

## **ENHANCING SCIENCE AND TECHNOLOGY HUMAN RESOURCES MANAGEMENT FROM THE COMPETENCY-BASED APPROACH IN VIETNAM**

**Tran Quang Huy<sup>1</sup>, Tu Thao Huong Giang, Chu Van Tung**

International and Post-Graduate Department  
Academy of Science, Technology and Innovation

---

### ***Abstract:***

*There are several training approaches in science-technology management human resource development, of which competency-based training is widely applied in developed countries with some advantages in comparison with traditional training approach. Based on theory of human resource development, international experiences and empirical research, this article proposes competency-based training for managerial human resource in the Ministry of Science and Technology (MOST). This application will promote managers' competencies to ensure the improvement of state management in science and technology (S&T) of MOST in the coming years.*

**Keywords:** *Competency-based approach; Training for human development; Science-technology management human resource.*

**Code:** 20071701

### **1. General introduction**

As the human resource development plays an important role in organizations many various training approaches for are being applied to provide individuals and organizations with knowledge and skills to meet required outcomes of works. Accordingly, the traditional approach is based on contents of works when designing training programs which target to complete shorted knowledge and skills. Although the traditional approach is useful for trainees, they are not sure to develop individual competences and to improve work outcomes of organizations. Then, by early 1990s, the notion of "competency-based training" was largely introduced (*Hugh Guthrie, 2009*). Before that, Dubois and Rothwell (2004) developed concrete models for implementation of training by competency-based approach that target development of individual competences according to development directions and plans of organizations for their better work outcomes.

Science-Technology-Innovation (STI) plays driving roles for socio-economic development of Vietnam. The shift of mind-set of STI management where

---

<sup>1</sup> Authors contact's email address: [huonggiangdhcd86@gmail.com](mailto:huonggiangdhcd86@gmail.com)

businesses come to focus of attentions and universities become strong research units would mobilize social resources. They are central tasks to be implemented in the coming time (*MOST, 2020*). In this context, competences of STI management human resources require much attention for annual training programs closely following requirements of each work position to improve State administrative activities of MOST in global plans.

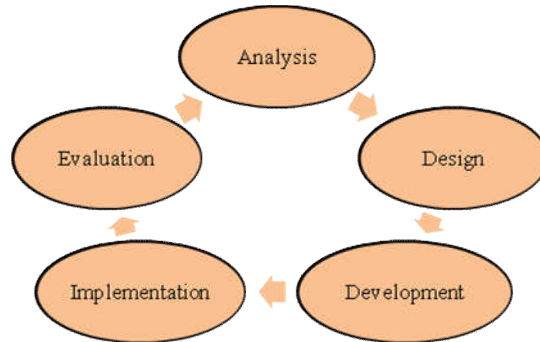
The competency-based approach is being studied and applied by many countries in the world with large implementation of various programs with positive results. Typically, Business Technology Management (BTM) of Canada (*ITAC Talent, 2016*), IPREP (IP Right Examiner Program) of Australia for training IP examiners (*IP Australia, 2017*) and Technology Management and Policy (TMP) of Taiwan (*National Tsing Hua University, 2018*) made considerable contributions for development of S&T management human resources. Therefore, the study for competency-based approach of training for S&T management on basis of international experiences and the recommendation of application for MOST human resources are found crucially important to make contributions to improvement of State administration activities in S&T sectors of Vietnam.

## **2. Competency-based approach of training**

### **2.1. Basic notions**

In practice of use of competency-based approach in Vietnam the notions of training and development are used largely and then need to be clarified as background for practical efficient application. As by the Government Circular No. 101/2017/ND-CP regulating the training of State employees, MOST issued Decision No. 1038/QD-BKHCHN on 02<sup>nd</sup> May 2019 on regulating the training activities which provides the unified definition of related terms.

According to that, the training is defined as the process of systematic transfer and absorption of knowledge and skills required by each learning level for granting certificates acknowledged by Vietnam Laws. The development is defined as process to complete, update and upgrade knowledge and work skills. Then, the derivative notions such as development of grade standards for public employees, development of professional title standards for State officials and development of leader and manager title standards according to position descriptions are defined as background for right implementation of relevant documents (*MOST, 2019*). Then in the scope of this study, the authors propose application of competency-based approach but not regular training programs such as higher education, master and doctor training programs for S&T management sector.



Source: Noe R.A. (2010)

**Figure 1.** ADDIE model for training designs for management of development activities

The procedure of implementation of development programs plays important roles for ensuring work outcomes. In this study, in addition to recommendation for application of the new competency-based approach the authors put accents on organizational and managerial solutions for training activities of MOST. Noe R.A. (2010) introduced the 5-stage model that designs the training procedure: *Analysis (of demands)*, *Designs (of programs)*, *Development (of documents)*, *Implementation (works)* and *Evaluation (of effectiveness)*. This procedure, as shown on Fig. 1, is largely used by organizations and businesses to ensure effective improvement of training and development programs.

The competence is a notion introduced by McClelland (1973) in his work “*Testing for Competence Rather than for Intelligence*” as underlining the tough links of competences and work outcomes by individuals. Accordingly, many authors gave different definitions on competences but, in basic common indications, the competences are the set of knowledge, skills, attitude and behaviour that help individuals complete well the assigned tasks and are seen through their real work outcomes. The competence frame is the description of full competences needed for successful job realization by a position, team, unit and entire organization (Dubois and Rothwell, 2004). By another words, the competence frame is the set of competences needed by an individual to do well his job position in an organization. In this study, the application of competency-based approach would help develop managerial competences in specific sectors for MOST employees in close line with objectives and requirements of State administration works in the coming time.

## **2.2. Approaches in activities of human resources training**

There are many approaches applied for implementation of effective adding, updating and upgrading knowledge and working skills, namely traditional content-based approach and new competency-based approach for training activities.

### *Content-based approach*

The traditional content-based approach is largely applied to meet needs of providing and updating employees of organizations with knowledge and skills. The implementation procedure is based on the instruction design model (ISD) with main principles of analyzing work scopes of individuals to define needs. Then, they design programs, develop documents, set up organizational structures and evaluate post-training outcomes (*Dubois and Rothwell, 2004*). Accordingly, the effects of this procedure of training activities depend on many stages where the roles of program designers and instructors are found highly important and the participation of learners and managing staffs are low and passive. Then it is difficult to ensure training effects to check work outcomes of individuals and activities of organizations. Through these training courses, learners may get rich knowledge and skills but their application in practical works remain depending on many factors.

### *Competency-based approach*

As given by Steven Hodge (2007), the notion of competency-based approach was shaped on basis of behaviour psychology theories and system theories. This approach is oriented to develop competences of learners and to improve work outcomes through training activities (*Hugh Guthrie, 2009*). Paprock (1996) when summarizing theories of competency-based approach in development of human resource development indicated 5 basic specific features of this approach:

- Concept of the center point of learners;
- Targets of meeting requirements of policies;
- Orientation of life;
- Flexible dynamic implementation;
- Clear formation of standards for competences.

As given by Paprock (1996) and Kerka (2001), these basic specific features lead to advantages of this competency-based approach, namely:

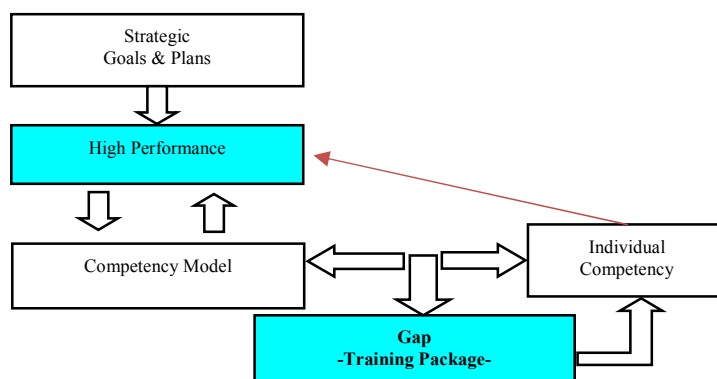
- Individualization of learning: the model of competences allows learners to complete shortages of competences in carrying out their actual tasks;
- Great attentions for outcomes;
- Flexible application to enhance outcomes in specific ways in line to individual features and situations.

Also, the competency-based approach offers possibilities to define clearly the targets to achieve and the standards to measure outcomes. The high accent for outcomes and the objective metric standards for necessary competences are the center of specific attentions by policy makers of human resource development.

For large practical implementation, Dubois and Rothwell (2004) introduce the Strategic System Model (SSM) and give 3 concrete models for application. Training activities with competency-based approach are oriented to main objectives to develop competences of learners in close relations to objectives and activities of organizations. Then, the training procedure by competency-based approach includes the following stages:

- Analysis of orientations and needs of development of organizations;
- Fixation of objectives and plans of activities of organizations;
- Building of competence frames for positions with titles in organizations;
- Designs of training programs;
- Development of documents and organizational structure of training activities; and
- Post-training evaluation of outcomes.

In global visions the training procedure by competency-based approach has numerous common points with the one by traditional content-based approach. However, the stages related to training needs and program designing works have many discrepancies. Accordingly, these two stages are closely bound to orientations of development and plans of activities of organizations which are reflected well through the building-up of competence frames for every titled positions. As given by Wu (2013), the key factors that decide success of training by competency-based approach include: (i) *Strategic goals and plans*; (ii) *Outstanding outcomes of activities*; (iii) *Competence frames*; (iv) *Strategies of programs of competency-based training*; and (v) *Individual competences* as indicated in Fig. 2.



Source: Wu (2013)

**Figure 2.** Critical success factors in competency-based training

For training by competency-based approach, the contents of training activities are focused on improvement of competences to settle professional situations in

a work position inside organizations. In order to carry out any task, employees have to gather the full set of knowledge, skills, attitude and behaviour needed to ensure work outcomes. Therefore, the contents of training by competency-based approach are not the system of concepts and skills but the system of competences to carry out concrete tasks. Standards for evaluation of training by competency-based approach are set up by definition of competences of skilful employees in sector then the learners can ensure related works after finishing training courses.

On basis of the above presented competency-based approach, Dubois and Rothwell (2004) introduced a model for practical implementation of training which includes: (i) *Training works are based on competence frames*; (ii) *Individual self-training and development*; and (iii) *Development of competency-based working teams*.

*Training works based on competence frames*: This model gets implemented still on basis of ISD model but by more strategic and system ways to get closely bound to objectives and plans of organizations. Accordingly, the competence frames for each titled position get built up in line with orientations of development of organizations and the training of individuals are based on relative standards of competences. This model ensures not only work outcomes of individuals but also improvement of outcomes of activities teams or organizations. The development of competences of individuals on basis competence frames would help managers pay attentions to context factors of organizations to ensure their improved outcomes of activities and sustainable development in right line with strategic orientations.

*Individual self-training and development*: In this model, the individual competence development by competence frames inside organizations are shifted to self-training and development works conducted self-consciously and pro-actively by learners in line with road maps of vocational development of individuals and development orientations of organizations. In this model of self-training and development of competences the evaluation of effectiveness is made by individuals, colleagues or consultants on basis of defined competence frames. With these theoretically set-up model and implementation stages, in practice, efforts for self-training and development by many employees get successful. However, this model cannot be implemented largely and become the leading model to be applied by organizations and businesses. It has the supplementary roles to enhance individual attitudes to self-training and development of their own vocational competences.

*Development of competency-based working teams*: This model puts accents on development of individual competences on basis of working teams. Accordingly, the works get organized in line with implementation by teams, and then the outcomes of individuals are not seen clearly as the ones of teams. Then, the competence frames get built up and the training activities get

implemented accordingly. The team-based model of competence development as above noted have many strong points but requires certain conditions when being applied in practice because it depends on actual working conditions of individuals and organizations.

The theoretical background of training by competency-based approach and produced study results show well positive points of the new approach for training works to competence development of learners, works outcomes of individuals and outcomes of activities of organizations. The trend of application of training by competency-based approach propagates and helps organizations make development in context of competition in field of human resources and outstanding outcomes of works. The study of status of training works of S&T management human resources in Vietnam and external experiences are needed for proposal of application of training by competency-based approach as measures to promote renovation of S&T management works in Vietnam in the coming time.

### ***2.3. International experiences of training of S&T management human resources by competency-based approach***

Many countries applying outstanding advantages of competency-based approach have renovated the educational systems, vocational training systems and training programs on basis of this approach. Accordingly, training activities are oriented directly to development of competences of learners through practical experiences during and after training courses. The training of S&T management human resources is not an exceptional case in this competency-based approach.

#### *United Kingdom*

The United Kingdom is one of the first countries to start development by competency-based approach in vocational and educational training (VET) systems. Since 1980s, the UK made detail descriptions on competences in every vocational scope according to VET systems, National Vocational Qualification (NVQ) system and National Official Standards (NOS) system. Here, the competence frames for government employees are built for 2012-2017 period to support the renovation plan for public servants and implementation of the system of work efficiency management (*UK Service of Human Resource Management, 2015*). In these frames, 10 standard competences are classified into 3 groups with detail descriptions as background for training and development of individual competences (Fig. 3). On basis of these competences, training programs are designed to develop competences of every individual and improvement of outcomes of activities of organizations.



Source: UK Service of Human Resource Management (2015)

**Figure 3.** Competence frames for UK public servants

### Canada

In Canada, National Official Standards (NOS) was implemented very early and largely recognized to help employees develop individual competences through training and development activities or process of realization of works. According to a report by ITAC Talent (2016), Canada had built and implemented the Business Technology Management Program (BTM) which is based on relative NOS for development of human resources for technological management in organizations and businesses in context of fast development of ICT sector by 2014. This BTM-NOS program targets to provide learners with knowledge and skills useful for settlement of problems in business activities, improvement of internal procedures on basis of application of the world's advanced technologies and techniques. The program was built for 3 main vocational groups (*analysis experts, system design experts and technological management experts*) in 5 sectors: (i) *Data safety*; (ii) *Financial services*; (iii) *Health cares*; (iv) *Data analysis*; and (v) *Business and innovation*.

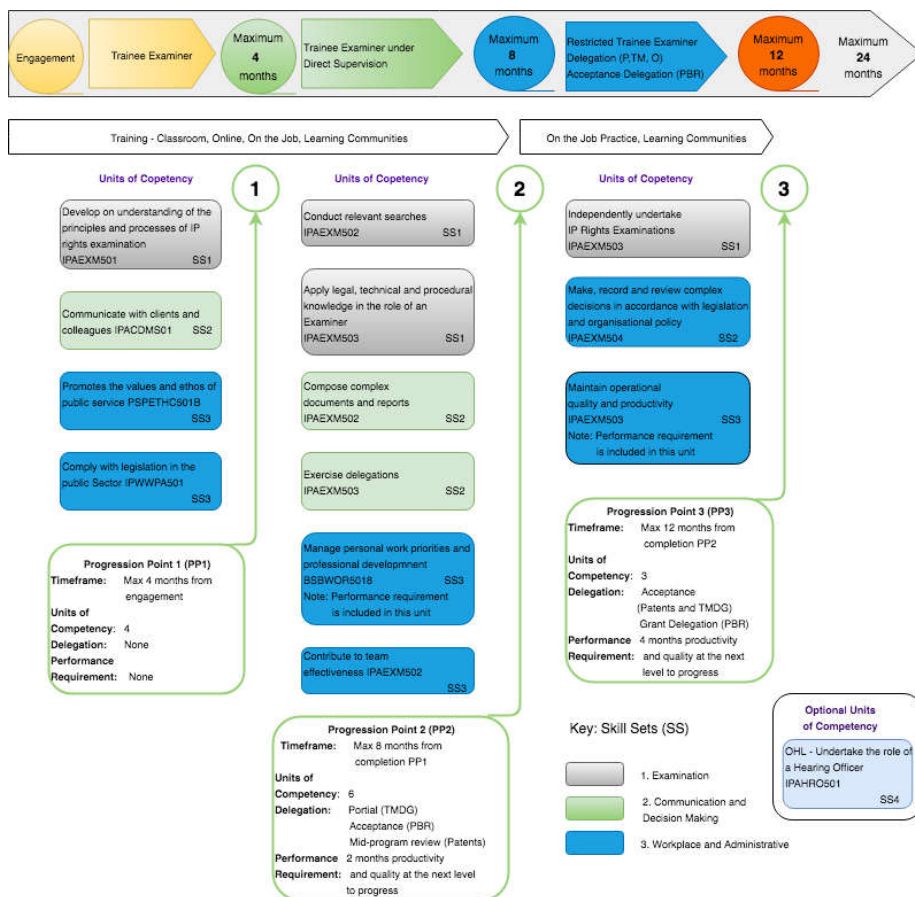
The program helped create the vocational certificate system, build relative training courses for improvement of sector required competences, development of vocational systems and corresponding development road maps where individuals can develop corresponding vocational competences through training activities and real work experiences. The implemented program includes:

- System of basic vocational knowledge (*integration, business, technologies, innovation, project management and individual working skills*);
- Competence standards are classified into 7 BTM levels (*following, assistance, application, execution, consulting, innovation and strategy*);
- Corresponding vocational certificates are classified into 3 levels (*specialist, professional and expert*).



Australia

As many other developed countries, Australia applies the competency-based approach for vocational and educational training to complete the vocational skill system for development of industrial sectors in context of global competition. Australian IP Organization is the Government entity with functions of IP administration where the IP Center of Excellence is in charge to implement training activities by competency-based approach. Here the IPREP gives contributions to successful activities of IP management works of Australia (*IP Australia, 2017*). The program lasts 24 months through 3 stages with diversified forms of works (direct, on-line and on-work). The main contents of the program relate to 3 groups of skills: *IP examination, communication and decision making, and management of individual works* as described in Fig. 4, all being attached to a plan of evaluation of individual competences according to corresponding vocational skill standards.



Source: IP Australia (2017)

Figure 4. Structure of Australian IPREP

### *Taiwan*

Taiwan applied the training by competency-based approach for both public and private sectors for development of individual competences and improvement of activities of organizations (Wu, 2013). Public employees in Taiwan are classified into 12 grades where the top grade - Grade 12 - is the Vice Minister position and the lowest grade - Grade 1 - is the public employee position in State organizations. The corresponding competence frames are also built up for the groups of high ranked positions (Grades 10-12), middle ranked positions (Grades 6-9) and low ranked positions (Grades 1-5) which serve backgrounds for salaries in line with the defined competence frames.

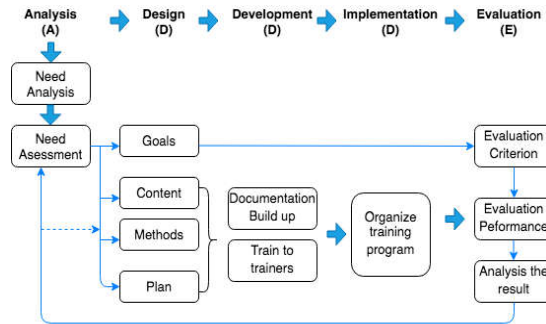
In field of S&T management, Taiwan has been implementing the TMP program for managing human resources in line with competency-based approach, the program being implemented by the National Tsing Hua University (Tsing Hua University, 2018). The program was designed to develop competences for building and executing S&T policies (including policies for sponsorship, industries, technology transfer, promotion of university-business links, development of businesses); technology management competences (technological planning and forecasting, technology transfer, S&T organizations, evaluation and valuation of technologies, high tech management). The above mentioned TMP program was implemented for provision of training activities for a group of Vietnam MOST managers in Taiwan by 2019.

Practice of implementation of some training programs for S&T management of some countries as presented above show well the trend that the competency-based approach fits to meet demands of development of individual competences and outcomes of activities of State administration agencies and related organizations. Developed countries all applied largely this approach in various sectors of vocational and educational training as well as activities of development of management human resources in State administration agencies and organizations in context of S&T management renovation for acceleration of socio-economic development. The above noted experiences are good reference background for the research team to make recommendations of training activities by competency-based approach for MOST managing human resources to meet requirements to build up and implement Vietnam strategies for STI development, 2021-2030 period.

### **3. Application of competency-based approach in training science and technology management human resources in Vietnam**

#### ***3.1. Status of training of S&T management human resources during 2016-2018 period***

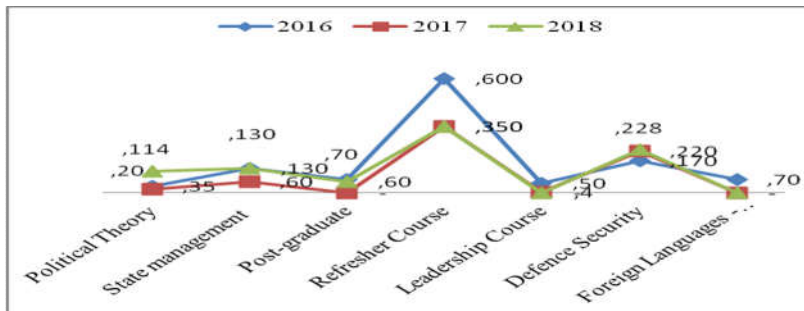
As seen by recent reality (2016-2018 period) of activities of training of S&T management human resources in Vietnam, MOST always provides attentions for implementation various programs with the model presented in Fig. 5 for training S&T management human resources and the spent efforts gain certain success. During three years from 2016 to 2018, MOST has been taking the lead roles in implementation of training programs for S&T managing staffs from ministries, sectors and local governments.



Source: Summarized by the authors from the status of training S&T management human resources

**Figure 5.** Model of training S&T management human resources in Vietnam

As shown by the report of outcomes of domestic training activities from Department of Organization and Personnel, MOST, in total, 1,300 employees and staffs of MOST took part in training courses for specific knowledge and skills of work positions, namely 600 by 2016, 350 by 2017 and 350 by 2018 (MOST, 2018). Contents of training programs deal with knowledge of State administration in S&T sectors, namely: scientific research activities, intellectual properties, nuclear energy and atomic radiation, control of standards and quality. Fig. 6 shows statistic figures of training activities of the period in various programs.



Source: MOST (2018)

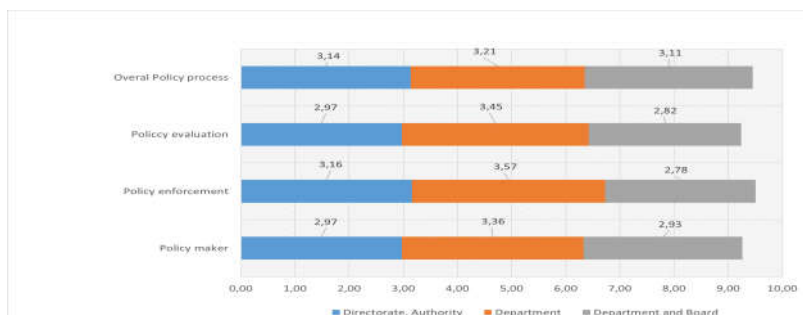
**Figure 6.** Data of training activities of S&T management human resources, 2016-2018 period

In terms of the required number of hours of annual training courses of officials and staffs as ruled by Decree No. 101/2017/ND-CP, in total over the whole country the 2020 annual plan of training activities for S&T management staffs (*Decision No. 4009/QĐ-BKHCN, 2011*) would have 5,300 attendants where 1,000 from MOST, 3,900 from provincial S&T departments and 400 from S&T departments of ministries. A survey of demands, Project 2395 for State budgeted training activities, shows the objective to have 500 S&T management staffs to be trained in domestic and overseas courses. Even with the content-based approach that is conducted presently (the competency-based approach is not applied yet) the training activities gain encouraging results. Nevertheless, the above noted demands and the need of changing S&T management mind-set lead to necessity to change the approaching way for direct improvement of State administration activities in S&T sector by MOST in the coming time.

**3.2. Relation between competences and outcomes of activities by S&T management human resources**

As background for proposal to apply suitably the competency-based approach for realization of S&T policies, the study team conducted a survey among 188 employees and staffs of MOST for the topics: *i) Central tasks; ii) Self-evaluation of individual competences; and iii) Work outcomes according to policy management procedures (Tran Quang Huy; 2019).*

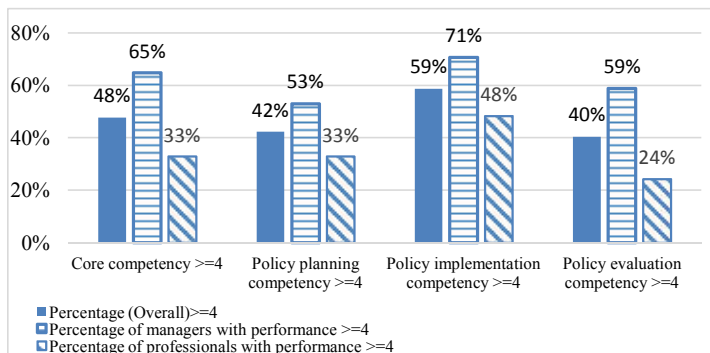
The survey outcomes showed the frequency of work execution by employees (5 levels from Level 1: Doing nothing up to Level 5: Executing very regularly) is related closely to S&T policy management procedures (planning, executing and evaluating). Accordingly, the average survey score of frequency of work execution by employees and staffs in sectorial management department of MOST is 3.21 (note Level 4.0: Executing regularly). The frequency of work execution is found different between groups of services and depends on stages in policy procedures, the details being presented in Fig. 7.



Source: S&T tasks (2019)

**Figure 7.** Frequency of work execution in relation to S&T policy procedures

The close relation between competences as noted in policy procedures and the planned outcomes, execution and evaluation of STI policies is illustrated by survey outcomes and descriptive statistical analysis. Fig. 8 gives a description of the relation between groups of competences (*general competences, policy planning competences, policy executing competences and policy evaluating competences*) and the outcomes of execution by policy procedures (*planning, executing and evaluating*). Namely, Fig. 8 the presents the percentage description of surveyed employees and staffs and gives the score  $\geq 4$  (score scale from 1 to 5) versus the corresponding self-evaluation outcomes (the same score scale). Statistical analysis showed that among the 4 surveyed groups of competences the highest score is of the group of policy executing competences (59% of the surveyed employees and staffs have the score  $\geq 4$ ) and the lowest score is the group of policy evaluating competences. The above noted analysis deal also with comparison between the group of leading and managing bodies and the group of professional-administrative staffs in MOST services. As shown, the group of leading and managing bodies with the score of policy executing competences  $> 4.0$  and the one of work outcomes  $> 4.0$  has the highest percentage mark (71%). The survey analysis outcomes also showed clearly a very high relation between competences and work execution outcomes in relation to S&T policy procedures. Majority of scores  $> 4.0$  of self-evaluation of competences by employees and staffs have the corresponding outcomes of evaluation  $> 4.0$  (scale 1-5).



Source: Ministerial level S&T tasks (2019)

**Figure 8.** Relation between groups of competences and policy execution outcomes

The close relation between the competences as by policy procedures and the outcomes of activities shows the suitability of competency-based approach for training of MOST employees and staffs. Training programs designed on basis of competence frames according policy procedures would help develop S&T

management competences and then give direct contributions to improvement of outcomes of State administration activities by MOST in the coming time.

#### 4. Conclusion and recommendation

The above presented study results show the training work by competency-based approach has clearly marked advantages and is found suitable to the objective of improvement of activities of organizations. These advantages were studied and made public in reputed magazines and this approach was applied by many developed countries for training of S&T management human resources. As noted, the training activities of S&T management human resources of Vietnam gain remarkable results during recent time. Nevertheless, as resulted from the survey for relation between the competences and the outcomes by S&T policy procedure, the high demands and needs of change of S&T management mind-set would orient the training activities of S&T human resources by competency-based approach to improvement of outcomes of State administration activities of MOST. The progress would be achieved as resulted from possible application of learnt knowledge and skills to practical works of every employee in MOST units. The requirement of outcomes of State administration works in S&T sector for socio-economic development leads to higher requirement of competences and work outcomes of every employees and staffs. This leads to necessity of system changes.

The model of training by competence frames is found suitable for implementation of S&T management training works by competency-based approach thanks to a high nature of system structure and ensured improvement of outcomes of State administration activities in S&T sector through development of individual competences. Other models of team-based training or self-training would play referential and supplementary roles for this model of training by competence frames in order to keep pace with the MOST project of work positions which was built by 2019<sup>2</sup>. For implementation of training activities by competency-based approach, MOST should conduct studies and build up S&T management competence frames and, then, design standard programs and diversified training methods in close line with practical works./.

#### REFERENCES

##### In Vietnamese

1. MOST (2018). *“Final report of results of training and development activities, MOST, 2016-2018 period”*.

---

<sup>2</sup> Project for study of work positions of MOST on 27<sup>th</sup> September 2019 addressed to Ministry of Home Affairs shows 115 work positions related to specific fields of S&T management within 15 units (Directorates, Departments and others) and 08 grades of officials (employee, senior employee, expert, high expert, senior expert, supervisor, high supervisor and senior supervisor).

2. MOST (2020). "Change of STI management mind-set". As accessed to <<http://baochinhphu.vn/Khoa-hoc-Cong-nghe/Doi-moi-tu-duy-trong-quan-ly-KHCN-va-doi-moi-sang-tao/384133.vgp>>
3. UK Service of human resource management (2015). "Employee competence frames of the UK, 2012-2017 period".
4. National Tsing Hua University (2018). "TMP: Technology Management and Policy".
5. Decree No. 101/2017/ND-CP on 01<sup>st</sup> September 2017 by the Government on training and development of public servants and officials.
6. Decision No. 4009/QĐ-BKHHCN on 29<sup>th</sup> December 2011 by MOST approving the Master plan of development of S&T human resources, 2011-2020 period.
7. Decision No. 1038/QĐ-BKHHCN on 02<sup>nd</sup> May 2019 by MOST on issuing Rules of training and development activities of MOST.
8. Tran Quang Huy (2019). *Building the training programs for STI management by competency-based approach for managing staffs of MOST*. MOST research project, 2019-2020.

#### **In English**

9. Dubois, D., & Rothwell, W. J. (2004). "Competency-based or a traditional approach to training". *T and D*, 58(4).
10. Guthrie, Hugh (2009). "Competence and Competency-based Training: What the Literature Says". National Centre for Vocational Education Research (NCVER).
11. Hodge, Steven. (2007). "The origins of competency-based training". 47. 107-209.
12. IP Australia (2017). "IP Australia annual report 2016-2017".
13. ITAC Talent (2016). "Business Technology Management, National Occupational Standards (NOS)".
14. Kerka, S. (2001). "Competency-based education and training". ERIC Clearinghouse on Adult, Career and Vocational Education, Columbus, OHIO.
15. McClelland, D. C. (1973). "Testing for Competence Rather than for Intelligence". *American Psychologist*, 28, 1-14.
16. Noe R.A (2010). "Employee Training and Development". McGraw-Hill/Irwin Paprock.
17. Paprock (1996). "Conceptual structure to develop adaptive competencies in professional". *IPN Ciencia, Arte: Cultura, Nueva Epoca*, 2 (8), 22-25.
18. Wu, J.-L. (2013). "The Study of Competency-Based Training and Strategies in the Public Sector: Experience from Taiwan". *Public Personnel Management*. 42. 259-271. 10.1177/0091026013487124.