strive to complete professional tasks. Right from the beginning of the year, the Tax Department has organized divisions, *District-level Tax Departments* to sign emulation covenants and register emulation contracts with the Provincial Tax Department. Based on the content of the annual emulation, the actual situation of each quarter, the Tax Department shall organize an emulation score for individual, on the basis of which is the result to consider the remainder of the salary increase. The launch of emulation and competition grading create a competitive atmosphere in the unit regularly and continuously in order to strive to fulfill the tasks every quarter, 6 months and every year.

3.2.6. *Creating motivation through cultural activities, arts and sports*

To take care of the spiritual life of civil servants better, Thanh Hoa Provincial Tax Department in collaboration with Union regularly pay attention to cultural activities, arts and sports to improve health and spirit for civil servants. At the Tax Department Office and District Tax Office, there are gymnasiums, volleyball courts, badminton, volleyball, table ball for civil servants to play after working hours, etc. Department of Taxation usually organizes sports tournaments, art festivals on holidays such as 30-4, 22-12, 20-10, 8-3.

Thus, we can see that Thanh Hoa Tax Department has been carrying out practical activities (both material and non-material) to motivate civil servants of the Tax industry. The following table summarizes the author's assessment of the satisfaction of civil servants with the motivational tools being applied at Thanh Hoa Tax Department. The author surveyed 335 out of 1063 officials of the Thanh Hoa Tax Department (based on a sample based on Slovin's formula) about their satisfaction with the motivational methods at Thanh Hoa Tax Department. The results are shown in the following table:

**Table 5.** *Survey results of public servants' satisfaction with the motivational methods at Thanh Hoa Tax Departmen*

<b>Creating motivation by material factors</b>		
<b>No.</b>		<b>MEAN</b>
<b>1</b>	Motivation through payroll tools	<b>3.61</b>
<b>2</b>	Motivation through bonus tools	<b>3.55</b>
<b>3</b>	Motivation to work through allowance tools	<b>3.63</b>
<b>Creating motivation through the spirit factors</b>		
<b>4</b>	Creating work motivation through the environment and working conditions	<b>3.754</b>
<b>5</b>	Motivation through training and development	<b>3.8</b>
<b>6</b>	Motivation through career advancement opportunities	<b>3.83</b>
<b>7</b>	Motivation through work performance evaluation	<b>3.794</b>
<b>8</b>	Motivation through emulation movement	<b>4.125</b>

*Source: Compiled from author's survey results*



From the survey results in Table 5, we can see that the level of satisfaction of civil servants at Thanh Hoa Tax Department is quite good, ranging from 3.5 to 3.8 (the maximum is 5.0). This may explain that the majority of Thanh Hoa Tax Department officials feel satisfied with the agency's motivation tools. And officials at the Thanh Hoa Tax Department feel more satisfied with non-material motivational factors than physical motivators, but the results also show that in most criteria, there are individuals (about 15%) who are not really satisfied with the motivation tools that the agency is applying. Thus, the Department of Taxation needs to have solutions to improve the satisfaction of civil servants, thereby increasing officers' motivation.

#### **4. Solutions to create work motivation for officials at Thanh Hoa Tax Department**

##### ***4.1. Solutions group about financial instruments***

In order for salary policy to become a working motivation for tax officials, it is necessary to focus on implementing the following measures:

Associated with the salary and the nature of the work, the degree of completion of the work, in order to get the results of the quarterly emulation score after each month of work, it should be evaluated and graded as a basis for the end of the review quarter, to avoid equalized statues of increased wages.

The work of evaluating and classifying officials must be conducted in an objective and fair manner, on the basis of monthly evaluation and rating so that at the end of the quarter, payment of additional salaries and bonuses to tax officials will be fair.

Studying and promptly implementing the regulations on irregular rewards for collectives and individuals with achievements in the working fields.

For welfare expenses: Right from the beginning of the year when setting up the expenditure estimates, it is recommended to build at the maximum expense level to proactively fund the welfare expenses for the Holidays and New Year to motivate civil servants in practice.

Implement administrative savings (such as Electricity, Water, Telephone, Stationery, etc.) to create a budget to pay for periodic medical examinations for civil servants as prescribed by the General Department Tax.

##### ***4.2. Solutions group for non-financial instruments***

To motivate better working for civil servants in the Department of Taxation of Thanh Hoa province, the author offers some solutions on non-financial tools:

###### ***4.2.1. Attention to working environment and working conditions***

Carry out a review and physical inspection of facilities, working equipment of each Division, Sub-Department of Taxation, Tax Team. From there, perform renovation, repair, purchase additional computers and other physical equipment, etc. timely for the affiliated units.

Department of Taxation needs to research and deploy for self-assessment officials, re-statistics of the volume and frequency of work performed by civil servants every year. On that basis, in order to have a plan for assigning, re-arranging suitable human resources, ensuring the well-performing tasks.

Implement the rotation, mobilization and periodic change of positions for civil servants in accordance with the regulations of the Ministry of Finance and the Government.

#### *4.2.2. Improve development training*

Right from the beginning of the year when the training plan is formulated, an overall review should be conducted, all subjects and fields of work need to be focused on training to make a budget plan and report to the General Department of Taxation for approval.

For basic skills training in 4 main Tax Administration functions: The Tax Department proactively develops a self-training plan so that all civil servants can access and timely update new knowledge and work-solving methods.

Periodically every 6 months, check and review training funding sources provided by the General Department of Taxation with plans to adjust appropriate training programs. Limiting the return of funding while civil servants are not trained in necessary skills.

Annually organize the review and re-evaluation of the training needs and training results of the units, ensuring the completion of the training plan, meeting the needs and desires of civil servants.

#### *4.2.3. Complete the performance evaluation*

Study to complete the personal emulation scorecard with specific criteria, distinguishing each target group based on job characteristics to make the assessment closely with the results and nature of the job.

Agree on how to classify according to quarterly emulation points and evaluate the classification of civil servants at the end of the year: Completing tasks or completing tasks with limited capacity.

Research to develop job tracking software for each civil servant monthly or quarterly about the results and level of completion of the job so that it can be used as a basis for assessing the work on a quarterly and yearly basis.

Research and apply different evaluation methods. For civil servants doing administrative work, the office applies the internal evaluation method; For civil servants who regularly interact with taxpayers, they may seek comments and assessments of taxpayers' comments to give an objective and comprehensive view of such tax officials.

#### *4.2.4. Create opportunities for career development and promotion for civil servants*

Carry out a general review of the units that are still under-represented (Head of Division, Head of Department, Team Leader) and human resources planning to implement, implement the process of appointing civil servants to units currently missing.

For the planned human resources, it is necessary to consider, evaluate and discuss carefully to select outstanding personnel, best meet the task requirements.

#### *4.2.5. Build a sports, cultural and artistic movement for civil servants*

The Department should organize at least 01 sports tournament or mass festivals every year on the anniversary of the establishment of Vietnam's tax industry (10.9) or the founding date of Thanh Hoa Tax Department (1.10). Besides, the Board of Directors of the Department of Taxation; Heads and Sub-Departments of Taxation should pay attention to the life of civil servants, listen to their opinions, grasp their aspirations, and promptly encourage officials when well performing tasks or when facing difficulties, create close relationships for tax officials to always trust, unite and work together to build the increasingly developed Thanh Hoa Tax industry.

### **5. Some recommendations and proposals**

#### *5.1. For the General Department of Taxation*

The General Department of Taxation should study and submit to the Ministry of Finance to propose to the Government for consideration and creation of conditions for the tax industry to enjoy seniority allowances to increase incomes and meet daily-life demands, especially is to be fair to other industries.

Assign autonomy and self-responsibility in recruiting civil servants to Tax Departments of provinces and cities under the supervision and management of the General Department of Taxation.

Develop and gradually apply modern human resource management methods through the development of standards of tax officials in each field of work and job position;

#### *5.2. Recommendations to the Provincial People's Committee and relevant departments*

Regularly reward and timely encourage achievements of tax officials and tax branches to encourage tax officials to strive to successfully fulfill their assigned tasks.

People's Councils and Provincial People's Committees, when assigning targets to strive for annual State budget collection, should consider and assess objectively and closely with the socio-economic development situation in the whole province, creating favorable conditions for the tax sector to fulfill its tasks duty and does not put too much pressure on civil servants when assigned to perform the task.

### **6. Conclusion**

The study has assessed the status of working motivation for civil servants at Thanh Hoa Tax Department. Although Thanh Hoa Tax Department has been applied measures to increase working motivation, such as creating favourable working environment, increasing salary and bonus, providing opportunities for training and development, measure of working performance, extra activities, etc.; there were still limitations and a number of civil servants have not satisfied with those policies and measures. Therefore, the authors offer solutions and recommendations to motivate civil servants at Thanh Hoa Tax Department.

## References

- [1] Tran Xuan Cau (2012), *Textbook of Human Resource Economics*, Publisher of National Economics University, pp.252.
- [2] Nguyen Van Diem, Nguyen Ngoc Quan (2007), *Curriculum of Human Resource*, Statistics Publishing House, Hanoi.
- [3] Nguyen Thanh Do, Nguyen Ngoc Huyen (2011), *Business Administration Curriculum*, National Economics University Publishing House, Hanoi.
- [4] Le Thanh Ha (2009), *Textbook of Human Resource*, Labor - Social Publishing House, Hanoi.
- [5] Law No. 22/2008 / QH12 of the XII National Assembly, 4th session, November 13, 2008: Law on civil servants.
- [6] Nguyen Tai Phuc, Bui Van Chiem (2013), *Textbook of Human Resource Management*, Hue University Press, pp.193-196.
- [7] Preliminary report on 5-year implementation of Directive No.31-CT/ TW of the Politburo on continued innovation in emulation and commendation work and a summary of 10 years of implementing the “nationwide” emulation movement.
- [8] Summary report on Taxation - Tasks of solutions for implementing tax work for the years 2017,2018,2019 of Thanh Hoa Tax Department.
- [9] Bui Anh Tuan, Pham Thuy Huong (2009), *Textbook of Organizational Behavior*, Publisher of National Economics University, Hanoi.

# APPLYING TOTAL PHYSICAL RESPONSE TO IMPROVE PRIMARY STUDENTS' VOCABULARY RETENTION

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**Abstract:** *This study explored the application of TPR method to vocabulary teaching in a primary school by carrying out the quasi-experimental method with two groups of students from Quang Son primary school in Tam Diep city, Ninh Binh Province. The data from this experiment is then evaluated and analysed to measure students' vocabulary retention. Based on the findings of the research, it can be concluded that, the students' progress during the teaching and learning activity by using TPR is better. TPR can improve the students' English vocabulary mastery in four aspects: meaning, spelling, pronunciation, and using the words. The most significant improvement was aspect of meaning and using the word in different context. Thus, by applying TPR students can remember the vocabulary longer. On the other words, TPR can enhance vocabulary retention for students.*

**Keywords:** *Total Physical Response, young learners, vocabulary, vocabulary retention.*

## 1. Introduction

With the trend of globalization, teaching English to young learners has been attracting a lot of attention all around the world, including Vietnam. In teaching English, teaching vocabulary is an indispensable activity. It is not only about helping students remember the meaning of words but also about helping them to hear words, pronounce words correctly and apply words in communication. So finding the effective teaching methods is an urgent demand of all teachers, especially Primary English teachers. Total Physical Response (TPR), developed by James Asher in 1960s, is a language teaching method which encourages people to combine language learning with physical actions. This study explored the application of TPR method to vocabulary teaching in a primary school by carrying out the quasi-experimental method with two groups of students from Quang Son primary school in Tam Diep city, Ninh Binh Province. In the process of the experiment, one group of students was taught by the TPR teaching method, another group of students was taught by the common traditional teaching method. The data from this experiment is then evaluated and analysed to measure students' vocabulary retention.

## 2. Theoretical frame of the study

### 2.1. Learning vocabulary and memorizing words

Learning vocabulary is a complex task. According to Ellis (1995) it involves various

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components: processing auditory and visual input, producing spoken and written output, and knowing the syntactic and semantic relations between words. Before being used to produce meaningful sentences, vocabulary has to be retained in the learners' memory.

Retention is defined as a memory storage process. Atkinson and Shiffrin (1968) described this process through different stages. First, a new word would be detected by the sense organs and enters the sensory memory. Then, It is paid attention to and transferred to short-term memory. Repetition of information causes a new word to be transmitted to long-term memory. If maintenance rehearsal (repetition) does not occur, the word is removed from short-term memory and lost.

Thus, vocabulary retention can simply be understood as the ability to recall or remember things after an interval of time. Vocabulary retention is an essential factor affecting the success of vocabulary learning. "In language teaching, retention of what has been taught may depends on the quality of teaching, the interest of the learners, or the meaningfulness of the materials" [12].

Therefore, in order to transfer information accurately from working-memory to long-term memory, FL/L2 (foreign or second language) learners need to treat the information actively rather than passively, and interact with the information in meaningful ways [13]. FL/L2 learners also need to look for both relationships and differences between the new information and other information that is already in long-term memory, and link them together [2,11]. One way to transfer the new lexical terms from the short-term memory to the long-term memory is to build a connection through finding some elements "in the mental lexicon" [1, p.179], and attach the new lexical item to those elements [13].

Information transfer in the present research context referred to the transfer of target words from L2 learners' short-term memory to their long-term memory. Thus, learners required some vocabulary learning strategies to acquire information and transfer them to memory for consolidation purposes.

## ***2.2. Total Physical Response***

Total Physical Response is abbreviated as TPR. This is a language teaching method developed by the Dr. James - a professor of psychology at San Jose State University, California late 1960s. The TPR method was originated based on the foundation of Asher's own research and theories on second language acquisition. According to Asher (1977), the TPR method relies on the assumption that the human brain is biologically programmed to learn any natural language within interaction. The process of learning a second language or a foreign language is internalized as the process of learning the first language and this process allows for long period of listening and developing comprehension prior to production. For example, interactions between children and their parents often originated in the form of speaking only from the parents followed by a physical response from their kids. Children typically can not speak until they listen to language for a long time, however, they can apprehend what their parents say and respond to them by physical movements in the most natural way.

An other important conditions for successful language learning is the absence of stress. The first language acquisition takes place in a stress-free environment with countless words

of encouragement, positive reinforcing from adults. Therefore, in the second language acquisition, Asher recommends that teachers focus on meaning interpreted through movement, rather than on abstract knowledge to liberate the learners from stressful situations to devote full energy to learning.

In short, TPR's nature is a language learning method based on the coordination of speech and action with the priority to develop speaking and listening skills in a comfortable learning environment.

### **3. Procedure of the study**

In this study, we applied TPR to teach students vocabulary with a view to helping them to memorize vocabulary longer. We used Pre-test and Post-test. The Pre-test was the test students take before the treatment to help teachers better understand their students' ability. The Post-test was a test given to students after completion of the treatment. It had conjunction with a pre-test to measure students' achievement as well as the effectiveness of the applied method. The pre-test was designed to check students' vocabulary before applying TPR method. The post-tests were designed to know about the English vocabulary retention of students after applying TPR method. One post test was given to the student as soon as all the lessons completed. The other one was given to students 3 weeks later after training.

All the tests were in forms of multiple choice questions, matching gap filling and coloring with 20 test items and the time allowance was 30 minutes for each test. The three tests were in the same level and the same for both groups.

To evaluate how well the tests measure students' vocabulary, we were interested in two concepts: reliability and validity. Reliability represents the consistency of the test. Validity assesses the quality of the test. In this research, the validity and reliability of the tests were measured to give the accurate result.

Before giving the tests to students, the test materials were in terms of the validity in testing the vocabulary knowledge of the students. The tests were valid as the content can measure the students' ability and knowledge in vocabulary.

The reliability of the vocabulary tests was measured by using Kuder-Richardson 21.

The satisfactory reliability coefficient will range from 0 to 1 [8, p.80]. According to Lado (1961), If an English reading test has a reliability coefficient of 0.9 to 0.99, it will be highly reliable. Meanwhile, an English writing test will be highly reliable if it has a reliability coefficient from 0.7 to 0.79. In the data collected, students' scores and the reliability coefficient of the test items in the pre-test, the post-test 1 and the post-test 2, the calculation showed as:  $KR - 21$  (pre-test) = 0.70;  $KR - 21$  (post-test 1) = 0.73;  $KR - 21$  (post-test 2) = 0.78. All the results were higher than 0.7 and lower than 0.79; Therefore, the test materials were valid and reliable.

All the pre/post-test scores of students were presented for calculating the reliability coefficient of the test items in Vocabulary Pre-test. However, the results in these appendices were only the correct answers of students not their final scores. In order to make the most

objective assessment about the scores of the two groups, we used the formula of Individual Scores as follows:  $X = \frac{R}{N} \times 100$

#### 4. Findings and discussion

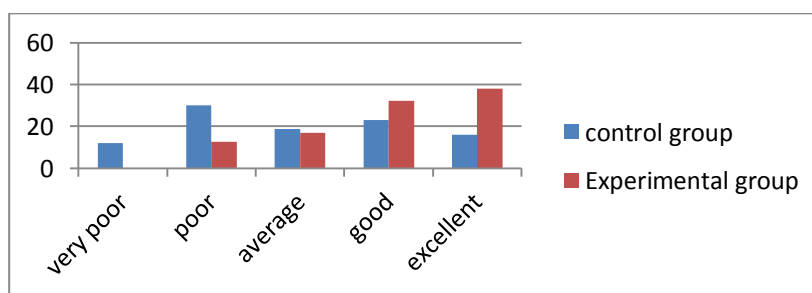
At the beginning of the application procedure, the same pre-tests were given to students in both groups to check their vocabulary. All scores ranged from 20 to 75. More than 40% of the tests scored below 5. This is an objective and understandable number because there were vocabulary items that the students have not learnt before. Besides, the average score of students in control group was 44.6 and the average score of students in experimental group was 44,5 This result showed that the vocabulary of students in both groups before training was at the same level.

##### 4.1. Data Analysis of the Post-test 1

Students of two groups were given the same post-test 1 after their lessons. Based on the data collected, the average score of students in control group is 53.2. This is a moderate result, not too high nor too low. The highest score was 85 and there was only three students reached this score, while there were 6 students got the very poor scores. In general, there was an increase in the student's score compared to the pre-test. However, there were still very bad grades and the ratio of good and excellent scores was not high..

The chart below shows the students' scores of the experimental group in post-test 1 which ranged from 40 to 100. Seen in the table, the average score of students in the experimental group in post-test 1 was 71 - a good result - much higher than that of students in the control group. There were 66.6% students got excellent and good scores, while there were only 13.3% students got poor scores and no students got very poor scores.

The mean scores of students in two groups had distinct difference. Students in experimental group taught with TPR method had mean score higher than ones in control group. And here was the comparison between the scores of post-test 1 of students in control and experimental group. From the result shown on the chart below, there was a appreciable difference between scores of students in control group and experimental group.



**Figure 1.** The comparison between scores in post-test 1 of control and experimental group.

Based on the chart above it was clear that both groups with two different teaching methods have positive results after 8 weeks of training. However, the mean scores of students in



two groups had distinct difference. Students in experimental group taught with TPR method had mean score higher than ones in control group. The percentage of students with very poor scores was 0% and the percentage of students with poor and enough scores in the experimental group is 19,1% lower than the control group, while the percentage of students' scores at all remaining range is higher. Especially, the percentage of students who achieved an excellent score in the experimental group was 38,2%, which is 22.2% higher than that of the control group.

**4.2. The results of Data Analysis of the Post-test 2**

Three weeks after the lessons, two groups took the post-test 2. The same language items were given to check the memory of students of both groups. The results are shown as follows:

*Table 1. The comparison of control group and experimental group*

Students' scores ( $X_1$ )	Control group		Experimental group		Qualification
	Frequencies (f)	Percentage (%)	Frequencies (f)	Percentage (%)	
20	0	12	0	0	Very poor
25	0		0		
30	3		0		
35	3		0		
40	6	30	2	12,7	Poor
45	3		2		
50	2		2		
55	2	18,8	2	17	Average
60	1		2		
65	2		2		
70	2	23,2	2	32,1	Good
75	2		3		
80	1		4		
85	3	16	3	38,2	Excellent
90	0		2		
95	0		2		
100			2		
$\sum X_1 = 1595$ $\bar{X}_1 = 53,2$ $\sum X_2 = 2130$ $\bar{X}_2 = 71$	<b>30</b>	<b>100</b>	<b>30</b>	<b>100</b>	

Looking at the data table above, it can be seen that there was a marked decrease in students' scores in the control group. The average score fall from 53.2 to 49.5. There were 6 very poor scores reappeared while the percentage of excellent and good scores decreased from 56.3% to 39.2% compared to the post test 1.

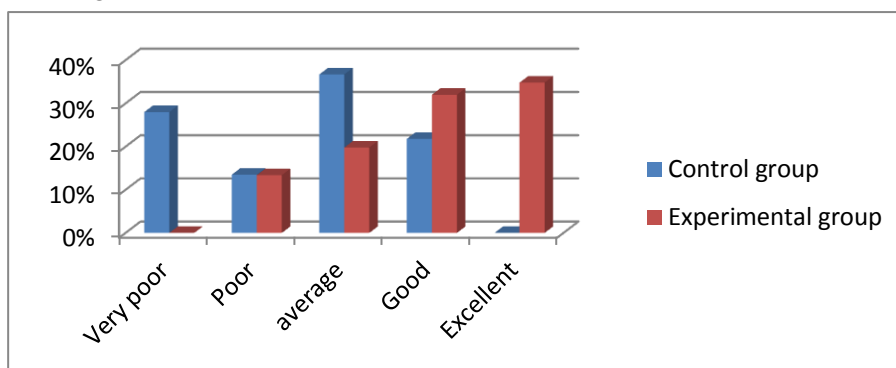
In the post test 2, the scores of students in the experimental group on the post-test 2 did not change much compared to the post-test 1. Among these tests, the lowest scores only stopped at 45 and there were 2 students got the highest score - 100. Meanwhile, the lowest score of students in the post test 1 was 40 and there was only one student scored 100 points.

From the average scores below, when the distance between the two mean scores of Experimental and Control groups was larger from 6.3 to 13.5, it can be seen that after three weeks, the difference is more significant in demonstrating the effectiveness of the TPR method in vocabulary teaching as well as enhancing vocabulary retention for students.

**Table 2.** Mean scores of two groups in vocabulary tests

	Pre-test	Post-test 1	Post-test 2
Experimental group	47	70.3	69.8
Control group	47,1	64	56.3
Difference	0,1	6.3	13.5

The comparison between the scores of two groups are also carried out to see if the difference is of great distinction or not, the results are shown as follows:



**Figure 2.** Comparison between pre-test score and post-test 2 score of the experimental group

As it can be seen in the chart above, there was a significant change in the pre-test score and post-test 2 score of students in experimental group. The post-test 2 was carried out three weeks after the training to check the memory of students after a period of time from the lessons. After eight weeks trained applying TPR method, the percentage of very poor scores of experimental group students was vanished. Instead of that, the percentage of good scores, especially excellent scores had a drastic increase. This was an significant evidence to the improvement in students' vocabulary memory when applying TPR method.

Consequently, the result of vocabulary tests proved that students who were taught using TPR method had improvement in vocabulary retention. Or in other words, using TPR method to teach vocabulary for third year students is proved effective.

## 5. Conclusion

Based on the findings of the research, it can be concluded that, the students' progress during the teaching and learning activity by using TPR is better. TPR can improve the students' English vocabulary mastery in four aspects: meaning, spelling, pronunciation, and using the words. The most significant improvement was aspect of meaning and using the

word in different context. It is supported by the result of the post-test is much higher than the result of the pre-test. Teaching using TPR method could help students have better and longer memory of words items. It was demonstrated by the result of the post-test 1 and post-test 2 in both groups. 3 weeks after the post-test 1, students took part in post-test 2. The average score of students in the two groups was significantly different. While the experimental group had a very small difference of about 0.5, the control group had a quite big difference of 7.7. Thus, by applying TPR students can remember the vocabulary longer. On the other words, TPR can enhance vocabulary retention for students. Hopefully, it will give a new perspective to the way of teaching vocabulary for Elementary level in order to improve the vocabulary mastery optimally.

## References

- [1] Amiryousefi, M., & Kassaian, Z. (2010), The effects of reading only vs. reading plus enhancement activities on vocabulary learning and production of Iranian pre-university students, *English Language Teaching Journal*, 3(2), 94-99.
- [2] Amiryousefi, M., & Ketabi, S. (2011), Mnemonic instruction: A way to boost vocabulary learning and recall, *Journal of Language Teaching and Research*, 2, 178-183.
- [3] Anthony J Nitko (1983:6), Educational Assessment of Students, Prentice Hall College Div.
- [4] Asher, J. J. (1982)., *Learning another language through actions* (2nd ed.) Los Gatos, CA: Sky Oaks.
- [5] Atkinson, R.C. & Shiffrin, R.M. (1968), Human Memory: A Proposed System and its Control Processes. In K.W. Spence & J.T. Spence (Eds.), *Psychology of Learning and Motivation: Advances in research and theory*, vol. 2, New York: Academic Press.
- [6] Brown, H. D. (2004), *Language Assessment: Principles and Classroom Practices*, New York: Longman.
- [7] Ellis, R. (1995), *Interpretation tasks for grammar teaching*, TESOL Quarterly
- [8] Henning, G. (1987), *A Guide to Language Testing*, Cambridge: Newbury House Publishers.
- [9] Hughes (2003), *Testing for Language Teachers*, Cambridge University Press.
- [10] Lado, R. (1961), *Language Testing*, London: Longman.
- [11] Mayer, R. E. (2014), Cognitive Theory of Multimedia Learning, In R. E. Mayer (Ed.), *Cambridge handbooks in psychology, The Cambridge handbook of multimedia learning*, Cambridge University Press, 43-71.
- [12] Richards, J. C., & Schmidt, R. (2002), *Longman dictionary of language teaching and applied linguistics (3<sup>rd</sup> Ed.)*, London: Pearson Education.
- [13] Schmitt, N. (2000), *Vocabulary in Language Teaching*, Cambridge: Cambridge University Press.

## VIETNAMESE TRADITIONAL MEDICINE (*THUỐC NAM*) IN THE LIFE OF THE MUONG AND THE THAI PEOPLE IN MOUNTAINOUS AREA OF THANH HOA PROVINCE

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**Abstract:** *The article aims to examine key issue of Vietnamese traditional medicine (thuốc Nam) (based on medicinal herbs) in community healthcare from the view of ethnic minority groups living in mountainous area of Thanh Hoa Province. Our research shows that indigenous knowledge of ethnic people about traditional medicine in this area is rich and diverse in terms of the conception of sickness, disease, medicine, disease prevention and treatment, eating and drinking under the controlling of nutrition and healing by using the folk remedies. Currently, some ethnic groups in the mountainous area of Thanh Hoa still maintain various ways of distinguished traditional treatments. Although their knowledge and practices are quite traditional in the modern life, there are many ways of treatment that are very useful for community healthcare. Especially, these are very popular and important methods to cure disease for local people who are disadvantaged in terms of socio-economic development and lack of opportunities to access modern treatment methods. Thus, Vietnamese traditional medicine is an ethnic cultural heritage that needs to be preserved and promoted.*

**Keywords:** *Vietnamese traditional medicine, medicinal herbs, ethnic groups, community healthcare, mountainous area, Thanh Hoa.*

### 1. Introduction

In recent years, promoting traditional medicine values as well as combining it with modern medicine in prevention and treatment has been noted for doing research and application in all corners of the World and in Vietnam particularly. In 1980, an anthropologist named-Arthur Kleinman introduced the sector model as a tool to understand the operation of health system. According to the author, there are three different parts of the sector model including *professional sector, folk sector, and popular sector*. The professional sector is comprised of medical professionals, fully trained as required, formally organized and legally recognized by the nation. Next, the folk section consists of healers, wizards, powwows and midwives, in which their treatments can be either mystical or folklore, or combination of both methods. The third part is the popular sector which belongs to people, making up the largest part of any health care systems, which activating the most health care activities. In Vietnam, professional sector is the most important part (both in political and social view), it also represents for national health

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care system. On the contrary, the practicing of the folk sector is somehow diminished and seen as superstition by massive people. However, it is worth to note that this sector is still plays an important role for the vast of ethnic minority population [9, pp.58-61]. Therefore, in this article, we mainly analyze Vietnamese traditional medicine in terms of the folk sector and popular sector and its role in taking healthcare of ethnic communities in mountainous area of Thanh Hoa, particularly for the Thai and the Muong peoples.

## **2. Common features in making Vietnamese medicinal herbs of the Thai and the Muong in mountainous areas of Thanh Hoa**

### ***2.1. In the western part of Thanh Hoa province***

Thanh Hoa is not only seen as an administrative unit simply, but also the land-named *Xứ Thanh*. This is an open, dynamic and transitional land locating between East- West, South-North of Viet Nam. The mountainous area of Thanh Hoa is very large with an area of 7,893 kilometer accounting for 3/4 of the whole province area. The northern system of Ma River consists rugged mountainous terrain that is an expansion of limestone mountain of Hoang Lien Son range and ending with Tam Diep mountain with the altitude decreasing gradually from 1,500 meters to 100 meters; the highest peak is *Pù Luông* (1.667m) lied between the boundary of Thanh Son commune (Ba Thuoc district) and Phu Xuan commune (Quan Hoa district). The southern system of Ma River consists of schist range, granite running from Muong Lat, Quan Hoa, Quan Son, Thuong Xuan to Nhu Xuan district with a height of about 1,000 meters; the highest peak is *Bù Chó* (1.122 m) in Xuan My commune (Thuong Xuan district). This is the living space of the Muong, Thai, Hmong, Tho, Yao and Khmu minorities, in which the Thai and Muong people account for the largest number of population approximately 634,489 people, around 94.6% over popumation of the Western part of Thanh Hoa.

From the historical perspective, most of ethnic minorities in Thanh Hoa mountainous area has a long origin and strong native character, typically the Muong and the Thai people. Moreover, these two ethnic groups used to live together on the same land for a long time. Because of living symbiosis among ethnic groups for a long time, therefore, they exchange their culture and acculturation as well as have a deep mutual understanding and respect, helping each other during the lifetime. This has created a rich and diverse socio-culture picture, at the same time, preserves many cultural values of ethnic minorities. This is a favorable condition for the development of Vietnamese traditional medicine.

From the ecological perspective, these mountainous areas of Thanh Hoa belong to the tropical rain forest area with a complex ecosystem and humid monsoon tropical climate, which is a favorable condition to create the best flora and fauna with rich and diverse species, with at least 3,500 species, most of which grow naturally. Due to the diversity of floristic composition, the fauna is quite diverse. As a result, there are many valuable and rare animals and endemic species [11]. This is a rich resource of pharmaceutical materials that is very valuable in medical treatment and public health care. Furthermore, some initial research results indicate that indigenous knowledge about traditional medicine of ethnic minorities here is extremely rich and diverse. This is reflected in some aspects such as the concept of illness, disease, medicine, prevention and treatment with traditional medicinal herbs, eating

and drinking from the perspective of nourishing and treatment, etc. As an important part of the intangible cultural heritage system, Vietnamese traditional medicine occupies an essential position in the daily life of people in the mountainous areas of Thanh Hoa in general and for the Thai and Muong people in particular. It plays a vital role of public healthcare, especially for a part of population who are suffering from socio-economic development and lack of opportunity to access to modern medicine.

## ***2.2. The role of traditional healers (thầy lang) in the life of ethnic people***

Practitioners of Vietnamese traditional medicine are known as traditional healers (*thầy lang*) (curing disease based on medicinal herbs) generally perceived as medical practitioners specializing in treating diseases by using oriental medicine methods, usually mainly based on their experiences drawn from practicing in the treatment of everyday life. From the Thai and the Muong's perspectives towards treatment, the medical practitioner must have a pure heart, good morality. They also have to love and respect to their patients. Besides, a traditional healer must always put their patients' life in the first priority. Although a good healer owns many good remedies, but without morality, he will not become a true healer and does not receive the respect from other in his community and his colleagues as well. Moreover, a true healer is made of two important parts: medical ethics and professional knowledge level. Thus, in the viewpoint of the Thai and the Muong (and perhaps to all ethnic groups in Thanh Hoa), a person has some kinds of characteristics such as calmness, perseverance, patience, prudence, eagerness to learn things, taking the patients' lives as prior duty is suitable to be a traditional healer.

Most of mountainous districts in Thanh Hoa has good traditional healers. To put more details, Lang Chanh, Thuong Xuan, Ba Thuoc districts are several places having many famous medicinal herbs practitioners. By the end of the twentieth century, according to a wide range of field trips, there are 133 traditional healers of the Thai and Muong people using herbs for medical purposes [1]. To the Thai people only, the mass of population know popular folk remedies. According to Vu Truong Giang (2009), in the year 2006 - 2007, there were 14 traditional healers in Yen Khuong commune (Lang Chanh district). Specifically, there are 10 villages in 13 villages having traditional healers, in which regarding to gender there were 13 males and only a female [4]. In Ba Thuoc and Lang Chanh district, there are at least a few traditional healers using medicinal herbs in their treatment. Referring to some famous traditional healers in these areas, local people and people living in surrounding areas often mention to the healers named Pham Thi Yem and Mr Vi Cong Tam [6, pp.805-806].

From the above statistics, it indicates that traditional healers have a crucial role in life of ethnic groups, typically in the life of the Thai and the Muong. In other words, they hold important roles in healing and taking community healthcare.

## ***2.3. General conception of medical occupation and occupation transfer***

### *General conception of medical occupation*

The Thai, Muong and other ethnic groups in the mountainous areas of Thanh Hoa believe that the most important thing to a traditional healer is a pure mind, good morality, kindness, love and respect for other. A medical practitioner must save patients' lives as their

first prior duty. It is a common outlook that because it is the simplest and least expensive method for individual and community. The prevention of disease is manifested in areas of eating, drinking foods that has good effects on curing; particularly hygienic eating and drinking with high nutrition, pure living environment, keeping body clean and hygienic, etc. it practically would help prevent disease. The motto: “disease prevention is better than treatment” is also manifested through taboo and ritual prevention and healing for individual and community. This type of prevention and treatment is not only found in the Thai and the Muong but also found in all ethnic groups in Vietnam.

Additionally, the professional level of the traditional medicinal practitioners is manifested through understanding the various types of medicinal plants, preparing medicines and fair preservation as well as the use of each medicinal plant and the combination of many herbs for folk remedies. Furthermore, to understand the status of patients’ health, the healers need to ask their patients for more information to examine the time of their illness, degree of pain and observe the patient’s injury and examine directly by hand. Based on all of these, the healers can diagnose the disease and offer their patients specific and appropriate treatment.

#### *General conception of medical occupation transfer*

In Vietnam, the experience of making medicine of ethnic minorities is often passed from one generation to another [5, pp.11-12]. Almost the Thai and the Muong adults simply know how to use some herbal remedies to prevent and treat some common diseases such as flu, stopping the bleeding wounds, bellyache... In case of complicated and serious diseases, they need help from traditional healers with “synthetic” remedies.

The method of traditional medical occupation transfer for common remedies is very simple, mainly through oral tradition by practicing it in daily life. If someone gets sick, they will be cured by their relatives or neighbors. They will guide patient how to recognize medicinal plants, the way to collect, ration of each herbs to make a folk remedy witness some taboo if there are any... This is a popular form of medical occupation transfer among ethnic groups containing profound human values inside. To learn traditional medical occupation, each disciple has to experience traditional rituals. In traditional healers’ opinion, besides ethical standards, those who are transferred the occupation must has some characteristics like gentle, calm, patient, carefulness and eager to learn things. In fact, learning medical occupation (based on medicinal herbs) is a long-term learning process to accumulate healing experience by the time. However, it is noted that traditional healers only share some common folk remedies not valuable remedies (such as curing snake bites or visceral diseases) for community. This can be explained that traditional healers want to keep inheriting secrets of their family and due to some superstition factors. Therefore, the valuable folk remedies do not widely spread to public.

#### **2.4. General conception of disease and causes of disease**

The conception of disease and causes of disease are part of health system and cultural system as well. According to the traditional conception of ethnic minorities in Vietnam in general and ethnic groups in mountainous areas of Thanh Hoa in particular, the causes of disease are explained in following different ways [2, 3, 5, 12].

Firstly, local people believe that sickness is generated by the imbalance between human body and living environment. In Northern Vietnam, the four-season climate has different properties, then it causes many different seasonal diseases. Secondly, diet and hard working conditions and sufficient abstinence are also the causes of disease. Thirdly, due to casual accidents happening at the work place or the lack of care during their work, people are more likely vulnerable or ill. Fourthly, insects or vectors can also be transmitted animals caused human disease. Although these are new knowledge that local people gained through a wide range of national campaigns and propaganda from modern medical practitioner at commune, they have been aware of this and applied it in their daily life before, this would help contributes to prevent some diseases.

More importantly, the cause of sickness from locals' viewpoint is explained from spiritual perspectives that illness is caused by their ancestors or ghosts. Almost all ethnic groups believe that healthy people are partly supported and protected by their ancestors. This is why local people deeply respect their ancestors. They fear making their ancestors angry because they believe that if their ancestors get angry they will no longer protecting alive people and make everyone in the family get sick. Thus, indigenous people practice many abstinences to not make any mistakes with their ancestors. This is also a common spiritual views among other ethnic minorities in Vietnam. Besides, sickness is generated by the lack of several '*vía*' (*a part of souls or spirits when people alive and it gone when people die*) because it is taken away by the devils. If the of the *vía* wanders somewhere or it is taken away by the ghosts, the corresponding parts of the body would hurt. And if the *vía* does not come back to the body, people will die. Thus, *vía* is one of five reasons that caused human sickness, suffering, pain and even death.

### ***2.5. Common characteristics of collecting, processing and preserving traditional medicinal herbs of the Thai and the Muong in mountainous areas of Thanh Hoa***

The herbal remedies of the Thai and the Muong as well as in other ethnic groups are mainly exploited in nature. Abundance of herbal plants is recognized by the Thai as valuable medicine resources is available surrounding us "*Hăng mạy lí xi ná khánh*" (good medicine is stuck in the legs).

One of the famous writing with many good remedies is in the book titled *Medicinal Book of the Muong (Sách thuốc Mường<sup>1</sup>)*, compiled by Le Xuan Ky - district Chief in Lang Chanh (the time under French domination). This book is a precious collection of valuable medicinal plants and traditional remedies of the Muong and the Thai in Lang Chanh district. In the preface of the book, the author has written: "*In the old days, Vietnamese people used to take leaves or plants to make medicine while suffering from diseases, it seems that Vietnamese traditional medicine is valuable and effective to cure diseases. Later on, practicing the Chinese and Western medicine was introduced and became more popular, so few people pay attention to national medicine as before. Moreover, people are often selfish, if anyone knows valuable remedies, they only keep it jealously or pass it on to their grandchildren not for others in community, as a result, some unfortunate families who suffering from illness are not*

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<sup>1</sup>The document was stored and provided by Mr Ha Chi Can in Lang Chanh district. The author would like to thank him sincerely for providing such precious document



*cured and die and valuable remedies also gone with those who know it... Vietnamese traditional medicine (thuốc Nam) is not life-threatening; in case of skin treatment, if medicine (herb) is not appropriate, it will make the skin red, warmer or even hurt more, when some diagnose happen, people know that medicine is inappropriate, they only need to take warm water to wash it away and alternate by other remedies; medicine is suitable when the skin get cool, smooth and comfortable. The same goes for oral medications, nothing is harmful to one's life-threatening. Most of medicinal plants is in the forest, many herbs do not have Vietnamese names (Vietic), because these plants are not available in China; so many of them only have the name in the Thai and Muong lingoies ...” [6, pp.775, 776]. Briefly, the folk remedies in *Medicinal Book of the Muong* collected by Le Xuan Ky are precious documents in terms of traditional medicine, carefully introduced and noted by the author in terms of the name and the use of medicinal plants by bio-languages: the Thai and the Muong for convenient searching. This shows the author's ethical responsibility as well as his deeply understanding of Muong and Thai folk medicines in the mountainous areas of Thanh Hoa.*

The herb- doctors have lots of experience in finding, collecting plants, writing out a prescription and making it up. Depending on types of disease based on healer's knowledge and experience, they will pick the suitable herbs to treat disease for patients. Towards collecting herbal plants, each ethnic group has certain rules and taboo that healers must follow. That is an explanation why local people believe that the taboo is crucial to the success or failure of the healing process. For the Thai and Muong people, specifically, before going to the forest collecting herbal plants, traditional healers have to make offerings and put it on the altar to pray their ancestors for finding good herbs, when disease are cured, they have to give offerings on the altar again to show their gratitude towards their ancestors. There is a common outlook of herb- doctors of ethnic minorities in the mountainous areas of Thanh Hoa that it is better to collect medicinal plants in the morning than in the afternoon, especially never collect herbal plants at noon because the scorching sun will “*release all good substance of herbs*”, or refrain from collecting herbs on rainy days because the rain will “*reduce good substance of herbs*”, that lessens treatment process or even the treatment has no effect at all. This is also similar to some scholars' perspective on the impact of the time collecting medicinal plants [7, pp.59].

Moreover, the healers believe that when picking the first medicinal plant, it must be carefully considered, if they are not satisfied with the first plant, they must keep it or take it to home whether they use it or not. If they give the first medicinal plant away, it means that they refuse to receive the gift from their ancestors and the Gods given, then finding the next plants will be very difficult, even they are unable to find the medicinal plants that they need or they found it but it will no longer have healing effects. When the bulbs are taken or if the roots are not totally removed, the medicinal plants must be replanted in the same place [10]. This is the folk knowledge in using and protecting medicinal plants. This is also an action to protect and sustainably maintain the source of medicinal herbs in particular and forest resources in general of the Thai and the Muong.

Regarding the process of making medicinal plants, most ethnic groups in mountainous areas of Thanh Hoa uses both fresh and dried plants. Fresh herbs are used immediately after picking up while dried herbs are used after preparing. From the realities of everyday practices it shows that using fresh herbs is better than dried one because substance of fresh herbs has

not been changed while dried herbs have lost good substances due to processing. However, for some vital herbs that if difficult to find out or must be transported long distances, it is processed into dried form for convenient use and storage. In fact, storing fresh herbs is difficult because *“the vast majority of herbs are made up of plant cells with full of nutritional ingredients that also are suitable for the development of microorganisms, especially the mold. Therefore, when the humidity of the air low or high, the mold develops well and creates some toxins that are harmful for patients’ treatment”* [10, pp.62].

In short, the traditional medicinal herbs of the Thai and the Muong ethnics in mountainous area of Thanh Hoa plays a crucial role in taking care of public health, especially it is important for the part of vulnerable population who have little chances to access modern healthcare system due to the difficult social - economic conditions. The results of some initial research show that indigenous knowledge about traditional medicine of the Thai and the Muong is very rich and diverse. This is reflected through practical experiences of local residents such as the concept of sickness, disease, medicine and medicinal occupation transfer, prevention and treatment, eating and drinking from the perspective of nourishment and healing. These experiences are passed on one generations to another and still valuable in the modern life, which contributes to take care of community health.

### **3. Current situation and conservation solutions promoting the values of Vietnamese traditional medicine**

From 1954 to present, provinces and districts in mountainous areas of Viet Nam have been strongly affected by the economic development policies of the Party and Nation. Natural resources in general and natural medicinal plant sources in mountainous districts of Thanh Hoa have faced four basic issues. Firstly, the emergence of the movement of agricultural cooperation and the emergence of forest enterprise for exploiting and processing wood; Secondly, the participation of residents who migrated from the plain or lowland to highland to settle down and boost up the national economy under the national socio-economic development policies; Thirdly, an increase of indigenous population and changes in society and population; Fourthly, the impact of the market- economy and some external factors from society. These four issues directly and indirectly impact on natural resources at different levels.

Many research results have shown that biodiversity, cultural diversity and indigenous knowledge are always interrelated and interdependent. In modern context, in the period 1960 - 1980, many head forests in the mountainous areas of Thanh Hoa were exhausted, number of plants and animals was reduced dramatically that leads to reduce the quantity of traditional herbs. Accordingly, indigenous knowledge about traditional medicine fell into oblivion. Thus, the current situation of exploitation of medicinal materials of ethnic minorities in mountainous area of Thanh Hoa has raised many issues that need to be addressed. In recent decades, the excessive trading of a large amount of medicinal plants inside and outside Thanh Hoa are alarmed. Medicinal plants become the commodity product bought by intermediaries from the local people. Whether intentionally or unintentionally, medical plants exploiters and traders are both engaged in taking healthcare of local people and a mass of population across the country. That is the positive side of the issue. However, another face of the coin is that local people

themselves are joining in deforestation group. They are destroying forest and natural resources day by day. Consequently, it is harder to find some first vital plants for traditional remedies. Additionally, some ethnic groups still maintain their traditional treatment by using medicinal remedies. Witnessing some outdated opinion, backwards knowledge and old practices in treatment by using herbs based on experience, many contents in using medicinal plants are very useful until now. Besides using traditional remedies, ethnic minorities recently have combined them accordance with using modern medicine. Local people are aware of the advantages and disadvantages of oriental medicine and western medicine. They use both methods to treat diseases, then public health is improving accordingly. For instance, in Ba Thuoc district, some Thai and Muong healers use the tomography result of patient's bone fracture combined with using herbal leaves or traditional healers use ultrasound results combined with their professional experience to pick up suitable herbs to treat some diseases.

For the above reasons, the authors would like to suggest some solutions to conserve and promote the value of local knowledge about herbal medicines as follow. Firstly, the traditional healers have to take advantages of using herbal remedies or some esoteric remedies to protect the public health. This obviously promotes medical ethics and contributes to the sustainable socio-economic development of the mountainous areas. Secondly, systematical studying about indigenous knowledge of traditional medicine and re-assessing the effectiveness of each remedy to apply it directly to taking care of public health are necessary. Also, the government should enact some policies to encourage and reward traditional medical practitioners who have made great contribution in taking care of public health. Last but not least, we should develop a plan to protect intellectual property rights for indigenous knowledge on folk medicine, in particular traditional medicine, in order to protect the spiritual rights of indigenous knowledge holders. The commercial exploitation of indigenous knowledge of herbal medicine will bring economic benefits not only for those who hold indigenous knowledge but also for the well-being of the whole community as well.

#### **4. Conclusion**

In general, the issue of public health in Vietnam has been concerned for a long time. Specifically, the ethnic community of Thanh Hoa, typically the Thai and the Muong people, have gathered valuable treasures of folk medicine to take care community health. Their knowledge about traditional medicine is expressed through cultural and spiritual activities, the use of plants and medicinal herbs to make medicine. These are the experiences that anthropologists perceived as the way local people be aware of health and treatment. This sheds light on the mutual relation between socio-culture and ecology in each region and each ethnic group. However, recently, Vietnam has no specific regulations on community copyright, such as taking valuable remedies and knowledge of using the remedies from indigenous people must be returned for that community. Moreover, many precious medicinal plants of many ethnic groups do not have scientific names; the use of herbs is also based on local people's experience and their senses, the lack of scientific evidence. Nonetheless, folk knowledge about traditional remedies is a national cultural heritage that needs to be preserved and promoted. Therefore, promoting research and understanding the value of medicinal

plants, preserving and using knowledge of valuable medicinal plants will contribute to preserving the national cultural identity as well as traditional medicine and conserving natural resources is an urgent need of each nation.

## References

- [1] Le Dinh Bich (1990), *An investigation on medicinal plants and folk remedies of the Muong in Lang Chanh district, Dissertation of Pharmacy*, Hanoi University of Pharmacy.
- [2] Vu Truong Giang (2008), Indigenous knowledge of Vietnamese traditional medicine of the Thai people in mountainous areas of Thanh Hoa (case study in Yen Khuong commune, Lang Chanh district), *Journal of Ethnology* (1).
- [3] Vu Truong Giang (2008), Vietnamese traditional medicine occupation in spiritual life of the Thai people in mountainous areas of Thanh Hoa, *Journal of Religion* (10).
- [4] Vu Truong Giang (2009), *Indigenous knowledge of the Thai people in mountainous areas of Thanh Hoa (Tri thức bản địa của người Thái ở miền núi Thanh Hóa)*, Doctoral thesis, University of Social Sciences and Humanities, Hanoi.
- [5] Tran Hong Hanh (2002), Local knowledge in using Vietnamese traditional medicine of the Red Yao people (case study in Ta Phin commune, Sa Pa district, Lao Cai province), *Journal of Ethnology* (2).
- [6] Lang Chanh District Party - Committee People's Council- District People's Committee (2010), *Geography of Lang Chanh*, Publishing House: Encyclopedia, Hanoi.
- [7] Do Tat Loi (1991), *Vietnamese medicinal plants and remedies* (6th edition), Publishing House: Sciences and Technology, Hanoi.
- [8] Nguyen Xuan Minh (2008), *Traditional medicine of the Muong people in Thach Quang commune, Thach Thanh district, Thanh Hoa province*, Dissertation on History, Ethnology, University of Social Sciences and Humanities, Hanoi.
- [9] Mogensen, Hannen O, et al. (2002), *An introduction to social anthropology in the context of Vietnam (research on gender and reproductive health in the Northern Central Coastal Region)*, Committee of Population, Family and Children, Copenhagen University, Denmark.
- [10] Le Dinh Phai (2000), *National pharmacy issues- environment and behavior of Vietnamese in the field of healthcare protection*, Publishing House: Danang.
- [11] Provincial Committee of the Party- People's Council- People's Committee (2000), *Geography of Thanh Hoa, Volume 1: Geography and History*, Publishing House: Culture and Information, Hanoi.
- [12] Mai Van Tung (2017), *Folk knowledge of the use and management of natural resources of the Muong people in Ba Thuoc district, Thanh Hoa province*, Publishing House: Hanoi National University.
- [13] Hoang Xuan Ty, Le Trong Cuc (1998), *Indigenous knowledge of highland people in practicing agriculture and managing nature resources*, Publishing House : Agriculture, Hanoi.

## STYLE OF PHILOSOPHICAL DISCUSSION IN NGUYEN KHAI'S PROSE

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**Abstract:** *Nguyen Khai is considered a great writer of modern Vietnamese literature in the second half of the twentieth century. With the concept "The writer is also a thinker", he succeeded in building a style of philosophical discussion in literature. Nguyen Khai's literary works express topical, shrewd, perceptive and wise insights. The style of philosophical discussion in Nguyen Khai's prose is revealed in all aspects of the genres: the subject, the plot, the characters and the language. Nguyen Khai deserves the honor of researchers and readers as: "an intellectual writer" (Phan Cu De), "one of the leading writers in the literary life" in Viet Nam over the past decades (Vuong Tri Nhan).*

**Keywords:** *Philosophical discussion, Nguyen Khai's prose.*

### 1. Introduction

"Philosophical discussion - Triết luận" has the root element "triết" which means "reason, knowledge" or "intelligence, wisdom" and "luận" which means comments, analysis and evaluation. As such, "philosophical discussion" refers to the discussion and explanation of an issue in a wise way. Writer Nguyen Khai is famous for his style of philosophical discussion thanks to the combination of shrewd, wise and argumentative elements in his works. This feature is revealed in both the content and the form of the works. With the aim of clarifying the style of philosophical discussion in Nguyen Khai's prose, the article contributes to clarifying the uniqueness of a literary personality.

### 2. Content

#### 2.1. The concept of literature as "a science that expresses the human heart"

In the Conference on founding Vietnamese Writers' Association (1957), writer Nguyen Khai, at a young age and at the beginning stage of his career, expressed the concept of literature: "In my opinion, the art is simply understood as: the science that expresses the human heart, the history of the human heart (...). Let's talk about the truth of human heart, the trifulness and the results of our careful, meticulous research, etc" (*Chuyện nghề - Job story*) [3, pp.8-9]. Later, he made it clearer in the notion of the writer: "A writer is also a thinker, a social activist by his means, a humanist" (*Knowing personal ability is an important factor for every writer - Presentation at the 3<sup>rd</sup> National Artists' Congress*) [5]. Towards the objective "A

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writer should think as a scientist, a writer and a thinker, a philosopher”, Nguyen Khai always pressed himself to cultivate knowledge, “learn in real life” and “learn from books”, any book in my possession is read very carefully. There are good and bad books (...). Through such miscellaneous knowledge, I select the most necessary contents for my job” [1], Furthermore, he always “judged” himself very strictly to make greater efforts: “If someone neither judges himself/herself severely nor preserve his/her modesty, then he/she will easily get worse, because he/she is satisfied himself/herself, becomes lazy, empty and he has nothing else to be praised”(Chuyện nghề-Job story) [4, pp.597].

Nguyen Khai called his journey of literary creation a “journey of awareness” and an “endless search”. The journey's purpose is to find and realize the aspirations: “The writer must have his own philosophical ideology, his own worldview, from which he will build up his art world with a system of characters, thoughts, languages and his own structure organization. They will go to the end of their art world, in their unchanging beliefs”(Literary job is also very elaborate) [3, pp.615]. As such, The style of philosophical discussion in Nguyen Khai’s prose was formed from his viewpoint and artistic thinking. To some extent, the writer has achieved certain successes in this style when he made a conquer of his readers over the past decades.

## **2.2. Philosophical discussion in the aspect of topic and subject**

Nguyen Khai’s tyle of philosophical discussion is revealed from the topic approach and development. Depsite the aesthetic orientation in the principle of artistic creation, Nguyen Khai always had his own approach and development. It is the analytical thinking and long view that helped the writer choose, “realized” the issues of great attraction (or) significance, drawing the social attention. They include the nature, the rules of the issue, hidden corners of reality. As such, the topics and subjects of Nguyen Khai's works often express novelty, sharpness, richness of narration, and criticism and predictive prognosis. This is the quality and strength of a writer with the style of philosophical discussion.

*Topic on the new-style countryside construction in the North:* In the 50s and 60s of the last century, the Northern countryside was eager to build a new life, a new society in the collective spirit of “One for all, all for one” aiming at preparing for the objective of socialist construction. At that time, literature and art focused on propagating and encouraging this very important political task. Like many other writers at that time, Nguyen Khai went on the “three with’s” field trip with people. His works at this time received the warm welcome of readers such as: *Xung đột - Conflict, Tâm nhìn xa - Far vision, Mùa lạc - Peanut season, Hãy đi xa hơn nữa - Go further, Một cặp vợ chồng - A husband and wife, Chủ tịch huyện - District chairman*, etc. It is worth mentioning that despite the same goal of encouraging and promoting the co-operative movement, appreciating and praising the prominent examples of collective spirit, Nguyen Khai had the unique topic approach and development. He not only made description but also conducted practical research. He always analyzed, criticized instead of “caressing” and always opened the issue instead of giving an assertion. For example, Nguyen Khai “posed” the issue of the fate/ destiny of the disadvantaged, the “inferior”, where they will “stand”, and which role they play in building a new life and society. Or, in order to build a new life, a new society, what is the quality of a leader? What is the relationship between talent

and virtue, how to solve the relationship between the personal and collective interests of leaders? If a leader is virtuous but non-talented or a bit talented will neither attract the people nor play a decisive role in promoting the movement (Bien in *Tầm nhìn xa - Far vision*), or if a leader is talent but non-virtuous (arrogant, short-sighted, self-interested, etc) such as Tuy Kien in *Tầm nhìn xa - Far vision*, Dam in *Chủ tịch huyện - District Chairman*. Or the issue whether the leader can get rich, enjoy the fruits from their efforts, at that time, is very novel. It can be said that, beyond the topical and political aspects, Nguyen Khai's approach and development in this topic area are still meaningful until now because his thinking of philosophical discussion has brought his issue to a higher level and broader generalization.

*Topic related to religion:* Developing a topic related to religion is not easy when the writers are the heathen. This may be the reason why the writings on religion or related to religion are quite few. Nguyen The Phuong has *Nắng - Sunshine*, Chu Van composed *Bão biển* while Nguyen Khai possesses 4 works: *Xung đột - Conflict, Father and Child...*, *Thời gian của người - Time of human* related to Catholicism and *Điều tra về một cái chết- Investigation of a death* related to the Caodaism. However, Nguyen The Phuong or Chu Van only described religion in human life while Nguyen Khai “discussed” about religion, philosophy of religion: “Religion appears to make people happy to live”, however, religion goes away from itself and brings people unhappiness. People have multi-mood and troubles, therefore, don't press them into simple mechanical forms, don't shorten them”. (*Thời gian của người - Time of human*) [5, pp.345]; Or: “A religion in which the doctrine, dogmas and decisions on administration, organization, reward and punishment, and promotion and demotion are all established and taught by a strong writer as gods, such as sorceress; actually, it is inconceivable.” (*Điều tra về một cái chết- Investigation of a death*) [5, pp.208] etc. Researcher Lai Nguyen An commented on the novel *Cha và Con - Father and child and...*: Nguyen Khai “expressed the philosophical discussion of religion and socialism in narrative language” [6, pp.320].

*Topic on revolutionary war:* Like many military writers at that time, Nguyen Khai shouldered his rucksack to the fronts: Con Co island, Vinh Linh, Quang Binh and Quang Tri fire lands and a series of compositions on the topic of war were released: *Họ sống và chiến đấu- They live and fight* (1966), *Hòa Vang* (1967), *Đường trong mây - Path in clouds* (1970), *Ra đảo - To island* (1970), *Chiến sĩ - Soldier* (1973), *Tháng ba ở Tây Nguyên - March in Tay Nguyen* (1976). In association with the goal of affirming the will and determination for victory of our army and people in the war against the US, Nguyen Khai still sought his own approach on this practice. He explored and demonstrated the daily life of soldiers in the fierce battle to know how they “live” to “fight”. It is miraculous and heroic to “live” calmly and confidently in extremely severe and dire circumstance, however, they made a more wonderful thing than that because they lived happily and optimistically to fight and win. As such, in addition to reflecting the reality, the writer made a philosophical discussion of living reason of a people, belief in truth, the relationship between individuals and the community, people and countries. Our cause of national liberation has the power of justice and things which symbolize the most beautiful sense of purpose of the human.

After 1987, Nguyen Khai changed the direction of topic development. If he previously focused on the stories of the times and philosophical discussion of the times, he currently

mentioned about the story of family, clan and old acquaintances. Borrowing the character's words, the writer shared about this change: "It was not until then that he completely realized the boundary between the youth and old age, between the age of living for himself and society full of dreams and the age of only living for his children, without any other hope and joy" [3, pp.195]. However, the only difference is the subject while the approach is still the same style of philosophical discussion. If the philosophical discussion had been focused on the times before, after 1978, the philosophical discussion was mainly related to the individual condition in the universe, life and times. Ms. Hien in the work *Một người Hà Nội - A Hanoian*, Ms. Bo, Ms. Dai in the work *Nắng chiều - Afternoon sun*, Ms. Vach in the work *Đời khổ - Unhappy life*, the mother in the work *Một mẹ chồng tuyệt vời - A wonderful mother-in-law*, with the philosophy and concepts of happiness - sadness, happiness - misery, rightness - wrongness, goodness - badness, etc. Clearly, in daily life, people always face and choose between these two categories.

It can be said that the discovery of issue and orientation of ideas is a special ability of Writer Nguyen Khai .

### **2.3. Philosophical discussion in the aspect of plot**

*The plot rich in knowledge information:* Knowledge is the basis for analysis, evaluation or judgment, thinking. To give conclusions, the convincing evidences are requested. Researcher Nguyen Dang Manh ever admired: "Every time I read Nguyen Khai's works, I always believe that my intelligence would be expanded by something..." [6, pp.274]. The "wisdom" mentioned by Nguyen Dang Manh is extremely abundant knowledge from politics to society; from scientific knowledge to cultural and literary knowledge; from folk to modern style, etc. For example, religious knowledge helped Nguyen Khai to vividly and persuasively demonstrate the people's lives (from psychology to lifestyle, behavior, customs, etc); Life knowledge contributes to creating intelligent, shrewd character personalities and unique and attractive details in Nguyen Khai's literature.

The dense knowledge expression sometimes creates the chronicle style for Nguyen Khai's stories. The works associated with the history - society topics have the style of chronicle and notes while the works associated with the topics in which the reflected subject is an individual have the style of essay. The writing style of dawdling, skipping from one subject to another is a method used by the writer to "show" the knowledge which seems "trivial" but hidden by an issue of the times.

It is the achievement of a writer who is eager to explore, think and always uses his analytical thinking to select the things to be accumulated.

*Orientation and logic of the storyline:* That the story idea is oriented in the title is a recognizable feature in Nguyen Khai's works. Unlike other writers who neither apply this style frequently nor create a prominent impression, Nguyen Khai orientates the coherence in the storyline and story idea right in the title of the work and it becomes the writer's personality and style. The idea is oriented and the storyline is developed to clarify/prove or persuade the reader, which creates a coherent logic in the plot: The title is the message of the story. Although there may be many characters, the storyline does not have many layers. Only one story layer goes throughout the work in a vibrant and strong way, including many new details and situations that attract and persuade readers. It is worth mentioning that the story



situations and details in Nguyen Khai's works are often associated with the political, economic, social and cultural issues of the country, therefore, they affect and attract readers. The works composed in the 50s and 60s of the last century, with the same topic of praising and affirming a new life thanks to Nguyen Khai's innovation, such as: *Mùa lạc - Peanut season*, *Đứa con nuôi - An adoptive child*, *Một cặp vợ chồng - A husband and wife*, *Chuyện người tổ trưởng máy kéo - Story of the tractor manager*, *Hãy đi xa hơn nữa- Go further*, *Tầm nhìn xa - Far vision*, etc. have simple plots and storylines proving the philosophical discussion: only revolution can radically change the fate of inferior and disadvantaged persons and only the revolution helps them regain belief and love in life and people.

For groups of works with the same anti-Americanism topic such as: *Ra đảo - To island*, *Đường trong mây - Path in clouds*, *Chiến sỹ - Soliders*, the topic idea is not clearly revealed in the title, however, there is a consistency of topic idea and storyline, specifically: affirming, praising patriotism, revolutionary heroism which has turned normal people into heroes, a small nation into a heroic nation. The plots of these works are in the same situation. They does not have many layers. They have only one storyline that tells the silent work of unnamed heroes, including the people and the soldiers who are ready to sacrifice, fighting for national independence and freedom: "I have decided to go to the end of life, going through all the ways to go and utilize all my strength. And at that moment, if I have not reached the destination, I will fall down very peacefully because I have been striving to the last minute, being a soldier to the last minute" [4, pp.429].

After 1978, Nguyen Khai's works achieved renovations in the topic subject and approach, however, the thinking of philosophical discussion still governed the reasoning logic and structure of the works. It is a method of introduction in association with a specific orientation towards a philosophical overview or discussion. Therefore, the plot can be "split" into pieces, forming a "non-central" plot type, however, the logic of the storyline is still consistent. *Gặp gỡ cuối năm - Year-end meeting* are the no-start and no-end stories of the Saigon "upper class" guests at the year-end meal. Each person is a "piece of story", however, such pieces focus on the issue: the tragedy of the "a bad patch", although each character is in a different situation, all of them are powerless and for survival, they have to "lean" on the illusion of golden days.

The "clusted" and "scattered" plots create a new feature for the plot format of Nguyen Khai after 1978, however, thinking according to "the issue", the logic of the storyline in linear order aimed at "explaining" and "lecturing" for a certain reason have not changed: respecting and admiring a "golden dust" of Hanoi; regardless of many changes, ups and downs of social circumstance and regimes, the Hanoians are still wise to keep themselves and their families a dignified lifestyle, standards in character, elegance and bravery in behavior (*Một người Hà Nội - A Hanoian*); Affirming and appreciating any effort of people towards happiness and caring for life (*Nắng chiều - Afternoon sun*); The philosophical discussion of humility: "*Một giọt nắng nhạt- A drop of pale sunshine*", specifically, it is "sunshine" but "it is pale", anyway, it is still "sunshine" which functions to shine and warm the space and the surrounding relationships. Anyway, it is a valuable contribution even just a little! Coming back to the issue that the work is named as the propositions of philosophical discussion: *Sống ở đời - Living in life*, *Danh dự - Honor*, *Lạc thời - Lost in time*, *May hơn khôn - An ounce of luck is*

*better than a pound wisdom, Phía khuất mặt người - Hidden side of the face, Thượng đế là hàng hóa - God is a commodity, etc.* The establishment of structure of the plot which explains, comments, generalizes the “issues”, the logic and consistence in the idea line contribute to shaping the plot with Nguyen Khai’s outstanding style of philosophical discussion.

### 3. Philosophical discussion in the aspect of characters associated with the story language

*Type of character with an shrewd ego:* The protagonist is the “idea spokesperson” of the writer in his work. Nguyen Khai's world of protagonists is quite diverse in terms of class, social position, age, however, whoever they are, they are very “alert” and wise. Such wise and shrewd “egoes” are often the “strong”, energetic, brave and “thinking” characters, who always analyze, assess situations and judge things based on the two-pole boundary: “pros-cons”, “gain - lose” in a very clear way. Rationally, the analysis and evaluation of the character are always accompanied by general assessments, philosophies and philosophical discussion in association with each individual's experience and education. A 10-year-old child who know to worry, calculate, consider in situations of facing with adults and draws his own experience with firm and mature “philosophies”: “I believe no-one is good”, “If they were evil, they would still be evil until death”(Đứa con nuôi- *An adoptive child*) [2, pp.277]. The vice head of an agricultural cooperative is always proud of his wisdom. All his calculations and tips show that he is tricky, pragmatic and shortsighted. However, he has his philosophy and he is always proud of it: “You have to manage; idle talk makes money, huh”; “Food must be kept for co-operative members; If we sell as much we have produced, then the cooperative members shall claim us; We do not know what we shall take to encourage them to actively produce?” (*Tâm nhìn xa - Far vision*) etc.; And here is the calculation and philosophy of a character who knows to “go with the times”, knows to adapt the times: “...Trust is a sacred thing that comes freely and cannot be forced. If anyone wants to hear, you should tell them. We are liberated, therefore, we should think about liberating others. ...At this time, a party, a religion as well as an individual who have showed anti-communist signs are considered digging their own grave” [5, pp.262]. For each summarized experience, the character turns it into philosophy and philosophical discussion about people and life: A fisherman not only “clearly understands” about fish but also borrows them to give the human philosophy: “There are many types of sharks. Some of them have teeth lined in rows like barbed wire, move around but they are gentle, very gentle. Some have only a set of gapped teeth, however, they are very cruel, even they can cut your leg when snapping it! The inside personlity of animals can not be determined through their appearance, let alone the human, etc. (*Điều tra về một cái chết - Investigation of a death*) [5, pp.215]. The women in Nguyen Khai's work are also very “shrewish”. The character Ms. Dao, who appeared in the 1960s of the previous century, realized the philosophy of life: “Do not be self-pity, so modest, everyone has good quality”(Mùa lạc - *Peanut season*) [2, pp.252]. Some decades later, the woman in Dong Thap were proud to affirm that: “Our sisters, regardless of standing in the dark, doing unnamed and trivial things, however, you see, our bravery and wisdom are not inferior to the men standing in the light (*Vòng sóng đến vô cùng - Endless wave*) [5, pp.394]. The town woman, through many decades of ups and downs, hardship, still maintained the family

order in a civilized and elegant lifestyle, with a thought full of pride: “Every society needs a upper class as a benchmark for all values” [3, pp.307].

The type of shrewd, smart, dynamic, energetic and brave character is a personality motif loved by Nguyen Khai. His writing style is flexible and sharp when expressing such personalities.

*Story language rich in criticism and philosophy:* Characters in Nguyen Khai's works often communicates with critical thinking, language and dialogues. This is also an indispensable logic when they are intelligent, shrewd and good at analyzing and generalizing. Conversations between characters often have “open” ending instead of “close” ending, which means that the characters often use the language of question, hypothesis, skepticism, suggestion, etc in dialogue: “How are your legs tired? Just a few steps away but you was afraid my legs would be tired... You must be tired (...); Do you feel cold - I never feel cold, uncle. I have a jaket but I rarely wear it - It is colder in Dien Bien than in the lowland, therefore, it is easy for you to be sick if you dress lightly; No need to say much about Dien Bien sugar-cane... Do you eat sugarcane or fear of tooth decay ?? Oh! Are you an adult? etc... (*Đứa con nuôi - An adoptive child*) [2, pp.285-287] etc.

When the character has monologues, he argues with himself or someone else in his imagination: “I ate some cups of rice but I work for her all afternoon, I do not beg” (*Đứa con nuôi - An adoptive child*); “Even if I am ragged like a beggar, I am still the vice head of the cooperative, and I am still your father when I go home”. (*Tầm nhìn xa - Far vision*); “... No one will follow your instructions, it is a sure thing because the wisdom of each person can be achieved only by his own experience”. (*Vòng sóng đến vô cùng - Endless waves*) [3, pp.36] etc.

The language of the narrator is also very remarkable in Nguyen Khai's works. The Narrator is presented in the story as an invisible character who comments, evaluates, “thinks” together with the character and argues with the character in the story. Therefore, as being caught in the thinking line of the storyline, the narrative language is also very philosophical, specifically, it not only tells and describes objectively but also tells/describes comments, evaluations, generalization, which means that the language is sharp and subtle.

“She is too tired, however, her cheeks full of freckles are sharp and stubborn, and her small eyes are still alight with the challenge...” [2, pp.251]; “Over six or seven years, that person hasn't changed much. It is a beard that is not often clean-shaven, a vivacious laugh and eyes which are sharp but full of love” [5, pp.286]; “I saw that Ms. Bo had her stiff wrists to hold her husband's chopsticks and use a piece of paper to clean them, and clean bowl (...) .The husband was so fussy, just waiting for his wife to pick up the food, just eating what his wife give him while not touching his chopsticks into any dish.” [3, pp.491]; “At the end of the meal, the owner gave a warm towel to each person, Mr. Phuc used it to clean his face and then gave it to his wife. The wife took her husband's used towel to wipe her face. I dropped my face, felt sting in my nose and just wanted to drop some tears of love” [3, pp.492]. Descriptive verbs cum adjectives showing the status and nature, such as: “sharp”, “small”, “stiff”, etc., the adjunct “and, to, then, so” contribute to emphasizing in order to express things and phenomena in a sharper, more suggestive, more meaningful way.

#### 4. Conclusion

Philosophical discussion seems to have become Nguyen Khai's personal style from the first pages to the last pages in his literary career. The philosophical discussion is expressed in all aspects of the work: the subject - the topic, the plot, character type and the language. Reading Nguyen Khai's works, the reader has received the information of the times while thinking of profound ideas from the issues posed by him. He was good not only at “posing the issue” but also at discussing, and good at predicting the changes of the times. Many issues posed by Nguyen Kha decades ago are currently emerging in social life.

Researcher Phan Cu De ever assessed that: “Nguyen Khai is an intellectual writer who always thinks deeply about the issues arising in the life and tries to seek a convincing answer in his own way. Accordingly, in the writer's works, through the topical political and social events, there are always emerging issues of philosophical significance and human ethics.” That's why during 40 years of writing, “he is always one of the leading writers in literary life” [2, pp.27].

#### References

- [1] Nguyen Khai (1957), A few comments about highlighting and the attitude of the writer, *Military Arts and Literature Magazine*, 5, 27.
- [2] Nguyen Khai (1996), *Nguyen Khai' collection*, Literature Publishing House, Ha Noi, vol.1.
- [3] Nguyen Khai (1996), *Nguyen Khai' collection*, Literature Publishing House, Ha Noi, vol.3.
- [4] Nguyen Khai (1997), *Short stories and miscellanea*, Youth Publishing House.
- [5] Nguyen Khai (1999), *A collection of Nguyen Khai's novels*, Writers Association Publishing House, Ha Noi.
- [6] Ha Cong Tai, Phan Diem Huong (Selection, introduction) (2002), *Nguyen Khai - Introduction about author and work*, Education Publishing House, Ha Noi.