

Chapter 5

Body of Knowledge and Scientific and Technological Imagination in the Folk Tale *Phra Abhaimani*

Regarding the body of knowledge and imagination in science and technology as appeared in the verse tale *Phra Abhaimani*, the researcher has classified them along the framework of objective 1 of this research as follows:

1. The Classification of Knowledge and Imagination in Science and Technology in the Verse Tale *Phra Abhaimani*

Concerning the classification of knowledge and imagination in science and technology analyzed from the verse tale *Phra Abhaimani*, the researcher had started from studying the value of literature. Sukhothai Thammathirat Open University (1983, pages 164 – 191) had suggested that the literary value could be thought of in two aspects - emotional and intellectual ones. *Phra Abhaimani* had yielded these two aspects of value. Regarding the intellectual values, *Sunthorn-Phu* had provided through the body of knowledge and imagination in science and technology. The composer inserted knowledge on star watch, living things both of the plant and animal, and the imagination of the new invention such as the gigantic ship of Pirate Surang. The mention of an ideal society of Muang Lom, for example, had reflected the ideals of its members' morality and ethics. They respect the social rules and were not to violate them. In short, the verse tale *Phra Abhaimani* created by *Sunthorn-Phu* is a science fantasy that had been far ahead any other the verse tales created at the same period.

From the story in the 132 episodes of *Phra Abhaimani*, it was found that *Sunthorn-Phu* had maintained a body of knowledge regarding nature both of living and non-living things. This content of his imagination is found being classified into science of physical and biological worlds as in the present (Prawes Wasi, 2004). The content also covered the natural rules suggested by Buddhism covering the following components (Phra Thepwethi, 1991, page 103):

1. Physical Laws: The natural laws concerning climate and all non-living things.
2. Biological Laws: The natural laws regarding plants particularly genetics generalizing to all living things.
3. Psychic Laws: The natural laws of mind and thinking process.
4. Moral Laws: Law of kamma, the natural laws governing human behaviors.
5. General Laws: The natural laws of cause and effect of all things such as The Law of Three Characters of Reality.

Phra Thepwethi (Prayuth Payutto) noted that science focused on only the first two components- physical and biological laws represented by physical science and biological science. The former covers Physics and chemistry. Physics itself is broken down further to cover astronomy, geography, and geology. Biological science covers biology. Knowledge substances of all these disciplines could be used to explain the body of knowledge and imagination in science and technology in the

verse tale *Phra Abhaimani* created by *Sunthorn-Phu* which could be summarized in the following concept map.

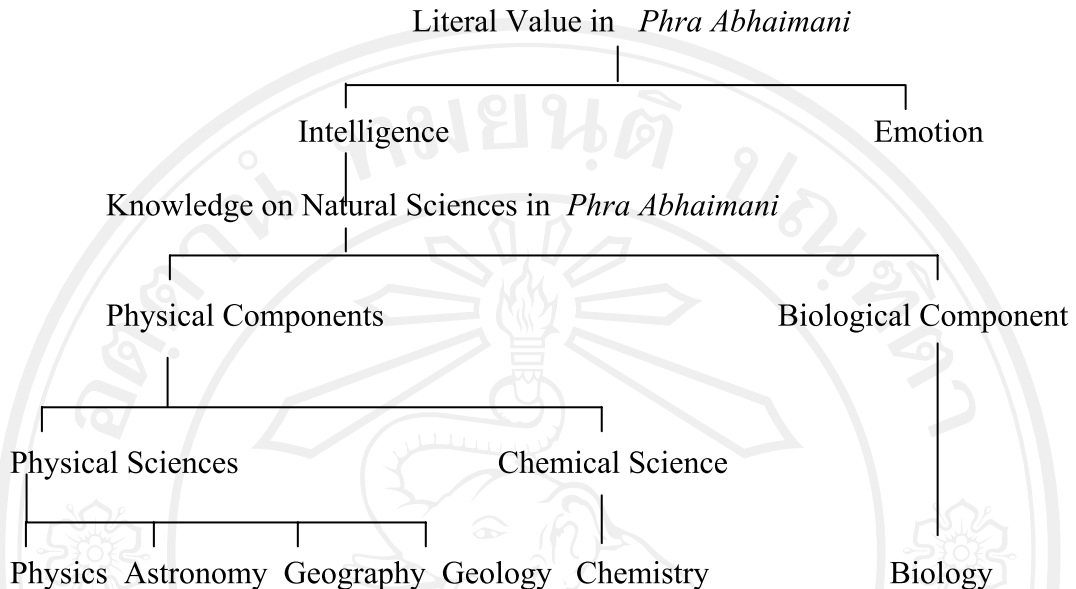


Chart 1: Concept Map Representing Subfields of Science Used as the Framework for Classifying Knowledge and Imagination in Science and Technology in the Verse tale *Phra Abhaimani*

2. The Result of the Analysis of the Body of Knowledge and Imagination in Science and Technology Embedded in the Verse Tale *Phra Abhaimani*

The researcher would put each of the subfield of science along the groups of Physics, Chemistry, Astronomy, Geography, Geology, and Biology, as follows;

2.1 Physics

In regard to the body of knowledge and imagination in science and technology embedded in the verse tale *Phra Abhaimani* composed by *Sunthorn-Phu*, the composer had many concepts about things basing on knowledge in physics. Some of them are the concepts about the ship used by the Pirate Surang, the Samphao ship, the Brahman's arrows, magical table, the autonomous accordion, miracle swords, and the woodwind of *Phra Abhaimani*. The details of each will be described as follows:

2.1.1 Pirate Surang's Ship: It was the imagination of *Sunthorn-Phu* portraying a gigantic ship owned by a pirate by the name Surang. How gigantic the ship had been was imagined by *Sunthorn-Phu* in the following verse:

The boat is four hundred both hands' stretch,
Made up as a big building with a lot of space.
Palm and fruit trees could grow to provide food,
Which could feed a whole lot of people,
Lambs, goats, chicken, pigs, geese, etc. could be raised there,
As were elephants and horses,

There are five hundred ships guarding around,
Each of which is fully equipped with weapons.

(

Volume 1, Page 167)

From this verse, we can see how big the ship is as it was 20 *sen* long (a Thai unit of measuring distance which is about 800 meters). On it, there are buildings for living, space for raising animals, and plant growing, etc. The only thing needed was fresh water. We can analyze this imagination of *Sunthorn-Phu* basing on the societal condition of early Ratanakosin Kingdom, particularly during the Reign of King Rama the 3rd when the trade via the ship was going well. Besides, there were many major superpowers the major one of which was the British who had big influence on the society in Southeast Asia. They came in to set up their colonial states and sought for commercial benefits as well. The Pirate Surang was then a character to represent the power and influence of the West which had deep impact on the polity, economy, and innovations in this region. The ship was the result of *Sunthorn-Phu*'s creativity which had not been realized at the time. At the present, there have been some big ships constructed for special purpose such as the Titanic which provides all kinds of facilities and entertainment. Other ship such as the plane carrying on is also gigantic in its scale. All these were the realization of a certain imagination. Even so, none of them could be as gigantic as the Pirate Surang's ship.

The Pirate Surang's ship, no matter how gigantic it might be, was imagined by *Sunthorn-Phu* to maintain the form and function of the ship in general. It could be floating which required some understanding on physics principles which related to the water's buoyancy, reaction force and density.

2.1.2 Samphao Motored-Ship: The ship was the product of the imagination of building a ship with straws by a knowledgeable Brahman by the name Mora. This ship could sail to any place both on the land and on and in the water. *Sunthorn-Phu* had described the motored ship in Volume 1, page 8, in the verse that says:

When the sun faded out and the wind died down,
One could then step up on the big motored ship as had wanted,
Leaving his house, he read out the magic words to get attention of the
wind,
That helped bring the ship across the forests,
Arriving at the sea,
Having a good time sailing on the big ocean.

This imagination of Samphao ship made from the straws of *Sunthorn-Phu* could have been from the context of Siam at the time which was an agricultural society full of species. Straws were handy and easy to be used in creating certain things such as the puppet or toy-boat. Another reason was the belief on magic power. This was reflected well in the verse tale. The imagined ship is, however, not simply a worshiping item but a real object which required the real wind not the magic power to move. Such technology, in fact, was used reflecting the fact that people depended mostly on nature in maintaining their living. One of the reflections is about the transportation at the time which depended mostly on water. The travel across the

forest was done with difficulty. That probably explains why the straw ship was used. This imagination had basically laid the form and function of the ship created in the story by Brahman Mora

This motored ship imagination reflects *Sunthorn-Phu*'s knowledge on how to utilize nature in the people's living. The use of Samphao ship in travelling through the water was relevant to the natural environments of the time. Nature affected people. Yet the people also affected nature. Both engaged in an interaction with each other. The motored Samphao ship signifies the people's wish to have the facilities to maintain their life in general and to travel in particular. The people would have wished to travel conveniently in any condition. At the present, the hovercraft has been invented as the vehicle that could go either on land or on and in water to satisfy the people's wish for the convenience. The vehicle is driven by the wind to lift it a bit from the surface to reduce the friction and move it forward making its movement more efficient on any condition. The motored Samphao ship imagined by *Sunthorn-Phu* in the verse tale *Phra Abhaimani*, in a way, could serve as a prototype for the creation of the present hovercraft.

2.1.3 Brahman's Arrow: It was the weapon of Brahman Wichian which could be fired out 7 shoots at a time and they would get at the wanted target. Sunthorn-Phu had mentioned about the Brahman's arrow in the story as follows:

One was with name Brahman Wichian,
Who had studied what he needed to know-the art of war,
He had acquired how to use arrow to elegantly fight the enemy,
Aiming at killing them,
Seven arrows were shot out at a time,
And got at the target without mistake.

(

Volume 1, page 8)

Regarding this seven-shot arrows, Prachak Praphaphitthayakorn (1986, page 109) had hypothesized that Sunthorn-Phu would have taken from the story Romance of the Three Kingdoms or Samkok, the title of the translated Thai version. It was when Khongbeng was about to die. He gave an invention which was finished but had not yet been tried to Jiang Wei. It was the arrow that could be fired out 10 shootings at a time. Sunthorn-Phu had adopted the idea but adjusted the number of shootings down to 7. In the period of Sunthorn-Phu, there were still some wars though less than at Ayutthaya. In fact, the situation in Southeast at the time was overwhelmed by the Western Powers who had both political and economic influences. Weapon and military were significant for the country's security. In a sense, the number seven chosen by Sunthorn-Phu could have been represented some belief. In Buddhism, 7 could represent the *Sappurisadhamma* or virtue of the righteous - the seven qualities of a good man (www.mahidol.ac.th) as follows:

1. **Dhammannuta:** knowing principles, knowing causes; he knows the underlying principles and laws governing the things with which he must deal in the process of everyday life, in performing his duties and carrying out his tasks; he knows and understands according to reason what he must do. For example, he understands what duties and responsibilities are involved in his post, his status, his occupation and

his work. He knows the principles involved therein and he knows how to apply them so that they become factors for the successful completion of those duties and responsibilities. At the highest level, dhammannuta means knowing fully the natural laws or truths of nature so that one can deal correctly with life and the world, with a mind that is free and not enslaved by them.

2. **Atthannuta**: knowing objectives, knowing results; he knows the meaning and objectives of the principles he abides by; he understands the objectives of the task he is doing; he knows the reason behind his actions and his way of life and the objective to be expected from them. [He knows] the aim behind a duty, position or occupation. He knows what may be expected in the future from the actions he is doing in the present; whether, for example, they will lead to a good or a bad result. At the highest level, atthannuta means understanding the implications of the natural course of things and the benefit that is the real purpose of life.

3. **Attannuta**: knowing oneself; he [or she] knows as they are the current extent and nature of his [or her] status, condition, sex, strength, knowledge, aptitude, ability, virtue, etc., and then acts accordingly, does what is needed to produce results, and rectifies and improves himself or herself so as to grow to greater maturity.

4. **Mattannuta**: knowing moderation; he knows the right amount in such areas as consumption and spending; he knows moderation in speech, work and action, in rest and in all manner of recreation. He does all things with an understanding of their objectives and for the real benefits to be expected, by acting not merely for his own satisfaction or to accomplish his own ends, but rather to achieve a proper balance of supporting factors that will produce the beneficial result as revealed to him by wisdom.

5. **Kalannuta**: knowing occasion; he knows the proper occasion and the proper amount of time for actions, duties and dealings with other people; he knows, for example, when what should be done and how, and he does it punctually, regularly, in time, for the right amount of time and at the right time. Kalannuta includes knowing how to plan one's time and organize it effectively.

6. **Parisannuta**: knowing company; he knows the locale, he knows the gathering and he knows the community. He knows what should be done in a given locale or community, thus: "This community should be approached in this way and spoken to thus; the people here have these rules and regulations; they have this culture or tradition; they have these needs; they should thus be dealt with, helped, served and benefited in this way."

7. **Puggalannuta**: knowing persons; he knows and understands individual differences; he knows people's greater or lesser temperaments, abilities and virtues and knows how to relate to them effectively; he knows, for example, whether they should be associated with, what can be learned from them, and how they should be related to, employed, praised, criticized, advised or taught.

Brahman Wichian's arrow serves as the symbol for intelligence resulting from withholding these seven Dhamma principles. As a saying in the Chinese story Romance of the Three Kingdoms mentioned above "Know them know us helps winning the war – Launch a hundred wars, obtain the hundred victories." Engaging in whatever, one should do it with well-thought action. This principle could be used to respond to the need for kingdom security at the time. The war could be pursued both by weapons and intelligence. The latter could be used to deal the an implicit threat

from the colonizers – their knowledge. The power of the arrow was through physical and mental considerations. The exact hit at the target was explained by Sunthorn-Phu as the mental determination which could control over materials and objects.

At the present time, there have been an invention of ballistic missile to be launched to destroy the enemy. The innovation utilized electromagnetic radiation in the Radio Detection and Ranging (RADAR) to guide the missile to hit the target which has become a significant weapon in doing the war as did Brahman Wichian's arrow.

2.1.4 Magical Table: It was a facility which worked autonomously. In *Phra Abhaimani*, Sunthorn-Phu (Volume 2, page 197) had imagined this miracle table as follows:

When the people rang the bell for the service,
The table full of magic came up,
With all kinds of rolling rings as those moving the cart,
With food and drink sets,
People closely watched it seeing no one operating it but the table itself,
The big table served all people surrounding it.

This magical table was described Sunthorn-Phu that it could move because of some mechanism composing of rolling rings. Eating at table was obviously a Western culture as the Thai style of eating was people sitting around the food set (Sumon Amornvivat, 2005, page 10). Sunthorn-Phu's magical table reflected Western way of eating which was being introduced into the Kingdom. The innovative table was part of the imagination to have convenience in life. In those days, people had to bring out the food set. They had to clean all the stuffs afterward. If they were members of royal family or aristocracy, they would have servants to take care of it for them. The magical table of Sunthorn-Phu came out itself and moved back after the eating adjourned.

At the present, people could control things to move autonomously. These include toys such as cars or plane. The toys depend on electromagnetic radiation in the radio detection and ranging to control the operation of things such as remote control for television, radio, tape player, etc. The control is even more efficient by utilizing electromagnetic radiation in electromagnetic radiation with the infrared wavelength.

2.1.5 Autonomous Accordion: This musical instrument was an inventive object through the imagination of Sunthorn-Phu. He mentioned this instrument here and there in the story such as when Nang Laweng had hosted a feast her relatives and led them to the garden to see the grand diamond (Volume 2, page 198). There Sunthorn-Phu mentioned the autonomous accordion as follows:

The one who was responsible for the dancing
Had started the instrument.
The music that came out was exactly the same as those ordinarily
played by the musicians.
The music was excellent and sounded impressive.
The sound of all kinds of musical instrument was generated,

As if it was created by a heavenly group of musicians.
 The singers sang along the melody,
 While some others played along with new style of music,
 Singing out in Western tone,
 To increase the fun to the group,
 Adding their happiness,
 All of which could never be felt even by flying on the golden swan.
 The audience had appreciated,
 Through their ears sensing the melodious sound.
 Others were fascinated by the machined instrument,
 Wondering how it could play by itself.

The accordion imagined by Sunthorn-Phu could be played and produced the song without any part of the musicians or singers. The instrument could have been the record or sound system as they are at the present. During Sunthorn-Phu's time, this technology had not yet been realized. The singing and music play had rapidly become popular, particularly during the Reign of King Rama the 2nd who was not only fond of composing poem but also of music playing. In those days, when the Siamese kings was going to bed or even they were in the hair cut process, there would be some music lulling. In the society at the time, music and plays had enjoyed popularity. There were some drama groups and well competent musicians all over. The idea of autonomous accordion imagined by Sunthorn-Phu simply reflected the desire to have some kinds of facilities for entertainment.

In the realm of sound technology, the recording was actualized for the first time by Thomas Alva Edison in 1877 through the device called phonograph (Reader's Digest, 1998, page 222). The device was later developed to the sound record resulted from converting the sound wave on to a disk which when played would converted the traces back into sound. The sound recording was later done through the tape and finally the compact disk or CD as at the present.

2.1.6 Bouncy Lever: It is the device installed in front of the residence of the Lankan Christian priest. When Nang Laweng went to see him (Volume 1, page 338), Sunthorn-Phu described:

The four servants led her way,
 Stepped up on the residence's stairway,
 Their feet touched on a stair step which lifted up with the noise,
 Of bell ringing three times.

The bouncy lever was set to signal someone stepping up the stairway with three bell rings. It was imagined to serve as the warning signal for the house residents to realize that someone had come up. Sunthorn-Phu would have thought about the device to respond to the need for security of Siamese people at the time.

The mechanism of the bouncy lever was described by Sunthorn-Phu that when someone stepped on the stair-step, it would bounce up pushed by the lever. The sudden spring was linked to the bell by a thread creating bell ringing. The trick worked on the principle of lever and pulley.

2.1.7 Phra Abhaimani'd Woodwind: It was Phra Abhaimani's personal music instrument. In those days, whoever tried to be good at the music was regarded

good for nothing – those who made a living by dancing and singing. King Suthus was once very mad at his one's decision to become a musician. He was portrayed (Volume 1, pages 6 – 7) in the episode that:

Thao Suthus, after heard what the son had said,
Was very mad.
He trampled and said to the son,
“Don’t be so elegant! I can’t stand such idea.”
“Musical instrument whatever it may be,
Is just for those who can’t do anything else but the play,
Even those women serving in the court,
Could become expert on it.”

To Sunthorn-Phu, the study of music was of high value. He put the words into the mouth of Phra Abhaimani in saying about it with the 3 Brahman in Volume 1 page 10 that:

The music is good in all aspects.
It is as valuable as gems.
Human, Garuda, God,
Or Animals in the jungle,
If I play the woodwind,
Would stop their frustration and anger,
Have tendering heart and want to rest.
The music is the best of the bests.
If you are not convinced,
Be prepared to drop off to sleep as I will play it for you.

The poem reflected that music could be used to reduce the people's anger or to convince people along a certain direction. As Sunthorn-Phu was fond of poem and had been the source of plot for the drama played by many musical drama groups, he could have been inspired in creating the main character which was a musician and use the music to solve the confronting problem in various situations such as to settle down the war, to kill the woman giant, or to call out Sin-Samuth, and the likes. The wind wood instrument of Phra Abhaimani could have signified the use of intelligence in solving the problem rather than totally depending on forces. It could have also been designed to represent the 5 sensory perception, namely, eye seeing, ear hearing, nose smelling, tongue tasting, and body touching, which led to satisfaction. When the woman giant died because of the woodwind, the audience would realize that anyone who had been occupied with the sexual happiness would eventually come to the end. Using the woodwind to kill the giant women was the way to kill the enchantment to get rid of the root of the problem. If this need was lit up again, the sexual enchantment would come back.

The windwood of Phra Abhaimani was described by Sunthorn-Phu that it needed the wind to play. Hence, before playing the instrument, one had to be concentrated to set up his body's wind element to circulate so that he could play it well and the music could have the power to hypnotize the audience. At the present,

modern science has explained the woodwind sound as the instrument which generates sound through the air passing in and out of the woodwind. The pitches are created by using fingers to control to holes on the instrument creating melody as wanted by the musician. It is interesting that Phra Abhaimani's woodwind had the great power to cause the giant woman's loss of breath and finally died. The woodwind is then similar to the modern weapon that could generate high-frequency tone affecting sensory perception of living things to the point of breaking their ear drum. In music, there is a technique known as "Open the Major Fingure" by which the player's other fingers cover holds on the woodwind except his right hand index finger making the sound unusually high. The sound creates the effect that touches the spirit of the audience. Meanwhile, it could also jeopardize their ear drum as well.

2.2 Chemistry

The concepts of knowledge and imagination in science and technology embedded in the verse tale Phra Abhaimani that are relevant to chemistry deal with the 4 elements in general, and *Din Thanan* (medicinal clay). The details are as follows:

2.2.1 The Four Elements : The concept of the Four Elements was basically religious. It explained that the Four Elements were the basic ingredient of all things including the living things. Sunthorn-Phu had clearly asserted concepts about the Four Elements in the episode on the birth of the Ocean Butterfly in Volume 1 page 163 as follows:

Then Mahingsingkorntthewaraj
Told the story,
Which had happened very long time ago,
Since the sky, sea, and mountains were created.
The Ocean Butterfly once was a stone,
In the middle of the ocean.
She was given a wish,
To save out her heart in a rock.
Afterward she climbed up the bank of the sea,
To engage in the war against the Fire God at the foot of a mountain.
Her body was all over burnt.
It was a luck that she was immortal,
And her heart which was somewhere else was not gone but reborn,
Became a spirit at the stone,
Which was incubated by the water as well as the earth steams,
Making the stone grows,
With face and strong legs.
All these were blessed by Goddess Laksmi,
Who gave her a thousand years long life,
She then became an ocean butterfly who flied up to the sky,
Was even more powerful when touched by the sun shine,
To bravely suppress all the devils,
Became the Super-power at Anoman River,
With immortality that no one could kill.

The woodwind play could turn her into the stone,
 As the elements of water and wind had gone.
 But if put her in the fire,
 She would not die but chase to kill all humans,
 And could never be killed,
 As she had reborn many times.
 Until the great fire got on the universe,
 She would too be gone.

Sunthorn-Phu had imagined that the woman giant was the monster who relocated her heart in a rock before engaging in the war with the Fire God and had been burnt down. Later on the rock that had contained her heart was reformed by the steam of the soil growing hands and legs and finally received the wishes from god to be in life. The woodwind play that transformed the rock into living things and vice versa had been based on the principle of the Four Elements. Woodwind play transformed the rock or earth into life and it could put her back into rock whose 4 elements no longer circulated. Sunthorn-Phu dealt specifically with these elements as follows:

a) **Earth Element:** Sunthorn-Phu did not directly use the term in the verse but in the episode of the birth of the woman giant has implied that the rock could grow into the body of the woman giant reflecting the fact that the body of living things and any other things all has earth element. When the woman giant died, the earth element had turned back into its natural origin – the rock.

b) **Water Element:** In Buddhism, there is a term called “Ar-po Thart” or water element. When this element in the woman giant stopped circulating, the water element returned to nature. In the episode, it flew out from her mouth signifying that water element was a major component of the body. In another episode, Brahma Sanon had set up the ceremony to call up the wind and rain before starting the battle in a war (Volume 1, page 397). Such magic rain and wind made the enemies trembling with the cold signifying that the water element in the body was relating to that of the outside. If water element in the body had unusual circulation, the person’s health was in weak condition. This principle used when the poet described the situation in which the doctor was healing Nang Kasara (Volume 1, page 91). During the discussion about the cause of her syndrome, some of the doctors hypothesized that her water element was not normal.

c) **Wind Element:** In Buddhism, wind element was called “Wayo Thart” to refer to the wind element which if circulating well would sustain the person’s life and health. If it ceased, life came to an end. This was the case when the wind element of the woman giant stopped circulating and she died.

d) **Fire Element:** When the woman giant who had died was burnt by the fire, she came back to life. The fire element, besides burning down all things, had become a required element for living as well. In many episodes, Sunthorn-Phu had shown the powerful effect of fire such as when Phra Abhaimani was fascinated by the painting created by Nang Laweng who had wanted to hook him into her charm. Sin-Samuth tried to free him out by putting the painting into fire (Volume 1, page 386).

The concepts of the Four Elements as appeared in the verse tale Phra Abhaimani had reflected the concepts which Sunthorn-Phu wanted to tell. All things were

composed of the 4 elements which had to be in proper proportion to maintain their balance. If not, one of the elements could cause the bad effect to the body.

Besides, Sunthorn-Phu had illustrated the interrelationship among all the four elements such as in the episode when Sin-Samuth was to launch the war against Usaren. In the episode, Nang Suwanmalee had proposed the trick to surround the ship with tanks of water to put off the fire in case the ship was fired by the enemy (Volume 1, page 236). She also warned Sin-Samuth not to sail the ship close to those of the Lankan side because if the great wind came, the fire could be too far to put off (Volume 1, page 238). Part of the verse was:

Though we have to fight with the Westerners,
Don't be too intimidated by them.
I would spell out the magic to create the big wind,
To push the ship back out.
We would then approach them from the windward direction,
And set their ships on fire.

(Volume 2, page 374)

The episode showed that fire element related to water element in an antagonistic way. Water could put off the fire. Nang Suwanmalee had Sin-Samuth set the water tanks around the ship to prevent the fire. The fire and the wind, however, had complementary interaction. The harder the wind blew, the stronger the fire burnt.

The principle of the Four Elements could have been adopted by Sunthorn-Phu as a Buddhist influence. The term “Thart” or elements used by the general public would have differed in their meaning from those suggested by Buddhism. People in general know these elements only in their physical properties.

Earth Element has the properties requiring space, being hard and solid, serving as the holding post, serving as the space on which things or living things could set or live, etc. It comes in a touchable mass form. In science, the element could be regarded as the solid matter which included our body organs and the land on which we lived.

Water Element has the properties of being harmoniously connected, giving fresh and cool feelings, etc. It is within and without the people's body. In science, the element is regarded as the liquid state of matter.

Wind Element has property of being movable, flowing back and forth, staying in and out of the body, etc. In science, this element could be regarded as the gas state of matter.

Fire Element has property of being hot, able to radiate, and generate light. In science, this element could be treated as the heat or temperature generated from the burnt.

These 4 components were, according to Buddhism, interconnected and hard to separate them out. Human body was composed of earth, water, wind and fire. Liver, for example, had the content matter in form of earth, among sub-elements of this earth element, there were some water and wind elements between the space between the tissues. When the cells were operating, there was some heat generated (fire). The food people ate into their stomach had the earth element but when it was not digested, there

was some acid coming out and the food was fermented producing the fart which is a wind element.

Hence, the term “Thart” or element according to Sunthorn-Phu and Buddhism, has more comprehensive meaning than recognized in the science. Earth element has the property of sticking together. The people’s organ are touchable because of its solidarity property. Water element has the property of being cool and fresh. This element is found in the blood and liquid between cells. Wind element has the property of natural things than could move and circulate in the space such as that between body organs or cells. Gas generated from the ferment of food in the stomach came out in term of fart. Fire element is the temperature of heat in human body generated from food substance burning activities in the body to maintain life. People’s body is always warm at 37.8 Celsius. This could explain why the woman giant had come to life when she was burnt by the fire element. The burnt could stimulate the body organs to re-function to get some food substances and energy to be able to move one more time.

Among scientists, the term “Thart” or element is specifically referred to the touchable matter such as Hydrogen(H), Oxygen (O), Carbon (C), for example. The scientists would regard water as the thing composed on hydrogen and oxygen in the proportion of 2 and 1 represented in chemical term as H₂O. The sub-elements of the “Thart” is called atom which regarded by the scientists as the smallest elements of things but still have the property of the element in which this sub-element is a part. In Buddhist perspective, however, the “Thart” are integrated together and has the balance.

2.2.2 Din Thanan or Thanan Clay is the product of Sunthorn-Phu’s imagination in an interesting way. Sunthorn-Phu described this Din Thanan as the thing popped up from the ground when it has reached it’s 1,000 anniversary. It was bright red inside smelling like fruit and had so many medicinal effects that it had been wanted by various kinds of animals. Sunthorn-Phu described his imagination on the medicinal clay – the Din Thanam or Look Nom Thoranee, or literally the pill of the earth mother’s breasts in the episode when Nang Laweng was lost in the forest in pages 428 – 429 of Volume as:

She suddenly heard clash of landslide,
Which had effect all over the forest and mountains.
Then something dropped,
With the size of a bottle gourd, it rolled over just in front of her.
With golden color, it smelled sweetly,
Refreshing her up, second to none.
With curiosity, she took out a knife cutting it,
Into two halves with red melon.
She tried and found it was delicious,
More than any other food fixed by people.
Its sweet smell and taste refreshed her,
Lubricating her dry throat creating great feeling.

She tasted it and found it was delicious and liked its good smell but was not sure what it was. Until the god came out to tell her about it (Volume 1, page 429) which was described in the verse that:

Then the god who took care of the place,
 Came out and told Walla, the nice woman.
 Such fruit is “Nom Thoranee” (the land’s breast),
 Which popped up only once in a thousand years.
 Hearing it had nice smell,
 All the animals showed up to take a bite,
 To get the cool and sweet taste and to obtain the energy,
 To protect from and cure the disease,
 To prolong life and stay young forever,
 To have the skin as nice as the fine gold.
 Though at the age going on the three hundred years,
 One would not loose their shiny complexion,
 With the nice odor,
 That attracts all men.

Sunthorn-Phu describe Din Thanam as the clay coming in round form like that a water melon but had various medicinal values such anyone who ate it would be free from any disease and stay young forever with beautiful and nice smelling complexion though at an older age. From biography of Sunthorn-Phu in Niras Wat Chao Fa, it was found that Sunthorn-Phu had been interested in a the life prolonging medicine and the alchemy to a certain degree. The Din Thanam in this tale could have been imagined by Sunthorn-Phu as a substance to prolong one’s life. Alchemy was originated in the West and Arab and had enjoyed popularity there for some time. The attempt to achieve all these dreams had stimulated the experiments and discoveries on matters and chemical substances. The instruments used had become the prototype of the pharmaceutical instruments of the present. It could be said that alchemy was the origin of the present chemistry (Padoongyot Duangmala, 1999).

By this virtue, the Din Thanam had clearly signified the belief on life prolonging medicine of Thai people though there has not been any success at the present. However, people have continued their attempt on it. They have tried to find the medicine that helps prolong life or the substance that could transform normal substance into gold. All these are to achieve the long life with good health and prosperity.

2.3 Astronomy

Knowledge and imagination in science and technology embedded in the verse tale Phra Abhaimani has also reflected Sunthorn-Phu’s knowledge in astronomy. It is the knowledge about the earth, universe, and stars in the sky. The details of this knowledge appeared in the tale are as follows:

2.3.1 Earth and Universe Systems: Sunthorn-Phu had not much mentioned about the earth and universe. However, we could see the perspectives of Sunthorn-Phu on this to a certain level, particularly that which concerns the origin and the end of the earth and the universe. His perspective on the earth figure had reflected in certain part of the verse such as in the episode when Mahingsingkornthewaraj told Phra Abhaimani about the legend of the woman giant (Volume 1, page 163). In such

episodes, Sunthorn-Phu created the verse about the origin of the earth that “...it was the old legend since the sky and sea were found...” In regard to the end of the earth, he said “...when the big fire burns down the earth, all people die...”

This verse of Sunthorn-Phu has signified the origin of the earth and universe. There was the creation of the sky, sea, and mountains. At the end of the earth, there was a big fire. At the time, people strongly held in Buddhism and Brahmanism. The construction of the earth implied there was a god who created the earth. Such belief clearly recognized the supernatural things and the creation theory which asserted that things could suddenly emerge through the creation of a powerful being. When the earth came to an end, it was on fire which signified the nature and supernatural things and their interaction that had impact on people.

Besides the origin and the end of the earth and universe, the flat earth notion was also embedded in the verse such as the part on page 64 of Volume 3 as follows:

To travel for three months was like flying up in the sky,
Went far seeing the sun shine becoming dim,
Seeing the edge of the universe as taught by many teachers,
There was no sun nor moon there,
Seeing mountain range blocking ahead,
With seaside bushes and island of oysters,
With the width of hundred length units,
Where god resided since ancient time.

The island of oyster was at the edge of the universe which would have referred to by Sunthorn-Phu as the edge of the earth which was very far reflecting the imagination of Sunthorn-Phu in travelling to survey nature using only a samphao ship spending only 3 months. There was very far and nothing but darkness and an island of oyster which marked the edge of the earth. People in those days believed that the earth was flat. When one travelled to the end of its scope, he would meet the edge of it. This knowledge had been accepted for a long time in the West and the East. Siamese people had also acquired this idea from both Buddhism and Brahmanism, particularly the religious literature of the *Tri Poom Pra Ruang* (Three worlds by ancient holy king Pra Ruang). As people at that time depended mostly on nature, they had good observation leading to the conclusion about the facts of nature. They saw with their eyes that the earth was flat. They had come to believe that it was flat. In a way knowledge acquired by Sunthorn-Phu and the people at the time was empirical complemented by religious concepts about things passed on from generation to generation.

At the present, the scientist have studied various aspects of nature and have additional explanation about the origin of the earth which emerged from the Big Bang. This theory hypothesized that the universe emerged from the explosion of the mass leaving various things afterward. The explosion had created the new things all of the sudden. Regarding the end of the earth, many scientists have speculated that it could be the result of the sun's overheat that burnt down the earth. Basing on the principle of the evolution of the stars including the sun and the solar system, when they come to an end, they could expand the explosion to destroy all the stars including the earth. At that point, the earth would have received an extremely high heat from the

sun and been burnt down. Such Western scientist explanation was surprisingly similar to that made by Eastern religions.

2.3.2 Stars: Sunthorn-Phu had knowledge about the stars and their effects on human life. This concept appeared here and there in the tale, particularly in the episode when Nang Suwanmalee was teaching Sin-Samuth and Nang Arun-Rasami to observe the stars from the ship in the middle of the sea (Volume 1, page 217) as follows:

Opening the window seeing the bright moon,
Shining all over the sea,
The mother had directed the children to watch the stars,
So they learned about them,
Arun-Rassami, look up there,
Those are the turtle and the plough stars,
The other one is the flag star just in front of the horse star,
Along the near-by chicken star.
The girl asked her aunt,
What is the one in front of the plough star?
She then pointed to the flag star,
And pointed up to the stars linking along the line and told her it was the coffin
star,
Which if came closer to people,
It would cause their widespread death.
The Samphao boat star had a mast,
With many stays held tightly at the tiller.
Look at that, Mom. It's crocodile star.
It headed down with the tail up on the sky.
The little star on the North looks so twinkle.
They call it "Yod Maha Julamane" star (The Star of Lancer of the Arcturus).
That one is the steelyard star.
The beautiful and bright one is the coffin carrying star.
The son Sin-Samuth and the daughter,
Were so curious and asked to satisfy their curiosity.
The mother tried to clarify so that they were enlightened,
In all directions on the sky.
When it was late, she suggested them,
It's time to go to bed.

This verse has reflected the talent of Sunthorn-Phu on star watch. There are millions of stars. Each กลุ่ม mentioned by Sunthorn-Phu was real and known by Thai people from ancient time. They are also mentioned in many other literatures (นิพนธ์ ทรายเพชร, 2542, pages 7 – 9). It is the people's imagination that leads them to see the forms of those stars and serves also as the wisdom for remembering and classifying the stars people see in each night. Lanna also has its own star classification which came out to 27 groups each of which represented major kingdoms at the time such as the Burmese, Khmer, for example.

Knowledge on the stars have been used in everyday life of Eastern people for a long time. They use them to get the direction and time. This was also used in this verse tale as in the episode when the ship of พ้าวลิลราช was misdirected by the storm leading it to no where in the middle of the ocean (Volume 1, page 130). The knowledge was also used when พระมิ่งกลา was teaching นางบุษบง to watch the stars (Volume 3, page 275). The stars are significant for the people to maintain their living as they did not have any other effective equipment to guide their direction as do their modern counterparts. Traveling along the sea then depended totally on the star watch to guide their direction as they were noticeable at night when the sense of direction was even more crucial for the travelers.

Knowledge on star watch, besides helps guiding the direction, had involved other aspects of people's life. In the East, astrology has played important role in predicting the event that might happen to the people or society. The astrologists would take the brightness of a particular star to predict that the king or other society's significant persons were keeping well. Other star groups, however, might signify the opposite situation such as some adverse event might occur (Volume 3, pages 143 – 144 and Volume 4, page 222). In the verse tale Phra Abhaimani, Sunthorn-Phu had made use of this star watch knowledge to imply the society's and people's prosperity. The change occurred in the stars was believe to affect the society and people's life.

As the stars had been important for the people's life, they have attempted to acquire knowledge about them. Astronomists have studied and tried to explain the phenomena on the sky. Some of the knowledge had been shared by folk wisdom by which Sunthorn-Phu had used to deal with the natural phenomena and people's everyday life. Not much was use by him in the domain of astrology. He had used the constellations to guide the space and time. The position of the sun was used to come up with the time system such as month. The trail of the sun had passed on a certain constellation known as the ecliptic. The knowledgeable persons also explained the brightness or dimness of the stars utilizing their knowledge on the star evolution. All these also deal with the origin and the end of the universe. The stars then were seen in different color tones which were also the case in the verse tale.

2.4 Geography

Knowledge and imagination in science and technology in the verse tale Phra Abhaimani relevant to geography was used by Sunthorn-Phu through his settings and locations. Most of the settings in Phra Abhaimani were mostly at the sea. Sunthorn-Phu had used the sea conditions to describe the lonely feeling of the characters. The sense of the place that Sunthorn-Phu had had been the product of the combination between old knowledge most of which was from Buddhism and Brahmanism and modern knowledge gained from outside. The combination allowed the poet to come up with various literary components as follows:

2.4.1 The tale settings are important point in the composition. It had been understood that the settings in Phra Abhaimani were mostly in the Gulf of Thailand as Sunthorn-Phu mentioned the travel from and to Rayong in his Niras Muang Klaeng led many people to speculate that Sunthorn-Phu would have imagined about เกาะแก้วพิสดาร basing on Samed Island. There is a school on this island with the name Koh Kaew Pitsadan School inspired by Sunthorn-Phu. Such evidence, however, is not well accepted by some scholars on the field such as Ganjanakapan (1999) and

Suchit Wongthed (1995) who have come up with the new hypothesis that the settings in the verse tale Phra Abhaimani are in fact corresponding more to the name of the sites and locations in Andaman Sea.

Nonetheless, the settings in Phra Abhaimani had taken place in the sea condition which was important transportation mode during early Ratanakosin period in which the Kingdom had depended on the sea to contact with foreign states. This could have inspired Sunthorn-Phu to imagine the settings in term of the sea. His reflection of the conditions and events of the time was like diary written to record the situation of the society through the writer's perspective. This is the case for many other literatures as well. Settings of the story always reflected Sunthorn-Phu's knowledge regarding locations on earth which was part of the geography knowledge. Sunthorn-Phu had imagined nature, particularly the sea and islands to convey the feeling of the characters – their loneliness such when Srisuwan and the three Brahman were searching for Phra Abhaimani (Volume 1, page 18). In such episode, Sunthorn-Phu described:

I've missed my brother who,
If came along, would pair with me as brothers.
We would together watched the fish in the sea.
At this time, I am alone,
Looking left or right seeing no one.
The sea is full of blue water,
With some rolling along waves,
Stressing the lonely way, making me even deeper in the sorrow.

The scene of the sea described by Sunthorn-Phu portraying the loneliness ignited the broad view of the sea with some islands every once in a while. These reflect the feelings of Sunthorn-Phu through his characters and settings. The knowledge of Sunthorn-Phu reflected from the settings signifies his being well-rounded on the physical conditions of the earth known in geography as lithosphere and hydrosphere.

2.4.2 Locations: Locations in Phra Abhaimani were clearly described in the episode in which Phra Abhaimani was thinking about attacking the new town of Nang Laweng. He has asked the Court's Brahman who had informed him that in the book of knowledge there were some mentions about various towns in various directions and scopes. There people spoke different languages some of which sounded like that of the animals. Beyond such sphere, there were places for the ghosts and spiritual things (Volume 1, page 400).

Knowledge on locations informed by the Brahman was that of Sunthorn-Phu as well as those others scholars at the time. Some of the knowledge was from Khampee Tripheth or "Three-formed mantra" as well as that on maps which had been invented for war purpose or commercial travelling. From this verse, it has shown the thoughts or the people in ancient time which had viewed the earth as the land centering on the people. Other living things lived at outer rings of it. Besides, there is a verse composed by Sunthorn-Phu describing various towns making the tale Phra Abhaimani entertaining and looking real as it involved with locations and characters who came from various towns. This is clearly illustrated when those people who had

followed Phra Abhaimani from the gem island who later splitting to return to their home land. In this part, Sunthorn-Phu had described in Volume 1, page 319, as follows:

The Chinese sailed using the map of the East,
Through the outer route on the peripheral scope,
Arriving kangtang, Kangjew, Tuntiewsiang, etc.
Heading smoothly along Aimui.
To Malay site, the ship reached at Thesa Town,
To Arum, Surath, and Pattana.
Could also go to Pahang and Java Island,
To Malaka, Kalaywang, and Tranganoo.
Dutch arrived at Laem Lo and Ban Kham,
Reaching the shark area, Ngor Strip, and Rahoo Island,
Passing Atjaejam passing Malaya,
To and pass Vietnam.
The Indians sailed to Sawati,
Wesalee, Romewisai,
Kabillabhas and Rompatana next,
Passing Abhai Sali of the Brahman.
The Thai people put their ship on the wind,
To Kungsri Ayuthaya, the Siamese Kingdom.
The Burmese and Mon entered Pukam Gulf.
The Westerners arrived at Germany.
Some had reached Wilas Bay.
Reaching further to the towns of Ma-ngad, Ma-ngada, and Manga-sawan.
Passing the islands of South Mary and Capital,
To be among their own people.

From the verse, one should see that Sunthorn-Phu had a the huge body of knowledge on locations of various place in the world. This knowledge was beyond that inserted in Tri Poom Pra Ruang in that it had was the combination of old knowledge from various religious books of knowledge and new knowledge gained through empirically perceived through seeing, and hearing, through both direct and indirect experiences before putting it into an imagination of various towns on the world map through the composer had not had the chance to really travel to those cities. This has made the settings in Phra Abhaimani more realistic than those in many other literatures.

At the present, scientists have acquired knowledge about various locations and places and put them down on the map which divides the earth into the north and south hemispheres divided by the equator. The line to specify the place up from the equator up north or down south is called latitude which is in term of degree north or degree south from 0 to 90 degrees. The other line is called longitude which is drawn from the north pole to the south pole starting at the one drawn passing Greenwich in England which serves as the 0 degree longitude that divides the eastern half from the western half. The longitude starts from 0 to 180 degrees East or West. All these are call geocode system which is used to specify the location of the places on earth. Besides,

geographers had created the globe to help visualize the locations on the earth in every direction.

2.5 Geology

Regarding knowledge and imagination in science and technology appeared in the verse tale Phra Abhaimani related to geology, it was found that Sunthorn-Phu had knowledge on “Muang Lom” (sunk city), rogue wave, wind, and gemology, each of which would be discussed as follows:

2.5.1 Muang Lom: Muang Lom or sunk city was mentioned by Sunthorn-Phu in the episode when Sudsakorn rode on the blue sapphire dragon-horse to find his father - Phra Abhaimani. During the way, he found the sunk city in the middle of the sea (Volume 1, page 299). Sunthorn-Phu had imagined the sunk city as the place full of zombie ghosts who, after being approached by humans, had created the underwater town as a human place where there were a lot of people who tried to persuade Sudsakorn to stop by. After he passed the town gate, the town suddenly became the city of ghosts who chased him for their food. Sudsakorn and his blue sapphire dragon-horse were fighting with them for some time and had thought about the rusi who then showed up to protect them from the zombie ghosts. Afterward, the rusi had told Sudsakorn the story about the sunk city as follows:

The Rusi then told the story,
This is the city of King Pakka Phasasai,
Because of his bad deed against Gautama, the town sank,
Leaving only Bai Sema (boundary stone) above water level.
When the city sank, it was a pity for all people there,
Who lost their life, my dear nephew.
No less than a hundred millions crews,
Were starved to death.
If a ship has been lost in here,
The people on it would become the victims of these ghosts.
Don't stay hear as you might be caught in,
Let's get out of the wall now.

(Volume 1, page 300)

According to the legend, the sunk city was the town of Thao Pakka which had been very prosperous but its people did not maintain morality. The city had become deteriorated. This is similar to the legendary Yonok Nakorn of the North and Atlantis of the West which had reached the peak of civilization but later deteriorated and sank down the ocean. The sunk city of Sunthorn-Phu was once very prosperous and had the concentration of people. As they were not keeping good morality, they were punished by having their city sinking down under the ocean. The whole population died instantly and became the zombie ghosts to catch the by passers for their food.

The sunk city of Sunthorn-Phu was created to reflect his societal perspective that members of the society should stronghold on the good deed principle or the society would get worse and finally collapse. This principle holds that morality of the people set the foundation for the society's prosperity. The principle was compatible

with that belief of the people most of whom were Buddhists who believed in the law of action. The failure live up with the morality was the cause of the city's collapse.

In science, there has been some studies and explanations for the natural phenomena of the sunk city. Scientists have explained that the earth had layers of lithosphere. These layers constantly slide back and forth leading to the earthquake due to the earth crusts movements. As the result, a piece of land could sink.

2.5.2 Rogue Wave: The rogue wave was mentioned by Sunthorn-Phu in the episode in which Mangala had taken back the large diamond and returned it to Lanka and had the close soldier secretly buried it back to the same site. At that time, there were earthquakes continuously for three days and three nights followed by the rogue waves. Afterward, Magala had come out to court meeting as usual (Volume 2, page 355 – 356) In this episode, Sunthorn-Phu had described the damages as the consequences of the earthquake as follows:

The Westerner King Mangala,
Had called the meeting of all royal servants after the quake,
Which generated dust both in the sky and the water,
The gigantic wave that could shake up the sea.
A thousand of ships were hit hard,
And ran ashore,
Water flooded over the new palace and the people,
Who fled away to the hill and starved.

This phenomenon had many related incidents starting with the earthquake that had occurred continuously for 3 days followed by the rogue wave that hit a ship which had been locked at the shore and pushed it up on the shore up to the road. This phenomenon was read by Nang Yupa-phaka for Nang Laweng Walla in Volume 2, page 354, as the bad sign for the society. It could be corrected, however, by having the people observe the morality precepts and eat no meat, followed by the worship to protecting gods, and taking the persons who were the bad threat to the society to throw in the water to change the society's bad fortune. The correcting measures also included the worship of the four elements for a year afterward. They believed it was because the four elements had fluctuated. Earth element which should be stable had moved and shaken. Water element which usually came in normal current had become the rogue wave which could clash a big ship and bring it ashore. The fluctuation of the Four Elements and natural disaster which were unusually powerful was shown by Sunthorn-Phu to signify that human bad action could fluctuate the Four Elements generating portents in the society.

The rogue wave and the sunk city were used by Sunthorn-Phu to reflect the view that good and bad deeds had impact. The bad deed should have the bad consequences to the society. The impact depended on humans' action. Mangala had stole back the great diamond and took the senior relatives as the hostage would lead to the conflict among the kins generating bad consequences to Lanka and Mangala himself. He later was confronted by a war and finally had to flee away from Lanka.

In science, there have been some studies on the rogue wave imagined by Sunthorn-Phu. Thosaporn Wongrat (2007, page 126) speculated that the portent pointed out by Sunthorn-Phu could be a geohazard in form tsunami in Lanka at the

time. This imagination was to show the disaster that could occur to the society caused by bad deeds of the people which had led to bad sequence in the concrete form of usually destructive natural disaster.

2.5.3 Wind: The concept about the wind is another thing mentioned by Sunthorn-Phu almost through the whole story. As most settings in the verse tale Phra Abhaimani took place in the sea, wind became an important factor as it had effect on the ship travelling. In some parts, Sunthorn-Phu had used wind as a metaphor for some ideas as well.

The wind notion was raised to certain extent when we discussed about the Four Elements. As Sunthorn-Phu had frequently mentioned about the wind in that it was an important factor for sailing (Volume 2, page 65) and when Phra Abhaimani was about to leave Kor Kalapang-Ha (the island of sea fan) to Lanka Sunthorn-Phu stated that:

When the forth month arrived, there was a northward wind,
The bid ship serving as the royal barge,
The others carried food,
And troops up to a thousand.

The forth month wind is Lom Taphao (sailing boat wind) which blows northward along Chao Phraya River between February and April. Besides, Sunthorn-Phu had mentioned other kinds of wind such as Uttra wind (from northeast to southwest), Pattaya wind (from southwest to northeast), for example. These mentions have reflected his wisdom on the wind which was an important factor for sailing at the time during early Ratanakosin period in which sailing was a prime trade transportation mode. Living at that time depended mostly on nature. The traders needed Taphao wind (a northward wind) to sail up to China during the months of May to September. On the way back from China, the sailors needed the kite wind (a southward wind) which blows during November to March, for example. Moreover, Sunthorn-Phu had mentioned the sailing of the characters in the tale which was always at night and their return at day time.

It is obvious that the winds are related with time or seasons of the year. The wind changed along the time cycle. People in those days, particularly those depended on sailing, often had basic knowledge about the wind so that they could use it to manage guide their trip to the destination. All these facts were well recognized and utilized by Sunthorn-Phu in this verse tale Phra Abhaimani.

In science, the phenomenon of wind has been studied. Scientists explain that the wind is the air that moves. The direction changes along the seasons because of the monsoon which bring down the cold and dry weather from China during November to February creating cold climate in Southeast Asia during this period. The other is the southwest monsoon which bring along the humidity from the Indian Ocean creating storms and rain during May to October. These two monsoons are seasonal winds that have big impact on Thailand's climate. At Sunthorn-Phu's time, there was no technology to guild the samphao ship sailing. The sailors depended totally on the wind which changed along the seasons. Other local sailings also needed local wind such as land and sea breezes. At night, the wind blows from the land to the sea and at day time, it blows from the sea to the land. These wind behavior allow the sailors to sail out at night and sail in to the shore at day.

2.5.4 Gemology: Gems were significant for the royal court people. They had to dress up to their social status. One example was when Nang Suwanmalee dressed up Sin-Samuth and Nang Arun-Rasami when they were to visit the King of Ratana Kingdom, the father of Phra Abhaimani and Srisuwan. Sunthorn-Phu had narrated about dressing up in an episode in Volume 1, page 287 as follows:

She set up the hair for the two sisters,
Had them wear gold skirt with “Theppanom” pattern on,
Put the 7 karat diamond belt on as usual,
Wore the enameled bracelet,
Also some other bracelets,
All jewelry was as valuable as the Kingdom itself,
Wore also necklaces with valuable gems,
Linked together with diamonds,
Rings were worn on fingers,
Their diamonds sparked with twinkles,
Ears were with ear rings made of gold,
And the feet were worn with diamond-decorated slippers.

In those day, dressing with a lot of valuable gems like this was exclusive among the high class of the society, particularly the king and royal court members. Common people wore too but in relevant to their social status. On instance is of King Rama the 1st who specially loved ornaments made of turquoise enamel called Karawek bird’s increment color enamel or in more formal term – Rachawadee enamel (See figure 2). Most of his personal items were made of this kind of enamel. In this period, many aristocrats had dressed themselves and their children up over their social status norm, the King had issued the regulation for dressing. Definitely, common people could not use Rachawadee enamel. Sunthorn-Phu was a royal servant at the time. He could have been very informed about all these regulations. From the verse, it was found that the round enamels used in Sudsakorn’s bracelet was of Rachawadee style reflecting his social status as an direct descendant of the Kingdom ruler. The boy was allowed by from the regulation due to his social status. This high priced gem is then the status symbol of the people in the society.



Figure 2 Karawek Bird Increment-colored or Rachawadee Enamel

Moreover, Sunthorn-Phu had also talked about the gems as the sign of the societal prosperity reflecting the economy which was expanded due to the trade and investments. Currency and jewels had become significant part of the economy.

One other interesting piece of knowledge and imagination of Sunthorn-Phu was the grand diamond which was found on the hill behind Lanka city. It was a huge source of Lanka's gems. When the grand diamond was found, there was a miracle of earthquake. Afterward, Lanka's gems had not grown any longer. This was taken as a bad sign or portent for the people in those days. It was the consequence of humans' action that altered natural trend. The earthquake was a portent to signify bad things were going to happen the Kingdom.

Jewelry, according to Sunthorn-Phu's understanding, besides being beautiful and valuable, was the status symbol of the people at the time reflecting the cash economy. Valuable things had come to affect mind of the people. This had affect the people's relationship with nature. It was an imbalanced relationship generating adverse sequences to the human society. This idea asserted that people's acts were the cause of things happening to their society.

At the present, scientists have studied gems as an underground resource. Thai people called the gems "Ratanachart." There have been many ways of classifying the gems basing on different criteria such as value, the look, and gemological concept. People in the past classified them in term of color and physical characteristics and came up with names for the gems. The popular one at the time was by grouping the gems into 9 classes class "Manee Nopparat" or nine gems. Besides, gemological scientists have explained conceptual principles regarding gems such as its reflexivity, color, and properties.

2.6 Biology

Knowledge and imagination in science and technology in the verse tale Phra Abhaimani regarding biology were reflected in the concepts about animals, plants, characters, and characteristics of living things. The details are as follows:

2.6.1 Animals: In the verse tale Phra Abhaimani, Sunthorn-Phu had mentioned many kinds of animals most of which were birds. He had narrated the views of birds during the journey of the characters both on land and sea. Such narration reflects the composer's well-rounded knowledge about various kinds of animals. He also used animals in the metaphor to signify some ideas for the readers. Both usages stressed the deep knowledge of Sunthorn-Phu on animals.

Sunthorn-Phu was so well knowledgeable about the animals and could use their name in the background setting in a melodious way in which the readers could imagine the forest full of various animals or sea where fish and other water living things swimming back and forth. This narrative verses were used here and there in the story such as when Mangala was fleeing from Lanka and during his walk in the forest (Volume 2, page 400). Sunthorn-Phu had described such birds in the following verse:

Looking up there on the high twig of the tree seeing birds sit,
Singing back and forth near the mountain,
Drongo, parrots, and bulbuls were all having fun with singing.
On the foot of the hill below, the group peacocks engaged in slow dance.
The Siamese fireback pheasants cooed joyfully,
Telling the time to get together.

The Green Imperial Pigeons were in pairs,
 The yellow oriole was feeding her babies with young buds,
 Hill Mynahs, nightingales, red-billed blue magpies,
 Koels, Racket-tailed Treepies, Eclectus Parrots, and Quails were all cooing.
 Grey-headed parakeets, Laughingthrushes, Robins, Rainbow Lorikeets,
 Gulls, Tailorbirds, Weavers, King Quails, and Indian Rollers were all there.
 On top of the mountains, the heaven swans and the sky peacocks were singing,
 Sounded like pins playing in harmony.
 Babbler and Jungle Fowls sang from far away,
 Sounded like the classical Thai orchestra playing to beg for love.

The verse reflects the talent of Sunthorn-Phu in transmitting his impression of the natural beauty of animal gatherings well showing fertility of the forest at that time. Besides directly mentioned animals in general, Sunthorn-Phu also used animals in a metaphoric expression. This was clearly evident in the episode when Nang Laweng persuaded the villagers at Sikaranam to work for the royal court. The villagers replied her using metaphor of animals (Volume 1, page 437) as follows:

We all are villagers who are humble and submissive,
 We are like a camel not the lion.
 We are good at carrying things.
 To serve the people is beyond our wit.

This expression was to convey the fact that Sikaranam folks were laborers like the camel. To work as the aristocrat in the palace would be too difficult. At this point, Sunthorn-Phu had used the animal used by humans – camel, as the analogy for the villagers. He then used the lion as the analogy for the other end of social status people – the aristocrats who rule the society. Lion or tiger were the symbol of power. They were the hunters who scared other animals. The camel was used as the symbol to signify common people who use their labor or engaged in the agriculture. The lion or tiger was to symbolize the aristocrats who were the ruling class and had high power at the time. The expression was to turn down the offering in a subtle way to make the message come across to the receivers. Such message was the facts of life of social stratification. People had role and duty relevant to their social class. They had aptitude, competence, and intelligence to fit the work expected to be carried out by lower class people. Animals also had different level of ability to do things and they were set to have particular role in serving humans. The use of them in the metaphor was not only effective but also artistic way to communicate.

It is apparent that Sunthorn-Phu was well-informed about animals. He had connected them in the verse to communicate the fertility of nature at the time. He also used nature of animals to serve as the symbol to relevantly communicate in literary way. The knowledge on animals maintained by Sunthorn-Phu was used by him to show that things in nature relate. Humans and animals had roles and functions relating to one another. Modern biology has discovered all these facts which were well understood by Sunthorn-Phu some hundred years ago. His understanding was well reflected in the verse tale Phra Abhaimani.

In biology circle, there have been some studies about the species of animals that could co-exist in the same habitat – the diversity of living things. Biologists have classified animal into taxonomic systems and explained the co-existence of living things in term of their food connections and ecological functions. Animals have relationship with nature and environment such as the rabbit who look for food at night. One metaphor using the rabbit is the expression of a rabbit approaching the moon to signify a low status man who wants to marry a high echelon woman. This metaphor is widely used and well comprehensible among Thai people.

2.6.2 Plant: Sunthorn-Phu had mentioned various kinds of plants in the episode on forest tour which showed the beauty of the forest full of plants. Some of them had flowers while the other produced fruit. Again, such narration shows the well-rounded knowledge on various plant species of Sunthorn-Phu. One example was when Nang Kessara and her care takers were in the park (Volume 1, page 38) in which Sunthorn-Phu had described bushes and trees of various kinds.

In some parts, Sunthorn-Phu not only used the plants in the settings but used them more metaphoric purpose to express his world views on life and feelings of people. One instance is when he composed the verse “...she picked *Dok Soke* (sad flower), and *Dok Rak* (love flower)...to tell the others what she has had in mind.” Sunthorn-Phu intended to use the name of flowers – “*Dok Rak*” which has the same sound as “*Rak*” (love) and “*Dok Soke*” – the same sound as “*Soke*” (sad) to signify the emotion and feeling of the characters “...to tell the others what they have had in mind...” to express one’s feeling at that moment when he/she had the mixture of love and sadness. The flower which was concrete was used as the signifier of emotion which was more abstract to make it clear to the audience. It also reflects Thai way of expression for woman at this period who should not express her direct feeling to anyone.

Another verse which is related to plant is when Sudsakorn was fooled by the nude ascetic to go for a training but later was pushed to fall from the cliff to take his magic stick and the blue sapphire dragon-horse (Volume 1, page 309). When the Rusi from Koh Kaew Pitsadan had come to bring him up to the top of the cliff, he had taught Sudsakorn that:

Then he suggested not to trust people,
As their mind is unpredictable.
Though the vines are complexly interconnected,
Their complexity is less than that of human’s mind.

In this verse, the Rusi was teaching Sudsakorn not to put too much trust on anybody because his or her mind was not honest, worse than the vines. He taught the boy many other things too. Again, Sunthorn-Phu had used the plant – this time the vine, to raise the analogy to human mind which was abstract so that the audience could concretely get the point.

Besides, trees were important for many other things in nature such as the Rotan tree on top of Singkhut mountain. Such tree was miracle and Sunthorn-Phu had imagined in Volume 2, page 484 that:

On top of the mountain, there was a huge Rotan tree,
 Whose leaves released drops of water as though it was the rain,
 When the sun shines,
 Fog emerges as always has been since ancient time,
 This mountain is the center of Lanka.
 The tope shaped like a lotus, functioning as a religious place.
 In the cycle of 15 days, it created
 The rain on the continuous basis.

Sunthorn-Phu had imagine this Rotan tree which had drops of water at the point of the leaves which became the fog all over the place when touched by sun shine. On the 15th day, a rain fell. Rotan tree does not match any real tree. According to Sunthorn-Phu's imagination, the trees formed a highly humid forest consistently generating the rain in its season. Sunthorn-Phu would have used the Rotan tree as the symbol of fertility of the forest system in which trees, water, and sun shine had interrelationship. Where there were trees, there was water and rain. This body of knowledge was presented in logical terms to reflect the balance in nature between living things and non-living counterparts one of which was the tree. In Buddhism, this principle was known as "Paticca-samuppada" referring to the Dependent Origination principle. The principle insists that everything is interrelated governing logic of things. Rotan trees generated water which was burnt by the sun and became fog which turned into rain every 15 days.

In biology, there are some studies on plant and its classification part of which was mentioned in systematic way by Sunthorn-Phu using biological classifying criteria. The biologists have come up with scientific name for each species while present also the local name. The latter is the source of local meaning such as Dok Rak and Dok Sok whose name has the sound resembling to the words "Love" and "Sad." Besides the connotation, the poet also described color of the plants produced by natural way of pigment formation. Nature is composed of both living and non-living things which interrelate and form cycle of natural process such cycle of water in the ecological system which was reflected in the case of Rotan tree.

2.6.3 Characters: The characters in the verse tale Phra Abhaimani were designed on 2 bases first of which is the emotion. Sunthorn-Phu had shown that humans had both the physical and mental parts. The former perceives various experiences through the five sensory organs generating emotion and feeling in the mind. The second basis was ethnicity which used by Sunthorn-Phu to show that humans were different. They were of different nationalities. This fact was the case at the Sunthorn-Phu had lived. In Bangkok at the time, there were people of various nationalities lived and stayed in different neighborhoods in Bangkok and its vicinities as mentioned in the part on the context of Thai society at Sunthorn-Phu's period.

Regarding emotion and feeling of the characters, Sunthorn-Phu had reflected his own world views on human perception and emotion. This is clearly evident in the episode when Phra Abhaimani was playing the woodwind for Srisuwan and the three Brahmans in the beginning of the story (Volume 1, page 12). The woodwind song played by Phra Abhaimani had melody signifying the adoring of the woman beauty to the point of saying that the moon was incomparable. The one who had made love with her would become obsessed with her. The verse explained the

emotion of the three Brahmans and Srisuwan who were drawn into the feeling of attraction to the girl to the point they had dropped off to sleep. These emotions were conceived by Sunthorn-Phu as the result of the perception by the people's sensory organs. In another episode, the senior teacher, Phintha Brahman, was teaching woodwind play to Phra Abhaimani (Volume 1, page 5). He had said:

Though being attacked by the enemy,
And had applied all sorts of defending,
Take out the woodwind and play to capture the people's mind.
It works through the 5 tricks –
Form, Taste, Smell, Sound, and Touch.
The victim would be caught by them
And drop off to sleep as though he or she is dead.
This is a way to gain victory as expected.

Perception occurs from encountering with outside things. Consequently, one's mind would be led to be attached to bodily happiness. In fact, body is not to stay forever but comes and goes. When people die, their body erodes. Using woodwind play is a symbol employed by Sunthorn-Phu to stand for the use of intelligence in solving the problem leading to peace. Phra Abhaimani had used the woodwind play to put the enemy army to sleep for many times. Using the woodwind play is like cooling someone down by rubbing him with cold water – a Thai saying. The whole troop of the enemy then drop off to sleep as though they are dead. This is a peaceful way to solve the problem. It works on the premise that most people are attached to the 5 senses – form, taste, smell, sound, and touch. Encountering with these five senses fosters one's emotion.

Besides, Sunthorn-Phu had shown that humans have the basic emotions – in love, anger, sorrow, happiness, and suffering all of which appeared in the characters designed by Sunthorn-Phu. These emotions and feelings are expressed through the people's gestures such as in the following verse:

Nang Naree Srisuda's face had become golden,
She was very happy but.

(Volume 1, page 78)

Though having only the role of the care taker of Nang Kesara, Nang Srisuda had important role of match maker between Nang Kesara and Srisuwan. She herself was fond of Srisuwan too. When she was asked to contact him, she was so glad that her face had become golden to reflect her feeling of being fulfilled. She was happy and the face expression followed.

The characters appeared in the tale Phra Abhaimani were created by Sunthorn-Phu to make the characters clearly standing out reflecting nature of humans who were composed of "body" and "mind" which interrelated. Perception was done through the 5 senses – form, taste, smell, sound, and touch all of which interrelated generating feeling and emotion in the mind. The mind then communicated such emotion through body expression. At the present, the scientists have depended on their 5 sensory

organs to perceive the phenomena to collect data and use them in building body of knowledge. In biology, they have studied the process of perception and emotion generation of the people. They have come up with the concept of nervous system which is composed on brain, spinal cord, and neurotransmitter. When the 5 senses perceive the phenomena which serve as the “stimuli”, they will be sent through the neurotransmitter to the spinal cord and end up at the brain to process the information. Afterward, the result of the information processing will be sent back through the spinal cord to the destination organs so that they would act out the behavior. Brain is then the very important part of the information processing. In the tale, Sunthorn-Phu used the term “jai” which would have been referred to “mind” rather than “heart”. Mind is regarded by Buddhism as the 6th sense. Science, however, stresses on the senses which could be empirically verified resulting only 5 senses. Emotion, feeling, and behavior is explain exclusively by psychology basing basically on the notion of nervous system.

Regarding ethnography of the characters, Sunthorn-Phu had created characters of various nationalities. The characters were classified into two sides – those of and with Phra Abhaimani and other allies called by Sunthorn-Phu as the people of “Chomphu Thawee,” the term to call ancient India. The other side was of the Lankan farangs – the term referred to Caucasian. At the time of Sunthorn-Phu, there were Westerners coming in to have prominent roles in Southeast Asia. They represented their mother countries- the colonial superpower who were expanding their colonialization. The characters in the tale have well reflected the societal and world situations during his period.

Sunthorn-Phu had created the characters to belong to the side of the Lanka’s farangs such as Usaren who was a bad guy. He, however, had set the story to explain his being bad guy as because his lover was stolen away. Finally, Phra Abhaimani, who would have been connoted by Sunthorn-Phu as a Thai who should be paired with Nang Suwanmalee- a Thai and Nang Laweng-wanla- a Westerner. It would have been Sunthorn-Phu’s intention in connecting the Eastern peoples and the Western ones. Sunthorn-Phu would have thought that the Westerners had modern knowledge reflected in their new technology such as the large motored ship of the Pirate Surang, autonomous accordion, tricky spin, and magical table as appeared through the story. Sunthorn-Phu had imagined all these modern devices to represent Western technology. The poet even made Phra Abhaimani who was studying English language. Both the characters and some of the actions had reflected the adoption of Western progress suggested by the author.

Besides the two main nationalities – Easterners and Westerners, Sunthorn-Phu also imagined other ethnic groups. One was when Phra Abhaimani gave the permission for his followers from Koh Kaew Pitsadan to return to their home land (Volume 1 page 319), he mentioned many peoples reflecting his ideas about “ethnicities”. He classified them through many criteria such as size and skin as well as origin, language, and culture. One example is when he mentioned the Chinese people by using name and places such as Kangtung, Kangjiew, Chun Tiew Siang, and Ai Mui, for example. Brahman is another group distinguished from the “Khaekthes”. The latter would have been referred to other Indian-looking peoples such as those from Persia or Islamic.

Naturally, people belong to many ethnicities basing on origin, language, culture and their settlement. These peoples are Chinese, Vietnamese, and Indian-looking peoples who could be broken down to many more groups such as Javanese, Indian, Makassar people, and the likes. At the present, there have been some attempts to classify the peoples' ethnicity basing on many criteria the most used of which is language. In Southeast Asia, there are 5 linguistic groups, namely, Mon-Khmer, Java-Malayan, Tai-Loa, Sino-Tibet, and Hmong-Yao. Biologists, on the other hand, have studied and put all the diverse groups under the same biological category. The ethnic classification of the peoples, either in Sunthorn-Phu's time or social sciences often relies on the settlement location, language, and culture as the criteria.

In classifying humans on science's principle, biologists have proposed that the modern "Humans" is classed as *Homo sapiens* which includes many races. The criteria used for the classification are hair feature, skin, head form, face form, and height. All these are passed on to their descendants. Each ethnic group has its own evolution through the struggle for the survival of its members in their environment.

2.6.4 Characteristics of Living Things: Living things are outstanding parts of Phra Abhaimani reflecting the deeper and more futuristic imaginations than did other poets and scientists at the time. Audience could see this talent through the characters created by Sunthorn-Phu whose marvelous imagination has impressed the literature readers all along. The characters of Sin-Samuth, Sudsakorn, the blue sapphire dragon-horse, or the mermaid, are uniquely created. Sunthorn-Phu had shown that people in those days had watched and observed to the point they had realized that the look of the offspring did not come from nowhere but their ancestors. One of the prominent characters is the blue sapphire dragon-horse whose characteristics were told to the Rusi by Sudsakorn who started by saying that he had seen a strange animal. The Rusi then had been in concentration to use his special sense to see such animal (Volume 1, page 295) and could finally realize that it was the blue sapphire dragon-horse which was the offspring of dragon and horse having special features and all kinds of super-natural powers (Volume 1, page 293 - 294). Part of the verse says:

The offspring has the head resembling its father's.
While body and feet are taken from the mother's.
The tail of a naga was from the father's side.
The Rusi was enlightened through his special sense,
Knowing that this horse was with super-natural power.
He then aimed at catching it for the nephew,
So that he could use it to find his lost kins.
The Rusi gladly explained it,
That this horse was wonderful,
The crossbreed product with diamond-strong canines.
It should be raised to ride to face any circumstance.
You could then use it to look for your father in various places.

It is clear that the blue sapphire dragon-horse of Sunthorn-Phu had very strange features. It had the head and tail of a dragon but body and legs of a horse. The combination made it unique and contains the strengths of the two animals. Besides,

the dragon-horse had super physical power. He did not eat grass like the horse nor eat meat like the dragon but ate both plant and meat as well as people. It had diamond canines, black sapphire scales, and birth-marked tongue. It was immortal. The features of the blue sapphire dragon-horse were imagined as in the drawing that follows:

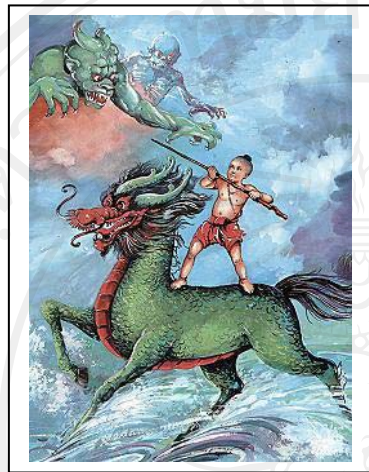


Figure 3: The Blue Sapphire Dragon-Horse

There are other characters which were the product of cross-breed such as the mermaid which was the product of the cross-breed between fish and human. Sin-Samuth saw the mermaids swimming in the sea for the first time, he right away thought they were people with the fish tail (Volume 1, page 107). The mermaids had explained him their origin as in the verse in Volume 1, page 107, that if Lankan people travelled by and their ship was wrecked, the mermaids would come and took the men as their mates producing the offspring with cross-features between human and fish. Their upper body part was of human while the lower part was of the fish. They could speak human language because their ancestors were humans.

These concepts of living things had reflected the knowledge of Sunthorn-Phu that asserted that nature had its own rules, particularly those on transmitting features of living things some of which were from the ancestors. This is a cause and effect rule. The parents produced offspring and transmitted their feature onto them. This natural rule had its own logic. When one violated it, he or she would get the consequence. This was the case in the case of the blue sapphire dragon-horse on which Sunthorn-Phu used the term “Katoey” – the modern term used to refer to homosexual person. This could lead to a speculation that the dragon-horse of Sunthorn-Phu was sterile and could not produce offspring as it was not clear of what gender it was. This is also the case in the case of mule – the product of horse and ass breeding, which is also sterile.

In biology, there have been some studies to find the answer to the characteristics of living things as they naturally are. The biologists have come up with knowledge on **genetic transmission of living things** which asserts that the living things had passed on their genetic characteristics to their offspring though genetic material halves of which are from the father and mother. The final features, however,

could not be pre-determined. It depends on the match between those genetic materials. In other words, it depends on nature. In general, two different species of animals could not breed as their genetic materials do not match. The case of cross-breed between horse and ass or horse and dragon as imagined by Sunthorn-Phu, their offspring could no longer produce offspring. At the present, people have tried to create living things to have the wanted features or to cross-breed them to have the produce suiting their needs. All this knowledge is known as the **cross-breeding technology**.



ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่

Copyright© by Chiang Mai University

All rights reserved