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IQP/MQP SCANNING PROJECT

A Study of His Majesty the King of Thailand's Technological Initiatives for the Kingdom's Development

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— by —

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Abstract

This purpose of this project was to provide an objective perspective on the King of Thailand's technological initiatives for the development of his country. A variety of project site visits and personal interviews were combined with an intense literature review to acquire comprehension of those aspects of Thai society integral to an understanding of the philosophies underlying the projects. With this basis, the Royal Projects were evaluated and issues regarding their continuation and extended application were raised.

Executive Summary

King Bhumibol Adulyadej has carried Thailand into modernity. Since the start of his reign over half a century ago, His Majesty the King has played an important role in the development of the nation. One of the most impressive aspects of his reign has been the implementation of thousands of technology-based development initiatives. The King has created a clear path for leading Thailand into the future through the moderate application of contemporary technology in combination with traditional Thai ways of life. The goal of our project was to gain a complete understanding of the King's Royal Projects in order to propose requirements for their continuation and extended application in other countries. As outside observers of the reverence for the Monarch, we hoped to bring an objective perspective to the evaluation of the King's initiatives for the development of Thailand.

As we were also exogenous to the religion, politics, monarchy, and economics of Thailand, it was necessary for us to become familiar with these aspects of Thai society. Theravada Buddhism, the doctrine practiced in Thailand, is evident in the behavior and attitudes of the Thai people. The ancient ten Rules of Royal Governance, *Thosaphit Rajadham*, provide the King with guidelines for governance and moral conduct, as he is Upholder of the Faith. Thus, even with the constitutional limitations imposed on monarchic power after the *coup d'etat* of 1932, the King maintains great prestige and religious importance. King Bhumibol has earned the trust and adoration of the Thai people because of his charismatic personality and genuine concern for their livelihood. As a country plagued by political turmoil, Thailand has relied upon His Majesty's influence to restore stability. A struggle for democracy has jolted Thailand's social foundations, creating civil unrest, which was abated by the timely intervention of King Bhumibol. Further involvement of the King has been exemplified in royal development initiatives, especially in Thailand's rural areas.

These development initiatives were in response to the country's fluctuating socioeconomic conditions as it has transitioned from an agrarian to an industrial economy. The application of contemporary technology is at the core of His Majesty's development efforts.

It was our goal to acquire enough information to form an objective viewpoint of His Majesty's technological initiatives. This was achieved through nine site visits and seven informational interviews. Our firsthand impressions of the development projects were integrated with additional literature to compose reports of our investigations.

Our investigations encompassed the following Royal Projects: Distance Learning, the New Theory, the Pa Sak Jolasid Dam, Monkey Cheeks, Royal Rainmaking, and the small scale experiments at Chitralada Palace. The projects we explored incorporated modern technology for the benefit of the Thai people. The Distance Learning Project uses a satellite system to broadcast lectures to understaffed schools as a solution to the shortage of qualified educators in the remote areas of Thailand. His Majesty's concept for sustainable agricultural development, the New Theory, employs a flexible system for maximizing the use of arable land. The water resource projects - the Pa Sak Jolasid Dam, Monkey Cheeks, and Royal Rain - are each components of the King's larger vision of sustainable development. At His Majesty's residence, Chitralada Palace, small-scale research efforts provide the foundation for future development projects. Through our investigations of the projects, we were able to evaluate the success of these royal initiatives.

In addition to individual project analyses, it was necessary to discuss the Royal Projects as a whole. Within each of the King's initiatives, we found the concept of sufficiency to be a thread of continuity. Furthermore, each project is influenced by four major aspects of Thai society: Buddhism, politics, economics, and the Monarchy. We examined the influence that these factors have on the King's development initiatives. One of the tenets of Buddhism is the idea of a "middle path". With respect to the projects, this concept incorporates

moderation with technological advancement. One way in which the King has attempted to improve the socioeconomic conditions is through his theory of sufficiency economics, a combination of the Buddhist middle path and industrialization. King Bhumibol's contributions to the development of Thailand have become the cornerstone of his reign. Dependence on this Monarch may have grown to the point where Thailand may find it difficult to prosper without such an active central figure. The response to these issues will determine the nature of the future of the projects.

The continuation of Thailand's development is dependent on the issues we have raised. His Majesty has been a role model in the initiation of projects designed to quell the hardship of his people. In the future, it is the responsibility of the Thai people to carry on his example as a tribute to his benevolence. This must be accomplished through financial support, active participation, and acceptance of the underlying principle of sufficiency. Furthermore, the philosophies underlying the Royal Projects have the potential to be adapted to other countries throughout the world. One of the King's most prominent philosophies is sufficiency, a concept that is based on the Buddhist middle path. This outlook far outreaches the King's local application to self-sufficient agriculture and embraces a global recognition of the value of moderation in all aspects of life.

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Chapter 1 INTRODUCTION

The Thai people have been taught to believe that their future will depend on the strength and stability of three institutions: nation, religion, and king. The religious institution in Thailand, Buddhism, remains a pervasive influence in society, affecting the behavior of most Thai people. More importantly, it serves as a link between Thais and their king. The institution of nation, both economically and politically, has been the least stable of this trio. In the half century following the Second World War, Thailand has developed from a subsistence agricultural economy to an agricultural export-oriented economy to the present day economy, which is predominantly oriented toward industrial exports and acting as a manufacturing base for multinational companies.

Although this progression has greatly benefited the elite of Thailand, it has done little for those in the slums or remote rural areas. This development and the accompanying economic disparity were achieved by sacrificing such natural resources as tropical forests, fish stocks, and the unity of rural families. The economic boom that reached its peak in the 1990s instigated the breakdown of rural families as young men and women abandoned their villages to work alone in factories and the streets of Bangkok. In prosperous times, such a tradeoff - financial gain for family unity - may have seemed justifiable, but the Asian economic crisis tipped the balance with the end of Thailand's economic boom in July 1997.

As a troubled companion to economic development, the political struggle for democracy pushed the nation towards civil unrest on several occasions. Throughout this, the institution of the Monarchy has certainly been the most stable of the three in the hearts and minds of the Thai people. With his needle of knowledge and thread of experience, King Bhumibol has worked to mend the rifts made to the nation's strong fabric of unity. Through economic

boom and political upheaval, the King has initiated development projects aimed at building a sustainable foundation upon which Thailand may stand securely.

His Majesty the King of Thailand is a monarch with technology as his ally; he has used his background and continuing interest in science for the development of the kingdom. Independent of the government's efforts to improve the socioeconomic conditions for all citizens of Thailand, King Bhumibol Adulyadej has initiated thousands of projects in his paternal role as moral and religious leader of the Thai nation. The King's use of technology in the application of his philosophy of sufficiency is unprecedented in Thai history; consequently, it is not fully understood by the Thai people. To assist him in his work, he has created various project foundations focused on sponsoring and undertaking initiatives designed to optimize the symbiosis of man and nature.

The unified goal of this project is to understand His Majesty's philosophies and use of technology in order to disseminate this knowledge to other developing nations and determine the requirements necessary for project continuation in Thailand. This project has been conducted in celebration of His Majesty's sixth cycle birthday so that people may become more aware of the underlying principles of his efforts and what must be done to ensure that his development projects continue. This report, detailing our findings, analysis, and recommendations, is the primary means for achieving our goal. Interviews and site visits have provided the information necessary to give this document its unique first-hand style.

The Thais have traditionally revered their kings, going back to the days of absolute monarchy. Under the present constitutional monarchy, reverence for the King has been undiminished, the level of which can only truly be understood from first-hand exposure to Thai citizens. This presented minor complications for our research. The King has initiated thousands of development projects throughout Thailand. From experience and intuition, it is reasonable to expect that not all the projects have had outstanding or even successful results,

yet the printed information available on the projects presents a unilateral point of view, lacking objective criticism. The majority of the projects have reportedly been successful and the methods behind them need to be analyzed and documented in a more empirical manner so that they may present the King's holistic vision of national development. As outside observers, we feel we brought an open perspective to the study of the projects. With this open perspective, however, came the realization that as external observers, it was our responsibility to respect the norms of the society in which we worked.

Our recommendations are aimed primarily at the Thai people but are also directed towards our peers who are in a position to readily understand our findings. A sub-goal of the project is to consolidate our findings in a presentation format that integrates the totality of our research and investigation. To that end, our results have been documented in this project report; ultimately we would like to compile our findings into a book. Interviews with various types of people associated with the projects and on-site investigations of the projects were our primary means of information gathering. The results of the project will be used to increase awareness among the Thai people of the philosophy of the King's projects, and what they need to do to ensure the continuation of development under this philosophy.

The subsequent sections of this document present a background of pertinent topics, the methodology used for the completion of the project, research results for each project investigated, analysis of the research, recommendations, and supplementary information. The Background chapter is sectioned according to the following topics: Buddhism; the political development of Thailand as it relates to the present monarch; the Chakri dynasty; King Bhumibol Adulyadej; an overview of the projects that were investigated; and the social and economic condition of Thailand. These areas provide a basal set of prerequisite information for understanding the context of the project, especially culturally. The Methodology chapter explains the preparation work for site visits and interviews. Results

from investigation of the projects present the information gathered about each project. The chapter on Analysis raises religious, political, economic, and monarchical issues which are vital for the continuation of the projects. Finally, conclusions on the issues raised in the Analysis are presented. Supplementary information contains interview transcripts, maps, and other sources referenced in the report.

Chapter 2 BACKGROUND

2.1 Buddhism in Thailand

If Christianity is considered the major religion of the West, then Buddhism is the major religion of the East. Approximately 95% of the Thai people are spiritually united through the teachings of the Buddha. Public ceremonies are structured around Buddhist practices and government policy and political issues are influenced by the religion. Furthermore, one's religion, whether inherited or chosen, entails moral preferences that strongly affect the manner in which a person thinks and exists. For these reasons, it is necessary to comprehend the principles of Theravada Buddhism, the dominant doctrine in Thailand. This provides insight into the interaction between the Thai people and their monarch and an understanding of the King's spiritual and moral motivations towards the development of the country.

2.1.1 The Story of the Buddha

Around the 17th century after the Buddha (1200 A. D.), the first Tai peoples migrated from their original homeland in southern China and settled in what is present-day Thailand, where they became identified as Thai. They were organized as tribal peoples under the reign of petty chiefs in polytheistic, animist groups living along the borders of southeastern China, northern Vietnam, and northeastern Laos. Others migrated towards central Southeast Asia, and came under the influence of local Indian beliefs, which had existed long before they arrived. The most profound of these beliefs was the philosophy of a man known in the ancient Sanskrit language of his day as the Buddha.

Siddhartha Gautama was a prince born to a tribal chieftain in northern India, around 563 B. C. His father bestowed great affection on and protected him, hoping that he would never

encounter the pains and miseries that accompany all human existence. As a new father at the age of 29, Prince Siddhartha first witnessed sickness, old age and death while riding through a poor village. The Prince, extremely disturbed by these sights, was unable to understand the cause of such suffering. Late one night after a final look at his wife and infant son, he left his palace, relinquished his wealth and title, and went out into the world in search of answers. For six years he tried fasting, self-mortification and other exercises of Hindu holy men, but found himself no closer to the true meaning of life. One evening, with a weakened body and tired soul, he decided to sit, legs crossed in the lotus position, under the shade of a large Bodhi tree, determined to meditate until death or the truth came to him.

That very night, the truth found him. "The cause of human suffering lies in man's own desires; man must control his cravings for worldly pleasures in order to achieve spiritual serenity. To live is to suffer, and to be reborn is to suffer again. The only way to escape reincarnation and break the chain of suffering is by leading a life of perfect goodness and moderation, and thus to achieve Nirvana - the ego dies, and the individual is beyond pleasure or sorrow, good or evil, life or death" (Chu 60). At this moment of insight, known as the Enlightenment, Prince Siddhartha became known as the Buddha, or the Enlightened One.

The Buddha spent the rest of his life preaching and traveling throughout India in order to spread his philosophy. After his death, a split developed among his followers and two schools of Buddhism developed. Theravada Buddhism, also known as the Doctrine of the Elders, adheres closely to the original school of thought. It became the adopted religion of most of southern Asia and has been the state religion of Thailand ever since the establishment of the Thai Kingdom at Ayutthaya during the middle of the fourteenth century A. D. Mahayana Buddhism spread throughout China, Korea, Japan and Vietnam and favors a more liberal interpretation of the Master's teachings.

2.1.2 *Theravada Buddhism*

Theravada Buddhism is not a religion in the Western sense of the word. It is a search for truth in life that exists in a person's own mind and heart. It also deals with the individual effort to attain enlightenment. Dhamma, the teachings of the Buddha, is a law of righteousness and if followed correctly will lead a person to the final release from all sufferings. The object of devotion, in which every faithful follower of the Buddha should put all hope, is the Threefold Refuge: the Buddha - the Enlightened One; the Dhamma - his doctrine; and the Sangha - the Order of his Noble Disciples. There are no prayers in the Western sense in Buddhism but instead, there is meditation for purifying the mind in order that truth can be realized. Therefore, a person's duty is to not break the laws of righteousness that govern the universe nor try to change them by prayers or any other means. Instead, the goal of the individual is to try to understand these laws and to learn to live with them in harmony.

From the 19th to 21st centuries after the Buddha (13th to 15th centuries A. D.), the Theravadin order of monks emerged as the dominant sangha throughout most of Southeast Asia. In the worldview of their teachings, the human experience, like all surrounding nature, is impermanent and always subject to change. The Thai came to make the individual rather than the spiritual deity the central focus of religious thought. If the actions of the individual contradict the moral premises of the Buddha, demerit will manifest itself in the future as some type of suffering. On the other hand, actions that are morally positive will produce merit and bring to the life experience some gratifying state of being. Most Theravada Buddhists see themselves undergoing a combination of both of these states because of the law of kamma. The individual is responsible for attending to the moral character of the Buddha in order to reap the best consequences of kamma in the future, either in this life or the next one. Therefore, belief in kamma is associated with a belief in rebirth (Keyes 35).

The sangha is the cornerstone of the Buddhist faith. The laity can gain merit by providing the sangha with food, clothing, shelter and medicines. Furthermore, "for a Thai layman, to serve for a period as a Buddhist monk is both a devotional act and an important way to make merit" (Chu 67). In pre-modern Siam, service in the monkhood was a requirement for instilling moral sense in a man. Although it is no longer required, the Thai government still recognizes the importance of the monkhood experience. Male civil servants are permitted to take a three-month leave, the duration of Buddhist lent, with full pay if they are ordained and spend the time in the monkhood. The amount of time one commits to this service varies. One may choose to serve for a week, several years, or a lifetime, but those who devote themselves to the study and use of the dhamma also subject themselves to discipline that advances them along the path to Enlightenment.

2.1.3 Buddhism and the Monarchy

With political development of the Kingdom, changes in religious authority were inevitable. It was not until reforms instituted at the end of the 19th century A. D. that an effective sangha hierarchy was implemented, encompassing all the monks in the country. Prior to the revolution of 1932, the King of Thailand held supreme religious and political power in the country as an absolute monarch.

During those times, the kings and lords sought to create a hierarchical order within the monasteries by appointing monks as abbots of the major sanghas within their domain. Although these abbots typically came from elite families, society was indifferent to their authority. Buddhism was not a religion of the elite, but a popular religion established throughout rural communities. It could be sustained through the local congregations without reverence for higher sangha authorities. Consequently, the abbots never gained the social significance that the Catholic hierarchy had in Europe (Keyes 37). For the same reason, the rulers and lords found it necessary to perform rituals in order to establish their legitimacy.

Though they usually impressed only those who participated, the people did believe that "any man who had successfully ascended a throne or became a lord was presumed to be a man possessing merit. However, it was necessary for a king or lord to continually revalidate his charisma through conspicuous religious acts: making a pilgrimage to an important shrine, erecting a new religious edifice, and above all, supporting the sangha" (Keyes 38).

The king remains hereditary Upholder of the Faith, even with the reduction of the patriarch's supremacy since Thailand's change to a constitutional monarchy in 1932. The pervasiveness of Buddhism in Thailand has been a dominant factor in the political development of the country, due to ties between religion and state. A review of the king's evolving social and political role is necessary for an understanding of His Majesty's current political views.

2.2 Political Development of the Kingdom with Attention to the Role of the King

The extensiveness of His Majesty the King's involvement in the improvement of the Kingdom of Thailand directly correlates to his role as a constitutional monarch. The Thai monarchy was traditionally absolute and only became constitutional in the early part of the 20th century. In order to provide a context for understanding the unique position of King Bhumibol in the politics of Thailand, a review of Thai politics as related to the alteration of the role of the king will be presented. Attention will be given to the political and social role that King Bhumibol has played in society during his reign. The majority of the material for this section has been drawn from Wyatt's *Thailand: A Short History.*

Modernization of Thailand began with King Chulalongkorn (Rama V, 1868-1910), following in the footsteps of his father, King Mongkut, who provided Thailand with her first introduction to Western thoughts. This was exemplified politically when, after investigation

into European forms of government, King Chulalongkorn introduced a system of government consisting of twelve ministries. The bureaucracy that was created strengthened the absolute monarchy by providing more control over the people. Yet this same bureaucracy allowed commoners access to the government, thereby eradicating the practice of reserving leadership for members of the royal family. King Chulalongkorn's primary achievements were abolition of slavery, which disappeared by 1905, construction of the first railroads, encouragement of students to study abroad, and creation of specialty schools. Additionally, whereas previous kings made rare public appearances, King Chulalongkorn provided the people with increased exposure to their king (Dhiravat 19 Jan 2000). This began a trend that cascaded down to the people throughout Thailand's coming decades of socially non-homogeneous modernization. The Monarch and Royal Family were the group that modernized most rapidly, followed by the bureaucratic elite and the military. The common people were far behind.

King Vajiravudh (Rama VI, 1910-1925) took over the monarchy after the death of King Chulalongkorn. During his reign, however, dissatisfaction with the monarchy as the absolute governing body of the nation grew. To the credit of this penultimate absolute Monarch, attention was given to education; the government enacted laws requiring boys and girls aged 7 to 14 to receive primary education, and King Vajiravudh organized the creation of Chulalongkorn University in honor of his father. In comparison to upcoming government changes, the reign of King Vajiravudh was untroubled. One exception was Siam's declaration of war on the Central Powers in 1917 after an initial assertion of neutrality at the start of World War I in 1914. King Vajiravudh had a vision of a Thai nation founded on nation-religion-monarch (*chat-satsana-phramahakasat*), a theme that would be revived by Prime Minister Sarit decades later.

2.2.1 The Coup of 1932

During King Vajiravudh's reign, financial problems developed that continued into the reign of King Prajadhipok (Rama VII, 1925-1935), Thailand's last absolute monarch. These financial problems translated into political problems. The public's criticism of the government was expressed through the press, the first voice of the public in Siam. During this time, King Prajadhipok addressed the question of a parliamentary system of government and, in general, a representative government for Thailand, realizing the potential consequences such a form of government would have on the monarchy. Democracy was something for which the public needed to be prepared. The seeds for change in the direction of democracy were sown among Thai students studying abroad who had received exposure to new perspectives of socialism and democracy. Among this group was a lawyer, Luang Pradir Manootham, and a military major, Luang Phibunsongkhram[†], both of whom would have critical roles in the subsequent political events in Thailand. In the meantime, the Great Depression of the 1930s had a drastic effect on the economy and dissatisfaction with the government grew. This culminated in a bloodless coup organized by the 114 member People's Party on June 24, 1932. Luang Pradit Manootham and Luang Phibunsongkhram led the group, consisting of 49 military officers and 65 civilians.

Although the coup was aimed at the ministers of King Prajadhipok's government, it consummated in the reduction of His Majesty from an absolute monarch to a constitutional monarch. As a result, the King was stripped of absolute political power, retaining only prestige and limited political influence. The newly promulgated constitution called for a unicameral legislature - the National Assembly - which was half elected and half appointed.

[†] In the year 1939, the government put pressure on civil servants to relinquish their royally bestowed titles. As a result, Luang Pradit became Pridi Banomyong and Luang Pibunsongkhram became Plaek Pibunsongkhram, keeping his royally bestowed last name. A few years later, the government declared that it was acceptable to reinstate the royal titles and several people did revert back to their old names. However, both Pridi Banomyong and Field Marshall Plaek Phibunsongkhram declined this offer.

The new government had the backing of the army, a circumstance that would begin the political struggle between the military and civilian governments (LePoer 26).

2.2.2 Government Turmoil and the Constitutional Monarch

King Prajadhipok abdicated the throne in 1935 and was succeeded by Prince Ananda Mahidol, who would reign as King (Rama VIII) from 1935 until 1946. As a young King, Ananda was absent for most of this time while he finished his schooling in Switzerland. The People's Party ran the government during that time, despite growing internal divisions and lack of public support. The senior military faction of the People's Party was led by Colonel Phraya Phahon Ponpayuhasena, the junior army and navy faction by Luang Phibun, and the civilian faction by Luang Pradit. Both Luang Pradit and Luang Phibun remained powerful figures in the government under Prime Minister Phraya Mano Pakornnitithade following a bloodless coup by the junior and senior military groups in 1933. The ministries were left in the hands of senior officials in order to retain administrative stability.

This was a time of increasing militant nationalism and Luang Phibun was elected Prime Minister. At the time, Luang Pradit was Minister of Foreign Affairs. There was countrywide nationalism during Luang Phibun's first government, 1938-1944, one consequence of which was a distinct anti-Chinese sentiment. This was partly strengthened by Luang Phibun's many anti-Chinese, pro-Thai, measures such as additional taxes, fees, and regulations for Chinese businesses. In 1939, Luang Phibun became Plaek Phibunsongkhram, and he changed the name of the country from Siam to Thailand, literally, *Muang Thai* – Land of the Free.

As the world prepared for war, Thai relations with the US began to deteriorate. In response to the Japanese invasion of Thailand in 1941, Plaek Phibunsongkhram gave Japanese troops right of passage through Thailand in exchange for recognition of Thailand's independence. Plaek Phibunsongkhram was confident that Japan would win the war and on January 25, 1942, he allied Thailand with Japan by declaring war on the United States and

Great Britain. The declaration was not official, however, since several officials, especially Pridi Banomyong, were "conveniently absent" for the signing (Wyatt 261). In addition, the Thai ambassador in the United States, Seni Pramoj, who several years later became a Prime Minister of Thailand, refused to deliver the declaration of war. Instead, he organized the Free Thai movement with the US Office of Strategic Services and Thai students studying in the US. By 1944, the war began to turn against Japan. The Thai people were feeling the effects of occupation by the Japanese troops who treated Thailand more like a conquered territory than an allied country (LePoer 30). Sentiment was turning away from Plaek Phibunsongkhram and eventually he resigned. Pridi Banomyong was chosen as regent for the still-absent King Ananda and rendered the declaration of war null and void in 1945.

In early 1946, King Ananda returned to Thailand from his studies in Switzerland. Political shuffling continued and in March of 1946 Pridi Banomyong assumed the position of Prime Minister. A new constitution calling for a bicameral legislature was promulgated in the same year. The reign of King Ananda was cut violently short by his death in June 1946. It was then that the reign of the present monarch, King Bhumibol Adulyadej, began. Public opinion was now unfavorable towards Pridi Banomyong and a coup in November 1947 put Plaek Phibunsongkhram him back in power. In 1948, he took his place as Prime Minister, thus beginning his second government which would last until 1957 (LePoer 33).

2.2.3 The King's Political Intervention

The King's role is limited by constitutional restraints and he has chosen to remain above political interactions within the government. As a constitutional monarch, however, he has the right to be consulted, the right to encourage, and the right to warn. As king of the nation, he has certain "reserve powers" which he has exercised only twice to abate intense political conflicts. His Majesty has remained informed, objective, and influential as a result of gaining political experience in his 53-year reign. Political instability has continued to disturb his

reign, most distinctly in the 1973 and 1992 demonstrations, but beginning as early as the tensions between the civilians and the military at the start of his reign (Chuensuksawadi 174).

The conflict between civilians and the military for control of the government continued regardless of this new King. A failed coup by the navy and marines attempting to restore the civilian Pridi Banomyong to power left Plaek Phibunsongkhram firmly in control in 1949. Plaek Phibunsongkhram began sharing political power with two generals - Police General Phao Sriyanon and General Sarit Thanarat. It was only the balanced struggle between the two that allowed Plaek Phibunsongkhram to maintain power. In 1951, King Bhumibol Adulyadej permanently returned to Thailand from Switzerland to continue his reign. At the time, Thailand was stable and powerful in comparison to its neighboring countries. Increased financial assistance, which came from the US, was welcomed.

Political control of the country was relaxed as a result of Plaek Phibunsongkhram's fresh enthusiasm for democracy following his 1955 tour of the United States and Europe. Most notably, he opened the government to public criticism and established a forum for such (LePoer 36). However, rigged elections in 1957 evoked public outcries of disapproval and Plaek Phibunsongkhram put Sarit in charge of public order, a move that some consider to have been a critical mistake. If such a move was a mistake, the failure came to fruition when Sarit gained control of the government in a bloodless coup that caused both Plaek Phibunsongkhram and Police General Phao Sriyanon to flee the country.

General Sarit Thanarat brought a sense of control back to the government. Although authoritarian in flavor, his style regained political stability and fostered economic growth. General Sarit Thanarat tried to provide a sense of direction for the Thai people, drawing from the past in order to foresee the future. The motto "Nation-Religion-King" was revived from King Vajiravudh's campaign earlier in the century and General Sarit began encouraging King Bhumibol to be active in public life (LePoer 38). During this period, the King was restored

to his position as head of the moral, social, and political order, though the monarchy still lacked political power. General Sarit Thanarat's government ended with his death in December of 1963.

General Thanom Kittikachorn, General Sarit Thanarat's deputy, succeeded General Sarit as Prime Minister. The government made a transition from a military-oriented leadership to a more democratic, elected government (LePoer 39-40). In November of 1971, General Thanom Kittikachorn, now a Field Marshall, staged a coup against his own government in order to impose military rule over the nation. He retained the office of Prime Minister but became part of a triumvirate council composed of Field Marshal Praphat Charusathian and Thanom's son, Colonel Narong Kittikachorn. Thanom's 1972 constitution called for a legislature that was entirely appointed and two-thirds military. This eventually led to his removal from office (LePoer 42).

Students and workers began demonstrations in 1973, demanding a more democratic government and constitution. In particular, the students protested the arrest of fellow students on accusations of communism. The intensity of the situation peaked in October when troops opened fire on the demonstrators as they were seeking assistance from His Majesty the King. Thanom resigned as Prime Minister as a result of King Bhumibol's carefully applied monarchic influence in the situation (LePoer 43). The period following these events was uneasy. Relations with the US were mildly complicated by political issues and the withdrawal of US troops following the end of US involvement in Vietnam. Political tension again exploded in October of 1976 when police and the military attacked and killed many Thammasat University students who were holding a sit-in protest (LePoer 48).

The political shuffling that has grown mutually with the development of politics in Thailand continued. Public protest over oil price increases fueled a no-confidence motion from parliament and General Kriangsak, chosen as Prime Minister in 1977, resigned.

General Prem became Prime Minister in 1980 and remained in power through two attempted coups and two elections until his resignation in 1988. Parliament chose an elected member, General Chatichai Choonhavan, as the new Prime Minister, though his leadership would last only until the February 1991 military coup led by General Suchinda Kraprayoon and General Sunthorn Kongsompong (Warr 17). Shortly thereafter, the coup leaders invited Anand Panyarachun, the former Thai Ambassador to Washington, to be Prime Minister until an elected government was in place.

The appointing of General Suchinda as Prime Minister in 1992 met with intense public disapproval and pro-democracy demonstrations began under the leadership of the former Bangkok Governor, Major-General Chamlong Srimuang. The demonstrations became violent when soldiers fired on the protestors. The situation was defused only by judiciously timed intervention from His Majesty the King, the second intervention of the King in political events in recent times. General Suchinda was forced from office and Anand Panyarachun was re-appointed as Prime Minister until the 1992 elections, which brought Chuan Leekpai to office. Between 1992 and 1997 there were assorted political changes but Chuan Leekpai emerged as the Prime Minister again following the Asian financial crisis of 1997. Chuan Leekpai is the present Prime Minister in Thailand, which has had a civilian government since 1992, marking the longest continuous stretch of civilian governments in Thailand's history.

Prior to today's civilian government and constitutional monarchy, Thailand was a feudal kingdom. His Majesty is the ninth King of the Chakri Dynasty, the last remnant of the former feudal system. The succession of monarchs is important for understanding the reasons why the monarchy has remained a prevalent institution in this day of democracies and Western influence.

2.3 *The Chakri Dynasty- Its History and Development*

The first Thai government was established at Ayutthaya in the 14th century. It was during this time that the medieval institution of the monarchy, which evolved from a tribal leader in the early Sukhothai period, became a permanent feature of Thai society (Dhiravat 16 Jan 2000). In 1767, Burmese forces succeeded in conquering Ayutthaya after a siege that lasted a year and a half. The invaders pillaged the city and took away to Burma the Siamese king, other members of the ruling family and much of the populace that had not already fled. The event plunged Siam into a turmoil that was to last much of the following decade. Many people were attracted to would-be kings who claimed to be bodhisattvas (future Buddhas). One such man, Taksin, a half-Chinese former general under the last Ayutthayan king, was able to capitalize on his apparent charismatic mastery and successful military prowess to claim the throne and reunite the kingdom in 1776. Since the previous capital had been destroyed, he chose the city of Thonburi as the new capital (Keyes 39). A map showing these locations is in Appendix A.

During the first seven years of his reign, King Taksin led all campaigns against the Burmese himself, accompanied by his two reliable and brilliantly capable generals, Chakri and Surasih. When Taksin eventually chose to remain in Thonburi to govern the country, General Chakri gained independent command of all fighting forces, with Surasih as second-in-command. In the remaining years of Taksin's reign, General Chakri succeeded in gaining the provinces of Chiang Mai, Luang Prabang and Vientiane as vassal states for the king. When he conquered Vientiane, he brought the priceless Emerald Buddha image to Thonburi. This carved nephrite image is believed to have taken over a thousand years to travel from northern India to Thailand. It now resides permanently in Wat Phra Kaeo, the Temple of the Emerald Buddha, and has since become a sacred national talisman.

Taksin thought he possessed extraordinary powers because of his military achievements, and thus requested the Buddhist clergy to recognize him a boddhisattva. A group of officials staged a palace coup, deposing the king and claiming that their actions were justified because Taksin was deceived by a vision of his divinity. The Army and Officers of State offered General Chakri the throne in 1782. Upon acceptance of the offer, he founded the present House of Chakri. This dynastic period is also known as the Ratanakosin era, which appropriately means the era of the Emerald Buddha (Keyes 40).

King Chakri chose the flourishing trading center of Bangkok on the east side of the Chao Phya River as the new capital. The river acted as a defense against future attacks from Burma, and the new capital developed into a port city oriented towards the outside world, a position conducive to becoming involved in international trade. King Chakri helped to establish many of the boundaries of present-day Thailand, enact effective political control over an enlarged domain, and restore Siamese civilization from the remains of Ayutthaya. He sent scribes to work on copying the most important religious, literary, and legal texts of the past. Leading members of the sangha were assembled to record and correct the Tripitaka, the Buddhist scriptures written in the Pali language. Poets and writers also began the composition of new such works. King Chakri undertook a purge of the sangha, ridding it of members whom had supported Taksin's messianic claims as well as those who were deemed to be in violation of the discipline incumbent on members of the order.

In Western writings, King Chakri became known as Rama I, meaning he was Prince Rama who became Buddha. The term Rama was derived from the Ramakian, a Thai version of the Indian Ramayana. Each king of the Chakri Dynasty is referred to as Rama, followed by the Roman numeral corresponding to their position in the succession. In addition to reinstating traditional Siamese civilization, Rama I and the other early Chakri kings began a new historical era.

2.3.1 *Modernization and the Monarch*

In the latter half of the 19th century and into the 20th century, Siam changed from a provincial and feudal kingdom into a modern nation, enduring the impact of Western colonial expansion that engulfed other neighboring countries of Southeast Asia. This era of radical change began with Rama IV, King Mongkut.

King Mongkut had been a Buddhist monk for 27 years before acceding the throne. During this time, he became very well educated. He mastered the Buddhist religion and understood Christianity just as well. Through these studies, he became enticed by world geography, astronomy, science, and the languages of Latin and English. King Mongkut had become quite aware of the influences of Europe and the United States in Far Eastern affairs, especially after the Opium War of 1840 between Britain and China. When the Chinese attempted to stop the commerce in opium, Britain fought to maintain its international trade profits. Consequently, the Chinese were forced to surrender to British terms. King Mongkut knew Siam must modernize in order to avoid China's fate.

King Mongkut inherited the throne in 1851. Beginning with his coronation ceremony, he sought to break ancient precedents in order to serve the people better. He invited foreign residents to the ceremony and exempted them from the traditional requirement of prostrating themselves before the king. As monarch, he requested that his subordinates approach him with any problems and concerns rather than going through the usual bureaucratic channels. King Mongkut made the commitment to come out of his palace twice a week to listen to the people and address their grievances. By pledging his loyalty to the people, in contrast to the traditional Siamese custom of noblemen and officials pledging loyalty to the King, Mongkut began orienting the monarchy towards more democratic ideals.

King Mongkut frequently invited foreign advisors to serve in his administration. Initially, he wanted help in minting Siam's first modern currency, but he also gained

knowledge in other areas of domestic relations. Seeking cooperation with the West, he welcomed the guidance of Sir John Bowring from Britain in negotiating a new trade agreement. The Bowring Treaty became the first of similar pacts hardening extraterritorial privileges in Siam for other countries such as the United States and France. Siam was able to retain its independence while other countries of Southeast Asia and South Asia were incorporated into Western-dominated colonial empires. Undoubtedly benefiting the nation overall, the treaties also increased the volume of international trade. The price was that Siam was consequently forced to surrender a considerable amount of territory (Keyes 44).

These newly formed foreign alliances stimulated King Mongkut to encourage the education of nobility and members of the royal family so that they might be better equipped to deal with Westerners. Such education included the foundations of science and technology and language, especially English, which from that time to the present has been the most important Western language in Thailand. King Mongkut assisted the Siamese in studying abroad to acquire a Western education that could be put to good use in Siam, and encouraged the education of women in the palace. These initiatives became the foundation for the modernization of education in the future.

Astrology was another interest of King Mongkut. His study of the subject was thorough and he claimed to be capable of predicting the exact moment an eclipse would occur far in advance. Accordingly, on August 18, 1868, he assured his court astrologers that an eclipse would be seen in its totality at Hua Wan, near the Samrotyoi beach, in Pattani Province. Eager to demonstrate his talents to both Hindu astrologers and Western scientists, he made elaborate arrangements for the entertainment of foreign guests on that day. The Royal astronomer was successful in his prediction, stumping French scientists whose calculations were incorrect by two seconds. Unfortunately, King Mongut and his son, Prince Chulalongkorn, as well as many others became seriously ill with malaria on their return

home. Although the Prince survived, his father, regarded as one of the most enlightened and progressive contemporary rulers, did not (Blofeld 85-87).

The heir to the throne, Prince Chulalongkorn, was only 15 years old when his father passed away and he became the new monarch of Thailand. By that age he had already served for a period of time as a Buddhist novice, learned to read and write, and had been tutored in English, but because he was still considered a minor, he was unable to rule the country. For this reason, a slight succession crisis occurred between royalty and nobility. Chao Phraya Srisuriyawong, a member of one of the most influential noble families in 19th century Siam, agreed to support King Chulalongkorn because he feared that if anyone else was placed on the throne, the British would use the act as a pretext to annex Siam. In return for his support, King Chulalongkorn named Srisuriyawong as Regent, and thus governor of the country.

During this five-year minority period, the young King traveled to Singapore, Java, and India to study colonial government and administration. He gained an enormous amount of knowledge and understanding, and from these visits foresaw that many drastic changes were needed in Siam. He was equally aware that his country's ancient and deeply rooted traditions could not be changed or removed totally. When King Chulalongkorn reached the governing age of 20, he immediately set about preparing the groundwork for his planned reforms. Although many of them were to take more than 30 years to complete, he stated that, "I wish to see whatever is beneficial to the people accomplished gradually according to circumstances, and unjust customs abolished... but as it is impossible to change everything overnight, steady pruning is necessary" (Segaller 18).

In 1874, King Chulalongkorn took the first steps towards reforming the administrative and judiciary branches of the government. He established a Privy Council and a Council of State, which acted as Siam's first real Cabinet. The purpose of these institutions was to bring greater well being to the people while also creating more equality between them and

government officials. King Chulalongkorn believed that the government must have Western methods and ideas as its guidelines. The whole country was divided into provinces, districts and sub-districts and the people elected officials of the central government from each of the divisions for representation. "The redefinition of segments of the government according to function reflected a desire not only to make ministries and departments responsible for particular tasks but also to expand radically the scope of government in its relationship with the populace" (Keyes 52). The aim of King Chulalongkorn was to transform the legal system of Siam into a form acceptable to the powerful countries of the West, for only then would Siam be safe from the threat of foreign annexation (Segaller 19).

The King had inherited obsolescent and impractical legal and tax-collecting systems that were confused and corrupt. For example, the ancient Law of Three Seals, which dated back over 600 years, was still in practice. This law stated that the truth of the plaintiff or defendant's claims should be decided by seeing which of the two could stay longer under water. Legal reform lasted over 34 years but culminated in a firm and centralized judicial structure that encompassed the entire country. Similarly, the tax system was reorganized when King Chulalongkorn established the Revenue Department, which later became the Ministry of Finance. With these reforms, a gradual improvement in Siam's economy occurred through increased trade and more efficient tax collection.

From the beginning of his reign, King Chulalongkorn was determined to abolish slavery. However, the slaves in Siam were not like the African slaves in the southern United States. The Siamese slaves were members of the personal retinues of members of royalty, nobles and provincial aristocrats. By being bound to a particular person, the slave was either exempt from taxes or else subject to a much lower tax obligation than a freeman. These slaves, or bondsmen, were also not free to work their own land and therefore, were not subject to taxes on land and produce. Coincidentally, King Chulalongkorn succeeded the throne shortly after

the US Civil War, and was probably concerned that Westerners would consider slavery in Siam barbaric. Although there was no great pressure within Siamese society for emancipation, King Chulalongkorn's interest was in the Westernization of the state (Keyes 53).

Education was another major interest of King Chulalongkorn. Like King Mongkut, his father, King Chulalongkorn respected Western education and thus sent his sons to England for their education so they could later help him with government relations. The modern educational initiatives instilled by King Mongkut made it possible for his son to continue those beliefs. In 1881, the King opened Suan Kularb School, which is today one of Thailand's biggest and best boys' secondary schools. In 1897, he founded a scholarship scheme to enable commoners to study abroad. The Royal Pages' School for future government employees, founded in 1902, developed into Thailand's first and most distinguished University and was named in the former King's memory. The National Library was established in 1904 as another effort to bring Siam into the modern world.

Among King Chulalongkorn's most important achievements in international business were his two visits to Europe. His early education in the English language allowed him to be the first Siamese king to leave Asia and the first Asian ruler to converse freely and informally with British and European royalty. The visits led to an invaluable association between Siam and the West (Segaller 22). It is obvious that the King's geographic, historic and constitutional knowledge was expansive. Of his many reforms and other achievements in preserving the independence of the nation and securing the well being of the Thai people, these are just a few pertaining to the development of Thailand as a modern nation-state. King Chulalongkorn was definitely one of Asia's greatest statesmen.

A son of King Mongkut and brother of King Chulalongkorn, Prince Vajiravudh was the heir to the throne, and became monarch in 1910 as Rama VI. As one of King

Chulalongkorn's closest advisors, he also shared the vision of creating a modern Thai nation-state, though he was ineffectual in his position compared to the two previous rulers. He wished to create a new type of kingship that provided a more direct relationship with the general public. He created the paramilitary Wild Tiger Corps, whose members could come from any segment of Thai society provided they were deemed good citizens. Members were not distinguished in the corps by status, and thus all wore the same uniform. Rama VI presented himself as a citizen, rather than an occupier of the throne. Some people close to the court perceived the fact that he held absolute power while at the same time presenting himself as a citizen king as contradictory and would have preferred he act more like previous rulers. Other people in the growing civil and military services began to conceive of a state in which absolute power was not vested in a monarch. In 1911, a palace coup had been planned but was aborted before action was taken. Despite failure, it began a trend that would ultimately bring the absolute monarchy to an end (Keyes 61).

2.3.2 Political Turmoil Creates Unrest in the Kingdom

King Vajiravudh died, still a relatively young man, leaving no heir to the Thai throne. Of King Chulalongkorn's 77 sons, King Vajiravudh's half-brother, Prajadhipok, succeeded the throne. He had never expected to become king and was rather unprepared for the position. Recognizing his limited knowledge, he turned to a group of King Chulalongkorn's noble associates and other members of the royal family to aid him in governing the country. Although he began to show more effectiveness than his predecessor, King Prajadhipok's reign was seriously disturbed by the economic crisis of the 1930s. Government revenues plummeted because of falling rice prices. The hardest hit were the salaried middle class, comprised mostly of bureaucratic and military members. The same citizens who sought to overthrow the king twenty years earlier were now suffering from reduced salaries and increased taxes. As a result, they began to resent the king for having restricted the exercise of

power to advisors chosen from the royal family who were not subject to the failing economy. Ironically, these citizens were educated in the King's school system, yet they envisioned Siam with a Western style of government. They came to be known as "the Promoters" (Segaller 63).

Led by the strongly anti-royalist Pridi Banomyong, the Promoters staged a successful revolution on June 24, 1932. The monarchy was not abolished, however, King Prajadhipok agreed to partially relinquish his power and become a constitutional monarch. Tensions in the transitional government quickly developed. The provisional government that assumed power was comprised of members of the Promoters, who later became know as the People's Party, as well as people who had served the King in the previous government. The character of the new government was reflected in the choice of conservative Phraya Mano Pakorn for Prime Minister. He was to remain in office until elections for Parliament could be held and the temporary assembly replaced. Turmoil between opposing governing opinions quickly divided many of the people between the formation of a communist country and that of a democracy. Unable to take a side and resolve the ensuing conflict, King Prajadhipok assumed a neutral position. He was unsure of his new role as constitutional monarch. Three years after the revolution, he left Siam and went into exile in England. He formally abdicated the throne in 1935, recognizing that he could no longer play an active role in shaping Siam's future and officially removed the kingship from Thai political life. It wasn't until 1950, when King Bhumibol, now Rama IX, returned that the kingship returned to the Thai people and they could once again seek guidance and support from the Royal Family.

2.4 King Bhumibol Adulyadej

Of King Chulalongkorn's 77 children, many had the opportunity to study abroad in order to further their Western education. One of his sons, Prince Mahidol, who had already served

in the Imperial German navy, was eager to accept this opportunity. Disgusted by war and the tumult that occurred during the reign of King Vajiravudh, he wanted to use the most modern ideas to help Siam become an oasis of peace. Calling himself simply Mr. Mahidol, he moved to the United States to study public medicine at Harvard University in Boston, Massachusetts.

On October 21, 1900, Sangwan was born in Thonburi from a father by the name of Chu and a mother by the name of Kham. Sangwan recalled to her daughter memories of her father's home near Wat Anonkaram (Somdej Krom Luang Narathivas Rajnakarin) in Thonburi. She had only a vague recollection her father who died when she was small. At the age of seven or eight, her father's family sent her to live at the Four Season Garden, within the enclosure of the Dusit Garden, under the care of Somdej Chao Fa Valai-Alongkon Krum Luang Petchaburi Raj Sirindhorn (Somdej Phra Chao Pee Nang The Chao Fa Kalya Ni Vatana). Sangwan would sometimes leave the palace to visit her mother, but when she was nine years old, her mother passed away. While living in the palace, Sangwan attended Satree Vitya School. She then enrolled in a program for midwives and nurses at what is now Siriraj hospital in Bangkok. Upon completion of the program, and with a great deal of fortune, she was one of two students who were selected by Krom Muen Chainat Narathorn, the general director of the public health department, to receive a scholarship from Somdej Phra Phan Vassa, King Bhumibol's paternal grandmother. Both scholarships were awarded for further studies in the United States. Sangwan decided to complete her nursing degree at Simmons College in Boston, and it was during this time that she met Prince Mahidol.

Prince Mahidol and Sangwan fell in love, and after about two years of courtship, they married in September 1920. Their first child, a baby girl named Galyani, was born in London, England in 1923. Her brother, Ananda Mahidol, was born in Heidelberg, Germany two years later. Two months later, Prince Mahidol became the Heir Presumptive when the Rama VI died and the throne passed to his younger brother, King Prajadhipok, who had no

children. Prince Mahidol moved the family back to America where he worked as an intern at the Boston Lying-In Hospital. Meanwhile, Sangwan juggled the roles of mother and housekeeper while also studying sanitation and preventive medicine at their modest apartment in Cambridge, Massachusetts. On December 5, 1927 she gave birth to another son, Bhumibol Adulyadej.

Shortly after the birth of their third child, Prince Mahidol settled his family at the Sa Pathum Palace in Siam with his mother, Queen Sawang, because he planned to go back to work in Bangkok at Siriraj Hospital. He later found out that Palace Law forbade him to perform as a doctor. Consequently, he joined a missionary hospital in the north to work among lepers, in search of a cure for kidney disease. Ironically, the work had exposed him to infections that further abraded his resistance to good health. Prince Mahidol died in September 1929.

Lost without her husband and stuck in the middle of a Siamese revolution, Sangwan decided to leave Thailand in 1933 and raise her children in Lausanne in Switzerland. Queen Sawang offered to help the family financially though Sangwan was ready to make her own living as an American-qualified nurse. Meanwhile, in Thailand, the provisional government was in chaos. Revolutionaries quarreled and became divided between the democratic vision of Pridi Banomyong and the fascist ambitions of a young army officer, Luang Pibulsongkhram. The people sought guidance from Rama VII, even though he no longer possessed ruling powers. In 1935 King Prajadhipok abdicated the throne. Five days later Sangwan received a telegram requesting her nine-year old son, Ananda, to become king.

In Lausanne, living was simple and cheap. Rather than depend on their royal ancestry, Sangwan urged her children to focus on scholarship, compassion and creativity. When the boys wanted a wireless receiver, Sangwan had them make their own crystal set. Toys were also homemade. They earned pocket money doing small jobs for neighbors and were made

to give half to local charities. At an early age, Bhumibol Adulyadej was interested in hydraulics, forestry and engineering, but Sangwan also made sure that he and the other children mastered Latin, French, English, German and Spanish. The boys had also developed a passion for jazz. When the request came for her eldest son to become king. Sangwan was shocked, but she explained the role to him, and after careful consideration, he accepted.

As a constitutional monarch, King Ananda was not needed for political governance. With the exception of a brief visit to Bangkok at the end of 1938, the family stayed in Switzerland through World War II. The young King studied political science and formed his own ideas about the future of Thailand with his younger brother. He wanted time to earn his university degrees and acquire enough confidence to face down any opponents who would challenge him with their superior wartime military experience. Their mother translated into English an essay on Palace Law as a guide for all the family in order to teach the children proper court etiquette and Rajasap, the royal language. When atomic bombs hit Japan in 1945, and the ordeal of a world war was upon all Asian countries, the Thai Regent, Pridi Banomyong, asked the King to come back to the country. At this time, King Ananda was only twenty years old. Tragically, the trip to Thailand proved to be fatal for the Monarch. He was found dead in the palace from a bullet wound in his head on Sunday, June 9, 1946. His actual cause of death, whether suicide, accident or assassination, remains a mystery.

2.4.1 The Coronation of Thailand's First Constitutional Monarch

Upon hearing of Ananda's death, crowds of citizens, including monks, senior princes, cabinet ministers, courtiers, and commoners, crowded in and around the Palace awaiting the declaration of a new king. The Buddha once said, "for as long as there are bullies and liars, kings are needed. For as long as the poor look for hope and the rich see excess, for as long as the wicked fight for domain and other nations maneuver for control, for as long as evil men oppose the impulses of good, we need to believe in a king whose power comes from above"

(Stevenson 74). At only 18 years of age, His Majesty King Bhumibol Adulyadej accepted their request, ascending to the throne as King Rama IX of the Chakri Dynasty.

In preparation for the kingship, he moved back to Switzerland in 1946 to attend the University of Lausanne, where he studied political science and law. Rooted in the back of his mind was a deep interest in Western technology. With the title of constitutional monarch, he was certain that a technological education would be much more beneficial in helping him empower the Siamese than a degree in politics. He foresaw the roles of innovation and science in changing their fate and leading a new revolution.

During his leisure hours, King Bhumibol continued to polish his musical talents, specifically in jazz music. He also acquired a fondness for photography, sports cars and the beautiful daughter of the Thai ambassador to France, Princess Sirikit Kitiyakara. On July 19, 1949 His Majesty King Bhumibol and Mom Rajawongse Sirikit were engaged, on the occasion of her seventeenth birthday party. The couple returned to Thailand the following year.

After officiating his brother's cremation in March, King Bhumibol had his coronation on May 5, 1950. During the ceremony, he pronounced the Oath of Accession to the Throne of all Thai Kings which states, "We will reign with righteousness, for the benefits and happiness of the people of Siam" (Tongdee). Another tradition of the King's coronation is the pouring of ceremonial water. This act symbolizes the dedication of his whole being and efforts to the task of reigning over the Thai Nation according to *Thosaphit Rajadham*, or the Ten Rules of Royal Governance. In summary, these principles advise the Monarch to rule the Kingdom with exemplary moral behavior, integrity, respectful manners, lack of unnecessary lavishments, and the resistance to action outside of the Dhamma or Truth. A complete reference to the *Thosaphit Rajadham* is located in Appendix C. King Bhumibol graciously

proclaimed his wife as Her Majesty the Queen and bestowed upon her the royal sash of the Chakri Dynasty on their wedding day, April 28, of the same year.

2.4.2 The Royal Family

Since their marriage in 1950, Their Majesties have had four children. It is common today for any one of the children to accompany their parents on visits throughout the country. The Former Her Royal Highness Princess Ubol Ratana, the eldest child, was born on April 5, 1951. In 1973, she graduated from MIT in Boston, Massachusetts, with a Bachelor of Science (B.S.) in Biochemistry. She has three children from a marriage with Mr. Peter Ladd Jensen. She used to live in the US but has now returned to Thailand.

His Royal Highness Crown Prince Maha Vajiralongkorn, Heir to the Throne, was born on July 28, 1952 in Bangkok. He graduated from the Royal Military College in Duntroon, Australia, and now serves in the Royal Thai Army, with the rank of General. His Royal Highness has one daughter from a marriage with Her Royal Highness Princess Soamsawali and four sons and one daughter from another marriage.

Her Royal Highness Princess Maha Chakri Sirindhorn was born on April 2, 1955 in Bangkok. She graduated with First Class Honors from Chulalongkorn University with a Bachelor of Arts (B.A.) in History in 1976. Her Royal Highness has also received a Master of Arts (M.A.) in Oriental Epigraphy and Oriental Languages and a Doctorate in Educational Development. She is also studying for her Doctorate in Educational Administration at Chulalongkorn University.

The King's youngest child, Her Royal Highness Princess Chulabhorn, was born on July 4, 1957 in Bangkok and now has two daughters of her own. She graduated with First Class Honors from Kasetsart University with a B.S. in Organic Chemistry. Her Royal Highness also completed her Doctorate work in Organic Chemistry in 1985 and received her degree from Mahidol University.

2.4.3 *The New Thai Nationalism*

In the thirty years following the 1932 Revolution, the Thai people have had seven different constitutions and thirty cabinets. From 1932 until the coronation of the present King, they were also lacking in the spiritual support associated with the royal family. The responsibilities of the new monarch were unknown, but the Thai people were desperately in need of a central figure to lead them through difficult times. When King Bhumibol returned from his studies in Switzerland in 1950, he and his wife, Queen Sirikit, began to tour the country and give regular radio broadcasts. The Thai citizens received the royal couple enthusiastically, encouraging them to assume more active roles in national life.

In 1957, a nonviolent coup led by Field Marshal Sarit Thanarat brought Thailand under the rule of an authoritarian regime. When Sarit Thanarat came to power, he turned to the throne for support and encouragement, acknowledging the peoples' emotional and spiritual affinity towards the monarchy. Sarit Thanarat wanted to renegotiate the relationship between monarch and government on terms different from those previously established by the 1932 revolutionaries. At Sarit Thanarat's suggestion, the King and Queen made trips abroad to help build a positive image of the country, which may have been ill viewed in light of the new authoritarian rule. Sarit Thanarat encouraged Their Majesties' royal role by restoring many traditional rites and ceremonies. By giving the monarchy an independent role in Thai society, Sarit Thanarat gained support and advanced his own view of Thai nationalism.

Even after Sarit Thanarat's death, the King and Queen continued to show tremendous kindness towards the people by traveling almost eight months out of the year to the provinces and rural areas of the kingdom. His Majesty has visited all of Thailand's provinces. Through these visits, the King was able to learn firsthand the needs and grievances of the people. He would find ways of giving immediate help, and also studied specific problems in depth to find permanent solutions. These permanent solutions were based on technological initiatives

that reflect his scientific interests and Western education. These projects are illustrated through specific foundations classified under the following categories: development of irrigation projects, reforestation and watershed development, crop substitution for opium growing in the North, irrigation network and water conservation, drainage and reclamation in the South, and land reform with co-operative farming. "In conversation with the ordinary people His Majesty would emphasize to them the necessity of self-improvement, the importance of basic factors of life such as education and public health in order that at least the level of their general welfare could be improved" (Tongdee).

His Majesty's efforts to improve the welfare and prosperity of his people are genuine. For this and other reasons, Thai citizens regard him with utmost respect. Despite the title of constitutional monarch, the King has become a significant center of authority rather than merely a symbol to be manipulated by the government in power. This was first exemplified in the 1973 political crisis. When university students' protests against military dictators turned violent, the King was operative in bringing the crisis to an end. Determined to avoid anarchy and further bloodshed, he was instrumental in the decision of Thanom Kittikachorn Praphat Charusathian, and Narong Kittikachorn, the political leaders, to leave the country. "The King then went on the radio to announce the departure of the triumvirate, to inform the country that there would be a return to a constitutional government, and to ask students and others to return to home" (Keyes 84). Although the events, which resulted in a civilian government, forced the military to share power with the civilian politicians, its most significant effect was to reverse the relationship between the monarch and government. A similar situation occurred in 1992 when violent unrest followed a confrontation of democracy versus military rule between General Suchinda and General Chamlong. King Bhumibol appeared on national television and "for the first time in history, the world saw an unarmed king in the very act of subduing men who had the physical power to destroy him" (Stevenson

225). They approached His Majesty on their hands and knees and both agreed that a civilian government should take over.

Of all the major contributions that His Majesty has made towards the development of Thailand, the most significant are his royally initiated projects. Throughout his reign, King Bhumibol has made a remarkable effort to visit every province in the Kingdom. By speaking with the people, he learns of their problems first hand, and finds solutions through appropriate use of technology and Monarchical influence.

2.5 The Projects

"Since coming to the throne half a century ago, His Majesty has concentrated on three areas: the well-being of his people, particularly those in rural areas; the promotion of national harmony and development; and the strengthening of security and stability throughout the Kingdom" (Panyarachun 225). The King's development projects encompass a wide range of areas, including agriculture, environment, public health, occupational promotion, water resources, communications, and public welfare, among others. We will be concentrating on the projects that have a marked technological component, in an attempt to better understand what King Bhumibol has accomplished and to gain a fresh perspective on the development projects in general.

2.5.1 Foundations

In an attempt to achieve his goal of improving the standard of living for Thai people, King Bhumibol has initiated innumerable development projects via a variety of non-government funded project foundations. The better recognized organizations are described in the following sections.

2.5.1.1 The Royal Project Foundation

The Royal Project Foundation was established by Royal Command in March of 1991. This organization was the result of one of the King's first development projects, the Royal Project. Approximately 30 years ago, during one of His Majesty's many holidays to Bhuping Palace in Chiang Mai, a visit to the hilltribe villages was made, and King Bhumibol was provided with first hand knowledge of the conditions that plagued the northern Thais. The people were horrendously poor; their means of subsistence was opium poppy and a local peach, which was so small it was only useful for regional consumption. The King believed that by grafting an "improved variety onto local rootstock, the fruit should become bigger and produce higher income than the illegal poppy" (Royal Project Foundation). The Royal Project was founded to determine if his intuition was correct. The project developed with the goals of improving the hilltribes' standard of living by allowing them to grow useful crops, decreasing the opium trade, and moving from a slash and burn style of cultivation into a technique that is less detrimental to the environment.

The Royal Project was supported by foreign organizations, including the US Department of Agriculture and the Republic of China, Taiwan. Eventually, with a donation of 500,000 baht and upon Royal Command, the Royal Project was established as a Foundation, with the King becoming the Honorary President (Royal Project Foundation). The current objectives of the Royal Project Foundation include, but are not limited to, the following.

- To render suitable assistance to hilltribes.
- To reduce the destruction of natural resources – forest and watersheds – thus benefiting the whole country.
- To stop opium cultivation.
- To make proper use of land.
- To produce crops to the benefit of the Thai economy (Royal Project Foundation).

The Foundation currently supports projects within the provinces of Chiang Mai, Chiang Rai, Lamphun, and Mae Hong Son. There exist four research stations and 34 development centers, extending across 294 villages with a total population of 73,425. The four research stations each have specific duties determined by the surrounding geographic region and populace. The *Royal Angkhang Agricultural Station*, situated in the Fang District of Chiang Mai, provides training and carries out research on temperate fruits and vegetables and fruit tree collection and production. The *Royal Pangdah Agricultural Station*, of Chiang Mai's Samoeng District, is responsible for fruit tree multiplication, as well as semi-temperate vegetable research. *Inthanon Station*, located in the Chom Thong District of Chiang Mai, promotes beneficial crops to the northern farmers and uses tissue culture to fulfill all of the Royal Project's plant requirements. Further, this center also provides floriculture research and one of the sub-stations, *Khun Huay Keang*, contributes research about pomegranates, seedless grapes, figs, and guavas. The fourth research center, *Mae Lord Coffee Research Station*, is situated in the Maetaeng District of Chiang Mai and works on the cultivation of rust free varieties of Arabica coffee.

In addition to the previously described research stations, the Foundation is comprised of 34 development centers. A listing of these centers can be found in Appendix D. These development centers serve as a link between the research stations and the people. The goal is to provide the farmers with a better life while encouraging conservation and other environmental benefits. The duties of development centers are as follows.

- To extend cold weather vegetables, flowers, fruits, and field crops to farmers.
- To improve the infrastructure and quality of life.
- To support work in selection, research, and demonstration of plants and animals.
- To encourage the conservation and regeneration of natural resources.

In conjunction with the research stations and development centers, the Royal Project Foundation has enlisted other units to assist in the organization's activities. These additional divisions include the *Plant Protection Unit*, the *Agricultural Extension and Development Division*, and the *Education, Social, and Public Health Development*. The *Plant Protection Unit* is responsible for the control of chemical pesticides. It is the Foundation's policy to not use chemicals for pest control unless entirely necessary; to this end, Plant Protection technicians are sent to the development centers to provide early detection of pests and diseases. The *Agricultural Extension and Development Division* transfers research results and technology from the centers to the people working in the field. Further, this unit is responsible for making production plans based on discussions with the Foundation's Marketing division. The responsibilities of the *Education, Social, and Public Health Development Division* are classified as either educational and social or public health. The former is responsible for setting up schools, child development centers, mobile and school libraries, as well as providing school lunches and encouraging leadership. Additionally, "housewives and youth are introduced to handicraft, like spinning and weaving, particularly of new raw materials like linen" (Royal Project Foundation).

The public health portion of this division is responsible for providing primary treatment and making other regular improvements to the general standard of public health. This is achieved through the volunteer work of doctors, dentists, and nurses from Chiang Mai University.

The Royal Project Foundation has proved successful. Through the application of concepts proposed by the Foundation, Thailand's northern hilltribe farmers have achieved a degree of financial stability. All produce from the hilltribes is purchase by the Royal Project Foundation and sold under the Doi Kham trademark. In total, there are more than 300 products classified into the following categories: winter vegetables, pot plants, herbs, dry

flowers, winter flowers, handicrafts, winter fruits, canned products, and farming products (Royal Project Foundation).

2.5.1.2 The Office of the Royal Development Projects Board (RDPB)

"The Office of the Royal Development Projects Board (RDPB) is responsible for about 1,800 royally-initiated projects covering a wide spectrum of development problems including agriculture, the environment, public health, occupational promotion, water resources development, communications and social welfare" (Panyarachun 225). One of the major goals of RDPB-sponsored projects is simplicity. The King strives to provide solutions that are simple, time efficient, and reasonable. The simplified concepts and theories utilized in the various Royal Development Projects stemmed from His Majesty's ability to study, modify, and improve the development obstacles surrounding each Royal Development Project.

Unlike the Royal Project Foundation, which is devoid of government funding, the Royal Development Projects are those that the King plans, advises and works on in conjunction with the appropriate government agencies, including civil agencies, police, military, and Thai people all over the country (Royal Development Projects). According to the Royal Development Projects Board web site, located at http://www.rdpb.go.th, there are specific procedures for the implementation of Royal Development Projects. What follows is a list of these steps, complete descriptions can be found in Appendix E.

- Study of Information.
- On-site Information.
- Study and Drafting of the Project.
- Implementation.
- Monitoring and Evaluation.

The RDPB projects are classified into eight categories: agriculture, environment, public health, occupational promotion, water resources, communications, public welfare, and other. The agricultural projects initiated by the King are based on the belief that agricultural development requires research and experimentation coupled with continuous practice. In a speech, King Bhumibol stated, "Agriculture, which concerns the livelihoods of the Thai farmers, should emphasize real practice, rather than relying on textbooks". King Bhumibol is a firm believer in research and experimentation, both before and after production. "Before production, the points of consideration should include suitability between plants and soil as well as the demand of the markets. After production, they should cover consistency of the markets, the quality of the products, and the farmers' basic knowledge of accounting and agricultural marketing, which will enable them to earn a living from self-supporting types of business". Another key element of the agriculturally based projects is ensuring the optimal use of nature. A result of this type of optimization is an economic one. "His Majesty stresses the necessity of reducing the expenses of the farmers as much as possible by relying mainly on nature" (Royal Development Projects).

The environmentally based Royal Development Projects generally involve the replenishment and improvement of the natural resources and the environment. These environmental projects can be separated into three basic sections: the development and conservation of soil; the development and conservation of water resources; and the development and conservation of forest resources. One of the most notable results of the King's environmental initiatives has been the New Theory. The New Theory, which has been widely promoted, "proposes appropriate management methods on a small piece of land (about 6 acres) with an adequate source of water in order that integrated agriculture will provide the farmers with income all the year round" (Royal Development Projects).

The Office of the Royal Development Projects Board is also involved with projects concerning water resource development. The projects on the development of water resources can be divided into the following five categories.

- For cultivation and consumption, such as reservoirs and dikes.
- For preserving water sources and streams.
- For electricity generation.
- For water drainage from low lying areas.
- For relief of flooding.

These types of developments have provided major benefits for the Thai people. Improvements include bringing in a maximum water supply, allowing cultivation in both rainy and dry seasons, and providing a clean water supply for yearlong consumption. Further, the water resource project efforts have helped by stopping the destruction of forested areas by turning flooded regions into productive land, providing an increased fish supply, and increasing soil moisture and consequently establishing "wet fire breaks" which form protective strips against forest fires. Most apparent to the average citizen, this type of RDPB project has had a role in relieving flooding in some of Thailand's larger cities, as well as in generating hydroelectric power (Royal Development Projects).

In addition to these projects, the RDPB has also embarked on numerous endeavors without such strong technological connotations. These undertakings fall into the categories of public welfare, occupational promotion, public health, and communication, among others. One such example is the Royal Medical Team Project, which was initiated in 1967 (Royal Development Projects). The current version of this project can be divided into two sectors: treatment and training. Advantages attributable to the medical team are found in two categories, health and economic, as described below.

- *Health* – The project can directly help cure hundreds of thousands of patients each year. Almost all of the patients receiving treatment from the mobile medical unit are poor rural people engaged in agriculture.
- *Economic* – Many of the patients receiving care are engaged in agricultural employment, which requires physical strength. Physically fit, the people can cope with hard work in the fields, which in turn affects the overall economy of the country (Royal Development Projects).

Other non-technical projects are those aimed at improving public welfare throughout Thailand. For the most part, these activities concentrate on providing assistance to "farmers in terms of general livelihood and occupational support" (Royal Development Projects).

In an attempt to provide guidelines and development methods appropriate to specific regions, the Office of the Royal Development Project Board has established six development study centers throughout Thailand: (1) Huai Hong Khrai Royal Development Study Centre, Chiang Mai Province; (2) Khao Hin Sorn Royal Development Study Centre, Chachoengsao Province; (3) Huai Sai Royal Development Study Centre, Petchaburi Province; (4) Kung Krabaen Bay Royal Development Study Centre, Chantaburi Province; (5) Puparn Royal Development Study Centre, Sakon Nakhon Province; and (6) Pikun Thong Royal Development Study Centre, Narathiwat Province (Royal Development Projects). The goal is to use the research and experimentation performed at these centers to provide farmers with location-specific, and therefore relevant, development methods. "In addition, the Centres are intended to serve as 'living natural museums' where interested people can come to observe and receive training by seeing and learning from the real thing" (Royal Development Projects).

2.5.1.3 Chaipattana Foundation

The Chaipattana Foundation was officially recognized on June 14, 1988 as a legal entity at the Ministry of Interior (Chaipattana Foundation). The name combines the meanings of Chai = "*victory*" and Pattana = "*development*". Objectives of the Foundation include, but are not limited to, the following.

- To support the implementation of Royally initiated and other development projects.
- To promote the development of social and economic welfare activities to improve the quality of life of the people and to enable them to become self-reliant.
- To carry out plans or projects that are beneficial to the people and the country as a whole.
- To cooperate with the government sector and other charity organizations for public benefit or to take actions to reinforce support of public welfare.
- To carry out activities without political involvement.

Unlike the RDPB, the Chaipattana Foundation is not in anyway involved in government funded development projects; in fact, the organization strives to complete development projects that are not repetitions of government projects. In some instances, the Chaipattana Foundation will undertake projects that have been restricted by government regulations. The Foundation promotes effective, prompt, and relevant projects, and as a result has implemented as their own, projects that were being delayed by government activity. A recent initiative of the Chaipattana Foundation was the donation of 18 million baht to facilitate the digging of a canal at Nong Yai, "Big Lagoon", in an attempt to prevent severe flooding in Bangkok. As stated by King Bhumibol during his December 4, 1997 Royal Speech, the Chaipattana Foundation lent the necessary funds until an official budget becomes available,

but if this does not become an actuality, "the Foundation will not mind sacrificing this sum of money" (King Bhumibol, December 1995).

Throughout its brief history, the Chaipattana Foundation has been extremely successful in helping with the implementation of many of His Majesty's projects. According to the King, "the Chaipattana Foundation has lived up to its name" (King Bhumibol, December 1995).

2.5.2 The Technology Behind the Projects

His Majesty's involvement in Thailand's development has not been limited to visiting project sites and proposing new development projects. King Bhumibol has been a first hand participant in the creation of new technologies as well as in the application and modification of others' ideas.

2.5.2.1 Distance Learning

The distance learning system was introduced to commemorate the 50th Anniversary of King Bhumibol's accession to the throne. The three major characteristics of the distance learning program are to provide students with moral and ethical training, agricultural knowledge for a living, and the opportunity to continue studies to their fullest potential. The official objectives of the Distance Learning Foundation (DFL) include the following.

- To enhance the quality of education and develop human resources at the secondary level and promote education welfare across Thailand.
- To decrease personnel shortages and ease budgetary constraints.
- To improve educational management so that educational quality in both urban and remote areas will not differ much (Distance Learning Foundation).

As of 1997, the Distance Learning Foundation consisted of 695 participant schools, an impressive increase from the 119 schools that were equipped to receive the distance learning

programs in 1996. With continued success, the budget for 1998 consisted of installation of receiving mechanisms in 500 more schools throughout Thailand. Through the use of this distance learning system, it is expected that following outcomes will ensue.

1. Educational institutions under all jurisdictions will be able to widen education opportunities more extensively in terms of quantity.
2. In terms of quality, students in remote rural areas will have educational opportunities equal to those in urban areas. Moreover, interested people wishing to continue learning will benefit from the project.
3. The outcome of the project operation marks a significant step for the expansion of educational management at other levels.

2.5.2.2 The New Theory

The New Theory "serves as a set of principles or guidelines on the proper management of land and water resources to create optimum benefits for farmers who own a small piece of land" (Chaipattana Foundation). The purpose of the New Theory is to provide an outline for how farmers can achieve self-sufficiency. In its basic form, the New Theory is a management technique. As such, it is easily divided into three distinct stages. First is the individual stage, which involves encouragement for diversification of income among farmers. This task is completed by enlisting a 30:30:30:10 formula, where land is allocated for each different economic activity, "a pond, a rice field, fruit and vegetable patches, and housing, animals' quarters and other purposes, respectively" (Bangkok Post Web Site). The second phase involves the creation of a community; to this end, it is suggested that farmers form cooperatives to coordinate the following activities.

- *Production* – In this stage, farmers have to work together in production, which includes soil and source of water preparation, crop variety selection, fertilizer production, and other factors necessary for cultivation.

- *Marketing* - Once they have produced the crops, the next step is for farmers to make the necessary preparations in order to optimize marketing and selling of their produce. These activities include provision of a central rice-drying area, a silo to gather the rice yields, and a rice mill as well as forming groups to sell their produce at a satisfactory price, which, in the process, also reduces their expenses.
- *Well-being* - Farmers also need to have a decent living standard, which equips them with the basic necessities of life.
- *Welfare* - Each community should offer security and needed services such as a public health station or funds established to provide loans to carry out the community's activities.
- *Education* - The community should play a dominant role in promoting the pursuit of education by establishing a fund to support the education for their youth.
- *Society and Religion* - The community will serve as a tool for social and moral development with religion as a welding component (Chaipattana Foundation).

The third, and final, phase involved in the New Theory examines the creation of beneficial partnerships between the private sector and the community. The goal is to make the necessary contacts and coordinate to establish a fund, or ensure funding from banks and companies, to assist farmers in generating investments that help to improve the quality of their lives (Chaipattana Foundation). Thailand has profited from the implementation of the New Theory in a variety of ways, not the least of which has been to improve the livelihood of many of the country's rural farmers.

2.5.2.3 Vetiver Grass

Vetiver grass is a plant that is similar in structure to sugar cane and sorghum plants. Used for centuries for medicinal and thatching purposes, more recently, the grass has been found to be extremely effective in soil and water conservation, as well as in land

rehabilitation. Widespread use of vetiver grass for these purposes began in Thailand after the King suggested experimentation with the plant to the Secretary General of the RDPB, Dr. Sumet Tantivejkul, on June 22, 1991 (Royal Development Projects). King Bhumibol has received two awards for his work in the advancement of vetiver grass. The first was the International Award of Merit presented by the International Erosion Control Association (IECA) on February 25, 1993 and accepted by Thai Ambassador, M. L. Birabhongse Kasemsri, on behalf of His Majesty. The second was the presentation of a bronze sculpture of a vetiver plant to the King on October 30, 1993 at Chitralada Palace by Richard G. Grimshaw of the World Bank. These awards provide some evidence of His Majesty's international recognition for his technological initiatives.

2.5.2.4 Monkey Cheeks

The Monkey Cheeks project is the implementation of the King's ideas on flood prevention. The water retention concept utilized in monkey cheeks (kaem ling) projects was modeled after His Majesty's memories of the way monkeys eat. During his childhood, the King's mother wanted her children to be aware of nature in many forms and in this effort, the Princess Mother bought chickens, monkeys, and birds. She wanted the children to "see many various interesting things, and it yielded good results"; if King Bhumibol had not seen the monkeys as a young child, the Monkey Cheeks Project would not have been created (King Bhumibol, December 1996). One application of monkey cheeks was in the prevention of floods in the Bangkok area. To this end, the following procedure was performed.

- Water from north of Bangkok was diverted and stored in large canals near the sea.
- When the sea level dropped below that of the water in the canals, water gates within the canals were opened and the water was allowed to flow by gravity.

- Water was then pumped out to sea from the kaem ling at the lowest points of the canals. By allowing the water to flow down to these canals at all times the level of flooding was reduced.
- When the sea level rose above that of the water in the canals, the water gates were closed to prevent the water from flowing back into them.

The current applications of monkey cheeks have involved a number of activities: identifying sites to serve as reservoirs and diverting water into these areas, building waterways leading to these water storage reservoirs, and continually draining water out of these reservoirs.

2.5.2.5 Artificial Rainmaking

One of the King's most notable uses of technology is found in the Royal Rainmaking project. The concept for this project first began in 1955 during the King's flight to visit the Phuphan Mountains in northeastern Thailand. The trip was during the southwestern monsoon, when rainfall should have been plentiful, but the clouds were unable to aggregate sufficiently, resulting in long dry spells (Royal Development Projects). "One new technique discussed in the science journals of the West early in his reign caught the king's imagination. Artificial rainmaking, if it really worked, would be most valuable in Thailand where farmers suffered frequently from drought" (Kulick 55). King Bhumibol went on to analyze the process of making artificial rain, and divided it into three stages: agitation, building up the cloud mass, and bombardment. The project was successful. Today, Royal Rainmaking is responsible for relieving water shortages during droughts between natural rainfalls, increasing the volume of water in low-lying plains, solving household consumption water shortages, facilitating water transportation by raising the water level in rivers that have grown shallow, preventing and alleviating pollution caused by the discharge of sewage and rubbish

into the rivers, and raising the water levels in both the Bhumibol and Sirikit dams for power generation (Royal Development Projects).

2.5.2.6 Reforestation

At Huai Hong Khrai Royal Development Study Center in the Doi Saket District of Chiang Mai Province, one of the most impressive and innovative research endeavors involves the creation of a "wet forest". This concept combines the efforts of forest conservation and rehabilitation with forest fire prevention, with a concentration on maintaining humidity within the forest with a goal of deterring fires. There are a number of methods that can be implemented in the creation of a wet forest; the chosen method should reflect the topography and vegetation of the area.

First Method: Set up a forest-fire prevention system using irrigation canals along which various types of vegetation are grown.

Second Method: Set up a forest-fire control system through we firebreaks using irrigation water and rainwater.

Third Method: Plant fast-growing trees over water channels so that moisture can spread out on both sides, allowing trees to flourish and preventing forest fires, which occur easily in the absence of moisture.

Fourth Method: Build check dams across water channels or streams at intervals to retain some water and silt. The water seeps into the earth and spreads out, turning both banks into a Wet Forest.

Fifth Method: Pump water up to the highest possible level, then release the water in a trickle so that it seeps into the earth, helping forest growth at high altitudes. This helps turn a Forest Mountain into a Wet Forest, which can prevent forest fires.

Sixth Method: Grow banana in the two-meter wide strips designated as areas to be kept clear of trees. When a forest fire encounters the banana, which contain more water than other plants, water loss will be reduced (Concepts and Theories 191).

The implementation of a wet forest is well underway at Huai Hong Khrai using the Fifth Method. His Majesty has made the following statements about this method of forest rehabilitation.

> One should consider drawing water up to the highest point possible, so that the water can at all times be released to nurture seedlings planted for reforestation downhill, particularly during the dry season, when they suffer a high rate of loss. When the seedlings are sufficiently mature to withstand the dry condition, the hill will revert to its natural state – a reasonably humid Forest Mountain, which also helps protect the environment in lower-lying areas against drought. ... Attempts must be made to pump water up, one level at a time, to the highest level possible, using a water pump run by natural energy – solar and wind energy, already being used – in order to save fuel. When water has been drawn up to the highest level, it can be allowed to seep down to accelerate reforestation with protective and fast-growing species. Moreover, the Forest Mountain will turn into a wet firebreak, which can prevent forest fires (Concepts and Theories 194).

The performance of this style of reforestation at Huai Hong Khrai has been extremely successful. This concept was developed through the King's recommendations but has been adapted through efforts of researchers and scientists at the development centers throughout the country. The following section discusses some of the projects in which His Majesty was actively involved with both intellectual initiation and physical implementation phases.

2.5.2.7 The King's Innovations

Not only has His Majesty had a vast involvement in the creation of development projects and in the initiation of concepts for development, but he has also played an important role in the development of new technologies.

2.5.2.7.1 Chaipattana Aerator

The Chaipattana Aerator is a mechanism proposed by King Bhumibol to help purify the heavily polluted waters around Thailand. The aerators, used to oxygenate the water, are part of a wastewater treatment process. One such treatment was developed in Nong Sanom, where constructed wetlands and air transfer have proven to be highly effective, natural and inexpensive ways of decontaminating water supplies. In this project, there are three stages of treatment. First, "the waste water is treated by the Egyptian papyrus, a reed which reduces pollutants in the water through absorption" (Royal Development Projects). Next the Chaipattana aerators operate within a pond; the oxygen breaks down organic matter, allowing it to precipitate more quickly. Finally, the aerators are used again at an inlet into Nong Sanom.

As is evident by the name, Chaipattana aerators were developed through funds from the Chaipattana Foundation, as requested by the King. The aerator is one of only nine machines of its type to be patented in the world.

2.5.2.7.2 The Royal Chitralada Projects

The King's efforts do not cease with the implementation of a project; he has taken it upon himself to work continuously at solving Thailand's development issues. King Bhumibol has designated a large area within his residence at Chitralada Palace for agricultural research and experimentation. The projects undertaken at the Palace "strive to adapt basic scientific knowledge and modern technology to the available local agricultural resources and environment" (Royal Chitralada Projects). The Royal Chitralada Projects encompass a wide variety of agricultural endeavors, ranging from fishponds and rice fields to a dairy farm and demonstration forest. In addition to their experimental emphasis, these projects, maintained by the Royal Household staff under the watchful eye of His Majesty, hold a very important demonstrative role. All the data and research results obtained at

Chitralada are open to farmers and all others interested in obtaining further knowledge about agriculture. As a result, the Royal Chitralada Projects have proved useful for research and education as well as training.

Through His Majesty the King's insight and dedication, development work throughout Thailand has been extremely successful. King Bhumibol has made extraordinary efforts to improve the wellbeing of his people. In doing so he has had played an influential role in unifying his nation, even during times of extreme turmoil, both political and economical.

2.6 An Overview of Thailand's Social and Economic Systems

The history of Thailand's recent economic development is a useful tool for understanding the need for the projects developed by His Majesty. Combined with Thailand's political history and the pervasive influence of Buddhism, understanding the economy helps create an overall picture of Thailand, allowing the projects to be viewed in a fuller perspective.

When King Bhumibol returned to Thailand in 1950, Thailand was primarily agrarian. The economy was driven by agricultural exports, most importantly teak, rubber, and rice. Meanwhile, the surrounding countries of Hong Kong, Taiwan, Korea and Singapore adjusted their economies and began to export manufactured goods. They changed taxes and tariffs to favor manufactured exports; channeled credit and investment funds towards industries with export potential; sank government money into large-scale industrial projects; and helped firms find the technology and skills needed to compete in the industrialized world market. Thailand's government did none of these because both government and business believed that agriculture promised quicker and surer returns than the difficult leap towards industrialization (Baker 22). Consequently, the direction and style of government policy-making between Thailand and the development-oriented countries evolved very differently.

From 1950 onwards, the demand for agricultural goods increased rapidly due to the economic growth of Europe and the United States. Seeing the vast amount of cultivatable land that Thailand offered, the US helped build dams, research stations, and new roads to remote areas in order to enhance the economy. Under the regime of General Sarit Thanarat in the late 1950s, the urban economy also began to grow. The US encouraged Sarit to adopt a free-world model of development, which meant government support for the growth of private businesses. Additionally, the US provided Thailand with the tools necessary to restructure the economy in line with their own model of economic development. With US money and expertise, Thai businesses increased in number and the schools necessary to train a new workforce were established. The US instituted an infrastructure to manage a modern urban economy, including a budget bureau, planning board, and upgraded central bank. They also trained employees to staff these institutions. Such a plan directly benefited Sarit Thanarat and other government officials who were already on the boards of Thailand's leading firms (Baker 21).

For thirty years, land continued to be cleared and planted at a rate of over 300,000 hectares per year, doubling the total area of farmland. Agricultural exports increased at an average rate of 12 percent a year and were the major source contributing to Thailand's prosperous economy. Thailand continued to experience rapid economic growth from the 1960s to the 1980s despite recession and other financial pitfalls resulting from the development strategy of agricultural-export-led growth. Five-year plans for economic development were enacted, each with a goal for the development of Thailand during that period. For example, The Third Plan, 1972-1976, aimed for higher growth and a decrease in the economic gap between urban and rural areas (Warr 30). Table 2-1 provides the income distribution for selected regions of Thailand that gives a feel for the growth that had occurred, and still exists, in the two major sectors of the Thai population (Warr 409). At present, the

baht is valued at 37 per US dollar. Although the exchange rate was different in 1981, this table provides an approximation for the economic status of the people during that time.

Subregion	Average per capita Household income (baht per year)	
	Poor	Non-poor
Rural		
Lower Northeast	2,475	7,623
Central Middle	2,261	13,445
Upper South	2,634	20,471
Lower South	2,548	9,712
All rural	2,533	9,908
Urban		
Bangkok	3,695	23,165
Other urban	3,623	18,398
All urban	3,625	20,332
Whole Kingdom	2,734	12,955

Source: Warr 417

Table 2-1: Average per capita income distribution in various regions of Thailand, 1981

2.6.1 The First Major Recession

The strategy of agricultural expansion and import substitution worked well for the business leaders of Thailand for two decades, but in the late 1970s, they became worried about its limitations for three reasons. First, since Thailand is a substantial petroleum-importing nation, the oil crisis of 1973-1974 significantly hampered its economic growth. Second, the world prices of agricultural goods began to decrease for the first time in twenty years. Lastly, Thailand's economy was quickly falling behind those of the Asian exporting countries.

Business entrepreneurs urged the promotion of manufactured export-oriented industrialization, but the structure of the economy changed little. Although the Fifth Plan of 1982-1986 focused on industrial development in hopes of matching the industrial output to the output of the agricultural sector, most of the early 1980s government policies still favored agriculture and import substitution. In 1984, Thailand ran out of reserves and creditors. By

attempting to stabilize the economy through fixed deflation, the government provoked a major business crisis.

High interest rates caused plummeting profits and financial difficulties for all business institutions. Out of 127 finance companies, 22 went out of business and another 25 had to be rescued. One bank crashed and three others needed significant financial assistance in order to prevent bankruptcy. Thousands of lesser companies went out of business and many thousands of small entrepreneurs were in court for issuing bounced checks. The government was forced to devalue the baht by 14.8 percent. In order to stabilize the economy, the government refocused on manufactured-export-led growth (Baker 69).

2.6.2 Thailand Today

Changes instituted by the government to correct the economy in the 1980s have had a distinctive effect on Thailand to this day. In the past fifteen years, the country has changed dramatically. Although industrialization has labeled Bangkok as one of the advanced cities in the world, it has also caused political turmoil, major disparities in the economy, and losses in natural resources. In order to understand the current social and economic state of Thailand, a basal comprehension of how industrialization changed the country is needed.

After the first recession in the 1980s, Thailand's policy-makers studied how other Asian countries managed export industrialization. The Board of Investments brought in new promotional rules favoring exporters. The Bank of Thailand's scheme of subsidized credit for agricultural exports was opened to industrial exporters. Foreign firms were allowed 100 percent ownership, provided they exported all of their output.

In a very short period of time the whole shape of the Thai economy altered. In 1980, three-fifths of the exports originated from agriculture. By 1995, over four-fifths of the exports came from manufacturing (Baker 4). In ten years, manufactured exports multiplied twelve times and drove total exports up seven times. These changes are shown in Table 2-1.

	1985	1996	% annual growth
Population (million)	52	60	1.3
GDP (billion baht at 1988 prices)	1,191	3,117	9.1
GNP per head (baht at 1988 prices)	22,731	50,565	7.5
Manufacturing percent of GDP	22	33	
Exports (billion baht at current prices)	193	1,412	19.8
Manufactured exports	96	1,151	25.3
as percent of total	49	82	
Manufacturing employment (million)	2.0	4.5	7.7
as percent of total	8.2	13.8	

Source: Baker

Table 2-1: Export Manufacturing Growth

In addition to a large amount of foreign investment, thousands of local firms joined in the manufacture and export of textiles, electronics, jewelry, leather goods, wood products, processed foods, computer components, auto parts, and many other consumer goods. During this decade, Thailand had the fastest growing economy in the world, with a real average annual growth of GDP at 8.4 percent. *The Economist* marked Thailand in early 1995 to become the world's eighth largest economy by 2020.

Meanwhile, in order for the economy to grow so rapidly in a new direction, the villages, cities and people had to change along with it. An agriculture-based income could no longer sufficiently support a family, therefore, both men and women moved out of the rural villages and into the city. From 1984 to 1996, three million Thai people sought work in manufacturing and another four million worked in other urban jobs to satisfy the demand for an urban labor force. While some farmers left the village and moved to the city permanently, many more only stayed for a short time. Usually during the dry season, villagers would go off to the city for three to six months to earn extra money since there was nothing to do in the rice fields.

This sort of migration occurred for two main reasons. First, Thai people still saw land, house, family, and village as their long-term source of livelihood and social security. The

city life was so different from that of the village. With pollution, traffic, and heat, people preferred village life. Second, the Thai people were educationally unprepared for industrialization. In 1983, about 90% of children not attending school were from rural areas, a condition resulting primarily from the cost and location of schools. The base cost for education made it prohibitively expensive for farming families (Warr 327). Additionally, very few Thai's had received a secondary education and the tertiary education system only supported the staffing of the bureaucracy.

The shortage of workers in the city forced industries and factories to spread farther and farther out along Bangkok's most expansive roads. Those who found new wealth in the industrial revolution started to invest in the increasingly available property market. Many people moved out of the city to the suburbs, which were quickly emerging on the newly colonized land. With the boost in urban economy and the influx of foreign firms, Bangkok quickly ran out of office space. Shopping centers, factories, housing estates and resort areas were briskly increasing in number in order to comply with the demand of the growing city. Between 1988 and 1990, prices of prime land in the city center and suburbs increased up to ten times. There was a large interest in property investments due to the existence of asset inflation and credit availability. It mattered little to developers if they were unable to pay the interest on the land; the value of the land collateral could be increased and the unpaid interest rolled into a loan. In 1996, finance companies had lent 350 million baht to property, almost a quarter of their total loan business (Baker 113).

Many people continued to make fast and extravagant fortunes by selling or developing property because it seemed to promise high returns. For example, in 1988, Thailand only had a small number of golf courses. By 1996, there were over 200 new courses. Industrialists were encouraged by success stories such as the new clubs that opened on the outskirts of Bangkok. In one year, membership fees were raised eight fold and the value of its land plots

increased as much. Many entrepreneurs believed golf was a good business. Unfortunately, only a few were making any money. Similarly, buildings started to come up in the wrong places. Housing projects, luxury condominiums, and hotels were being built in financially impractical locations. Consequently, many of the developers went out of business.

One positive improvement to the country that occurred during this period was in the educational institutions. Beginning in 1991, the government responded to the shortage of skilled workers. A program was launched to extend secondary schooling, such that between 1987 and 1994 the number of students continuing their education increased from 33 to 63 percent (Baker 145). At this time, tertiary education was also poorly equipped to prepare students with advanced skills. The first university, Chulalongkorn, was evolving from a college that only trained administrators inside the royal palace. Thammasat, Kasetsart, Mahidol and Silpakorn all evolved later to staff the government's growing involvement in agriculture, health, and culture, and focused on the skills needed by the bureaucracy. From 1970 to 1980, the number of those with tertiary degrees multiplied four times, from 180,000 to 720,000, due to the first economic boom. Although the expansion of bureaucratic education slowed in the early 1980s, another demand for executives occurred after 1985. The government responded by not only building more universities, but also by opening the possibility for tertiary education to the private sector of society. Between 1987 and 1994, the total enrollment in higher education, excluding open universities, grew from 364,000 to 659,000. In addition, the government increased the number of overseas scholarships. Although the abundance of educational opportunities had improved, the content and quality of the education had not. There was a lack of teachers, labs, and equipment, such that it was impossible to generate large numbers of well-qualified scientists and engineers (Baker 147).

2.6.3 *The Crash*

In the early 1990s, the growth of manufactured exports began to decrease. "New and cheaper competition had entered the market. Demand from Japan had slackened. Too little had been invested in improving productivity" (Baker 126). At the same time, foreign firms continued to invest money in the Thai economy. Unfortunately, the policy-makers and macroeconomists struggled to understand and control the impact of foreign money flows. "The inflow [of foreign investment] obscured the export slowdown and pumped up a bubble economy of inflated assets, overbuilt property, excess spending, and incautious investment" (Baker 126). In 1996, the export growth dwindled from twenty percent to zero percent and the stock market lost two-thirds of its value. Although similar conditions occurred in other Southeast Asian countries, the people of Thailand suffered the most.

Not only has economic growth severely affected the financial status of the people, it has also lead to the deterioration of natural land, forest, and marine resources, which are the basis of the villagers' livelihood. On the eastern edge of Bangkok, large tracts of swampland used to exist. Suburban residences replaced the land. Orchards and coconut groves disappeared under the concrete of newly cut roads. The establishment of housing estates arose in paddy fields. Factories polluted the air, rivers, and soil. In 1964, the government decided that 40 percent of the country should remain as forest, but it did not enforce the regulation. By the 1980s, the amount of forest remaining was approximately half of this projection. Since agriculture was no longer a focus of the economy, the government was reluctant to ensure the welfare and prosperity of the farming villagers.

2.6.4 *His Majesty's Commitment to Rural Development*

His Majesty the King of Thailand has been a stable figure in the economic development of the rural villages. Since the beginning of his reign, King Bhumibol has used his knowledge, generosity, and resources to help the Thai people. By thoroughly investigating

the economic history of Thailand, it is possible to recognize a distinct correlation between rural development and His Majesty's Initiatives.

Before the 1980s, Thailand was primarily an agrarian country. During that time, a majority of Thai people made a living exporting rice and other agronomic products. Consequently, in Their Majesties' travels throughout the country, the most prominent need of the people was the improvement of land conditions, such as soil fertility and water management. These problems are essentially a result of two distinct seasons in the year. From May to November, the Kingdom is bombarded with sporadic, heavy rainfall. During the rest of the year, a warm and dry climate is prevalent. Although the Thai people have grown accustomed to these weather conditions, the fate of their sustainability is dependent on natural forces such as flooding, soil erosion, and drought, over which they have no control. In an attempt to alleviate these difficulties, and in turn, improve their economic status, King Bhumibol has successfully utilized modern technology in a manner that is appropriate to the development of Thailand.

Specific projects, employing these technologies, have been initiated to ensure the continuation of rural development. A consequence of excessive flooding during the rainy season is fertile soil erosion. His Majesty's response to this problem has been the construction of dams and "monkey cheeks". These same regions of the country are plagued by a deficient water supply during the dry season. The dams and Monkey Cheek Projects are strategically designed to act as reservoirs, storing excess rainwater used for irrigation and general consumption during the dry months. In addition, His Majesty's Royal Rainmaking Project provides a supplementary source of water when needed.

With the economic changes in Thailand since the 1980s, His Majesty has adapted the use of technology accordingly. Industrialization altered the social conditions in both village and city, creating an indisputable need for improved public education. To address this issue, the

King proposed the use of a satellite system of education to alleviate teacher shortages and enhance the overall quality of education. This technique provides an equal education to all participating Thai students and encourages the importance of life long learning.

His Majesty has attempted to improve the economic conditions of his people throughout his reign. Although many of these development initiatives have focused on improvements in rural Thailand, King Bhumibol's intentions are to enhance the quality of life for all Thai people.

Chapter 3 METHODOLOGY

The purpose of this project was to study the King of Thailand's development initiatives to determine and disseminate the issues that must be addressed for their continuation and extended application in other countries. In order to fulfill the requirements of an Interactive Qualifying Project at Worcester Polytechnic Institute, students must relate some aspect of science or technology to society. This project meets the requirements of an IQP for several reasons; we have analyzed the use of technology as it has affected the society and economy of Thailand and assessed how the use of technology has been shaped by Thai culture and history. Most importantly, we have analyzed the political, religious, and economic conditions that affect the continuation of Royal Projects. It was our responsibility to objectively assess the impact of His Majesty's technological initiatives for the development of his country and increase awareness among the Thai people of the issues that must be addressed for their continuation.

3.1 Interviews

In order to achieve a first-hand impression of the impact that these projects have on the kingdom, we conducted a series of interviews and project site visits. A complete list of these may be found in Appendix F. On the subject of interviewing, the IQP Handbook states that qualitative interviews, the style we employed, are intended to be flexible and adaptive, and therefore cannot be planned out in specific detail. However, it was necessary to prepare a list of important topics for reference during the interview. From this list we drafted questions to address sensitive issues. Careful thought was also given to the organization of the interviews. Effective qualitative interviews are typically divided into three stages. In the first stage, the goal is to establish the background of the interviewee. In the second stage, the focus shifts to

the details of their present experience that is relevant to the topic. Finally, having reflected on their background and experience, they would be ready in the third stage to report on the meaning their experience has had for them. This basic tripartite structure was kept in mind for each interview, ensuring that participants rendered judgments and opinions only after careful reflection. A complete reference to In-depth Qualitative Interviewing according to the IQP Handbook is in Appendix G.

We were allowed the opportunity to meet with many people as a result of the efforts of our liaison, Dr. Woraphat Arthayukti. In preparation for these interviews, we followed the procedure described above in that we created topic lists covering the variety of information we felt we could obtain from each interviewee. By using the information we had derived through our background research in combination with basic biographical information provided by Dr. Woraphat, we were able to formulate topic lists specific to the individual's expertise. The following people were interviewed for reasons noted. All interviews were recorded and transcribed. Transcripts of each interview are available in Appendix H.

- *Dr. Dhiravat Na Pombejra, Department of History, Faculty of Arts, Chulalongkorn University* (January 19, 2000) – As a historian specializing in the Ayutthaya period of Thai history, Dr. Dhiravat provided information and personal insight that contributed to our background knowledge. Our goal with this interview was to gain a perspective on the development work of past kings; we accomplished this goal and obtained a significant amount of other pertinent information.
- *Dr. Sumet Tantivejkul, Secretary-General, Chaipattana Foundation* (January 25, 1999) – Dr. Sumet has been deeply involved in His Majesty's development projects for a number of years, previously as Secretary-General of the Office of the Royal Development Projects Board and currently as Secretary-General of the

Chaipattana Foundation. Because of his position, we were able to gain background on the basis for many of the projects as well as general information about His Majesty's development initiatives in general. Further, Dr. Sumet graciously supplied us with numerous contacts for site visits.

- *Members of the Royal Rain Research Center* (January 25, 2000) – While visiting the center, we had the opportunity to discuss artificial rainmaking with some of the researchers. We were able to obtain invaluable information about the process of rainmaking and the development of the technologies used.
- *Dr. Suchit Bunbongkarn, Professor and Director, Institute of Security and International Studies, Faculty of Political Science, Chulalongkorn University* (February 8, 2000) – An expert in Thai politics, Dr. Suchit provided us with a perspective on politics and the monarchy. This interview was designed to explore the political aspects of His Majesty's development initiatives.
- *Khun Apilas Osatananda, Chairman, Mae Fah Luang Foundation* (February 15, 2000) – Khun Apilas is an integral member of the Mae Fah Luang Foundation, a private non-profit organization established to carry out the development activities of Her Royal Highness the Princess Mother. Due to his involvement over the years, Khun Apilas has gained a keen understanding of the operational and monetary relations of foundations and non-government organizations in Thailand. He proved to be a reliable source for such information in our project.

3.2 Site Visits

In addition to the information gathered through interviews, we made the following visits: Huai Sai Royal Development Study Center; Wang Klaikangwon Distance Learning Broadcast Station; Phimai Phithayakhom School; Phra Parityatitham School; Huai Hong

Khrai Royal Development Study Center; Nong Hoi Royal Development Center; Pikun Thong Royal Development Study Center; Pa Sak Jolasid Dam Project Site; Saraburi New Theory Project Site; Monkey Cheeks Project Site; Artificial Rain Making Demonstration; Chitralada Palace. Although the research activities conducted at each site tended to be dissimilar, we developed a core set of questions to be answered during each visit.

At the forefront of these inquiries was our attempt to gain a better perspective on the King's direct involvement on the project. That is, to determine the amount of influence His Majesty had on the creation of the site and what level of involvement has been maintained throughout the implementation of the initiative. We also felt it important to determine how the projects are funded. To this end, we made it a point of finding out financial information about each site that we visited.

Finally, one of our major goals in this project was to understand exactly what the King has done with these technological initiatives. As our project progressed, we noticed an underlying theme relating the projects, His Majesty's philosophy of sufficiency. Keeping this theory in mind, we made sure to investigate the individual projects' ties to the sufficiency concept. Literature gathered at the project sites in conjunction with our own observations and informal discussions with guides and other project site employees enabled us to compile a quantity of information pertaining to specific project sites as well as a mass of information concerning the development projects as a whole. To corroborate our documentation, photographs were taken at each site and can be found in Chapter 4, Project Investigations.

In our study of Thai social norms, we identified several issues that we anticipated encountering. First, we had to be fully aware of the pervasive influence of Buddhism in Thailand. The Buddhist outlook on life is very different from what we are accustomed to in the United States. A second concern was the language barrier. With the assistance of our liaison, Dr. Woraphat Arthayukti, we were able to partially overcome this. He acted as a

translator and reviewed our questions. Most importantly, we have encountered a partial view of the Thai monarchy resulting from the immense reverence for the King. As a result, it has been difficult to extract an objective view of the projects.

From the information gathered through interviews and site visits, we have created a constructively critical interpretation of the development activities. Our interviewees provided us with a wide variety of background information. Subject-specific questions were created to obtain information matched by the interviewees' experience or expertise. The sum total of information will help us to attain a balanced understanding of the technological methods initiated by the King.

Chapter 4 PROJECT INVESTIGATIONS

The results of our research, fluidly integrated with the information obtained from interviews and project site visits, are presented in the following detailed project reports. The style of the reports reflect our experiences, impressions, and recommendations. Where applicable and available, full transcripts of interviews and notes from question and answer sessions are provided in Appendix H. References to the relevant appendices are provided within the project reports. A succinct analysis is provided for each site, addressing issues concerned with the future of the projects as a whole. The central issue of project continuation is explored in greater detail in our Summary Analysis.

4.1 Distance Learning Foundation

Figure 4-1: Map depicting location of broadcast school in Hua Hin District and receptor schools in Nakhon Ratchasima Province.

Our investigation of His Majesty's use of technology for the purpose of education began on January 16, 2000 when we were fortunate to attend a training program conducted by the Distance Learning Foundation, entitled Education Media Human Resource Development in

Southeast Asia Countries. The four-day curriculum commenced at Wang Klaikangwon School in the southern district of Hua Hin, which is the location of the Foundation's broadcast station, and ended with site visits to two broadcast destination schools in the northeastern province of Nakhon Ratchasima. The program aimed to introduce the television-based system of education that has found success in the remote areas of Thailand to surrounding countries with the intention of expanding the already existing system. Ambassadors, educators, journalists, and media representatives from Burma, Cambodia, Vietnam and Laos were invited, as well as teachers and students from the schools and members of the Distance Learning Foundation, including its Chairman, Mr. Khwankeo Vajarodaya. In addition to the detailed reading material which was provided, we were able to acquire first hand information by touring the facilities, witnessing live broadcasts, testing equipment, and interviewing personnel.

Figure 4-2: Meredith, Jessica and Paul explore the broadcast studio room in Wang Klaikangwon School.

4.1.1 His Majesty's Focus on Education

The Wang Klaikangwon School is located in Hua Hin District, Prachuap Province. King Rama VIII established the school in 1938, in an attempt to provide basic elementary education to the children of the Klaikangwon Palace staff and the surrounding villages. During his reign, King Rama IX has maintained focus on continuing education, a mission

known as "full-cycle education". His goal is to ensure that a student can reach his or her educational goal in one place and in a fixed amount time. In recent years, he recognized that the Hua Hin District did not have a secondary school under the jurisdiction of the government. Concerned with the shortage of both school facilities and teachers, the King ordered the reorganization of the Wang Klaikangwon School in order to provide education from kindergarten through secondary school. Furthermore, since the school is under his jurisdiction, financial assistance is offered to the children from poor and needy families so that they may attend the school. "Every effort was made to ensure that His Majesty's desire to see children who, with the education and training from the school, will thrive in goodness, compassion, common sense as well as in academic excellence, materializes" (Distance Learning Foundation 184).

Another demonstration of the Monarch's devotion to education occurred in 1962, when more than 1,000 people were killed and many houses were destroyed by a typhoon at Lam Talumphuk, Nakhon Si Thammarat. He rendered help to the victims and persuaded people all over the country to donate money and necessities. Afterwards, with the remaining funds, he founded the Rajaprajanugroh Foundation, giving them permission to establish Rajaprajanugroh schools for the children who had become orphans and left to fend for themselves after the storm. Presently there are 34 such schools all over the country. "The three characteristics of His Majesty the King's kindness given to the Rajaprajanugroh schools are first ethical and moral training, second agricultural knowledge for a living and third the opportunity for high achievement students to continue their study to their full potential" (Distance Learning Foundation 10).

4.1.2 The Government and Education

The Ministry of Education has been accelerating the expansion of Thailand's educational opportunities in line with stated government policy and His Majesty's guidelines and ideas.

Although diversity in educational management is a recognized necessity, a uniform high standard of quality has not yet been achieved (Distance Learning Foundation 9). This is due to the varying degrees of readiness in different schools and dissimilar levels of operation under different jurisdictions. In addition to educational inequality, almost all secondary schools in the present system are facing a shortage of teachers. Schools located in the remote and rural areas are not easily accessible to commuting educators and there are few qualified members of these rural communities who possess an adequate educational background to teach, making the situation difficult to remedy.

Although the agencies responsible for educational management have been attempting to both enhance the quality of education and alleviate the shortage of teachers, the failure of the government lies in lengthy legislative processes. For example, "if the National Primary Education Commission could provide a secondary education to M3 (Grade 9) for 100 schools a year, or more than 10,000 students annually, it would still take 300 years to meet the needs of every school in the country" (Distance Learning Foundation 12).

4.1.3 The Royal Opinion

As noted in the Background, King Bhumibol is actively involved in the lives of the people of Thailand. By traveling throughout the country, he learns of their problems and difficulties. After drawing upon various sources of information, he assesses the problem and attempts to provide a solution. The solution is called a "Royal Opinion", such that he initiates the project, then others actually implement it (Royal Speech 1996). In this case, it is the Bureau of the Royal Household that supervises the administration of schools and other establishments under the jurisdiction of the Private Education Commission to ensure that they comply with His Majesty's guidelines and ideas for full-cycle and life-long education. The Bureau of the Royal Household and the Ministry of Education brought the following challenges to the attention of His Majesty, in the hope that he might offer a possible solution.

- There are vast numbers of remote communities and towns where there is neither a budget nor instructors to provide adequate support for a formal classroom.
- There are large numbers of the population who are unable to find success in the academic school system or drop out of formal education altogether.

In search of a solution, King Bhumibol referred to information with which he was familiar. Throughout his lifetime, he has relied on communication technology. He became interested in satellite communication when the Communications Authority of Thailand used a satellite for international communication in 1967. Since 1968 King Bhumibol has extensively studied, researched and experimented with radio communication technologies because he believes that communications are vital to the development and maintenance of national security in the modern world. Consequently, he always travels with such equipment so that he is always on alert for news of natural disasters and hardships and can immediately draw up relief plans for victims. Furthermore, King Bhumibol is quite knowledgeable about computers. He was the first King in the world to have used a computer to create New Year cards and was also the first person in the world to develop a computer software program for use with an ancient Indian alphabet, the Devanakhri (Distance Learning Foundation 4).

Additionally, King Bhumibol used solutions derived in the West. The trend of education in developed and industrial countries shows that local education will be linked to worldwide education in the future by way of modern technology. Distance learning via satellite was a system already utilized within the United States in an attempt to ensure equal educational opportunities. The system provides access to education for all people in an economically efficient and convenient manner. From this base of information, a Royal Opinion was formed. His Majesty recommended the implementation of a distance learning system of education within the school systems of Thailand. Its objectives are as follows.

- To enhance the quality of education and develop human resources at the secondary levels and promote educational evolution across Thailand.
- To decrease personnel shortages and ease budgetary constraints.
- To improve educational management so that educational quality in both urban and remote rural areas will have minimal differences.

4.1.4 The Royal Project

As Grand Chamberlain of the Bureau of the Royal Household, Mr. Kwankeo Vajarodaya suggested the creation of a distance learning system for the continuous improvement of education in Thailand. The system consists of a radio-television station located at Wang Klaikangwon School that broadcasts various subjects from M1 level (Grade 7) to M6 (Grade 12) between the hours of 8:00 a.m. and 8:00 p.m. via satellite. The Vocational College at Wang Klaikangwon offers courses in home economics, mechanics, electronics, and computer science, among others. The Rajamangala Institute of Technology at the Wang Klaikangwon Campus provides higher education courses at the university level. In summary, the distance learning project is defined by the following precepts:

- Advancement in broadcasting technology, especially by the use of a satellite, enables the transmission of vast amounts of information over large distances from one uplink location to another regardless of terrain; and
- Broadcasting instructional material via satellite will allow any student to study the courses wherever they live while the instructors conduct the lecture from the classroom on campus.

Mr. Kwankeo Vajarodaya dedicated the project in honor of His Majesty, on the occasion of the 50th Anniversary of His Accession to the Throne, and as a tribute to the late Princess Mother. Additionally, because the undertaking originated from the Royal Opinion of His Majesty, it achieved the status of a Royal Project, thus serving several purposes. First, His

Majesty is actively involved in the augmentation and progression of the system throughout the country, ensuring its success and benefit to the people. He has provided advice on academic improvement and equipment to students and the teaching staff. For example, he recommended that there should be a video player in each classroom to record difficult subjects such as science, mathematics and foreign languages for students unable to keep up with the lecture. He also recommended strategic placement of the television sets, eliminating any reflection of light on the screen. In terms of scheduling, he requested that class schedules be sent to remote schools before the start of each term to ensure readiness of teaching equipment and preparation for effective teaching and learning processes.

Additionally, because the acquisition and operation of the necessary technology is extremely expensive, donations are essential to ensure the continued success of the program. His Majesty granted an initial fund of 50 million baht, which was bestowed by the Telephone Organization of Thailand to carry out the project. The Organization also helped with the installation of fiber-optic networks stretching from the television station at Wang Klaikangwon School at Hua Hin to the earth station on Rattanathibet Road in Nonthaburi Province, and provided four telephone lines free of charge for the schools to use in teaching and learning. The Ministry of Education allocated a budget of 125 million baht in 1996 to finance the project at the initial stage and another 216 million baht in 1997. Subsequent budgets to support the system have been and will continue to be allocated on a yearly basis.

A number of other companies, organizations, and individuals have also contributed to the project funding. For example, the Shinawatra Group donated equipment worth 20 million baht for the school station and establishment of a record library and collection system. The Provincial Electricity Authority supports electricity service at the station. The purchase of satellite signal receivers for use at schools participating in the program was possible because of monetary donations from companies and private individuals. In addition, the Supreme

Command Headquarters and the Royal Thai Army cooperated in several areas – personnel, the installation of necessary equipment for school networks nationwide, and the completion of a follow-up study of the project throughout the year (Distance Learning Foundation 11).

Figure 4-1: While visiting the Phimai Phittayakhom School, a recipient of the distance learning broadcast, Paul interacts with a Wang Klaikangwon teacher under the supervision of D.L.F. Chairman, Mr. Kwankeo Vajarodaya.

4.1.5 The Distance Learning Foundation

As a result of the overwhelming cooperation from the private sector, the managing team decided to set up the Distance Learning Foundation to facilitate the operation of the project. Mr. Kwankeo Vajarodaya was elected Chairman of the Foundation and the headquarters are located at the Department of General Education, Ministry of Education in Bangkok. As of 1999, 700 of the planned 2,000 receptor schools were equipped with distance learning equipment. Also, an increase in the number of schools receiving the equipment has promoted enrollment as well as created an opportunity for equal education. "The Foundation is determined to carry on the mission of providing efficient distance learning program by utilizing various media technologies and such devices as satellites, fiber optics, radio, and the internet network" (Distance Learning Foundation 12).

4.1.6 *Analysis of the Distance Learning Project*

Through our detailed investigation of the distance learning project in Thailand, we found that in general, the satellite system has many benefits in comparison with the current system.

Current System:

1. No standardization exists in the current system. Each school has its own teachers, each with different styles of teaching, and it is thus difficult to maintain a uniform standard of education.
2. It is necessary to send an instructor to remote areas in order to ensure that students who want an education receive one.
3. Each school has its own evaluation criteria. Consequently, the development of education nationally is difficult to evaluate by comparison of different school systems.
4. It is difficult to provide an equal education to every citizen, especially in remote areas.

Satellite System:

1. It is possible to increase the effectiveness of the instruction process because thousands of students can learn from one experienced instructor simultaneously.
2. The system eliminates the problems of sending an instructor to remote areas, resolving difficulties surrounding safety, accommodation, and unwillingness for relocation.
3. The program allows for easy maintenance of the consistency of instruction and standardization of educational materials and tools throughout the country.
4. The Satellite Direct Educational Television has been implemented and proven effective for educational and business purposes in the United States, Japan, Korea and India.

The second problem arises in the case that the receptor school does not receive live broadcasts. Although each classroom and student has the option of recording different courses and viewing them at their leisure, there is no replacement for concrete student-teacher interaction. The process of learning is most effective when the student is able to exchange thoughts with other students and communicate freely with the professor. A student cannot ask questions of a television screen.

Figure 4-1: Televisions and satellite equipment have been recently installed in the Phra Parityatitham Religious School, enabling its students to receive educational broadcasts.

Concerning this matter, His Majesty stated in his address to the people on the occasion of his birthday in 1996 that

> As for the means of creating good people, there is education. In the past, the quality of education and the rate of literacy was rather high, compared with other countries, but nowadays, it has dwindled because, while the population has augmented, schools or the teaching staff have, in comparison, diminished. One could dispute that, nowadays, we have high technology that offers better means of expanding schools and disseminating knowledge. But there is nothing that can replace an education that develops knowledge and edifies the mind...Teaching by using these advanced media including high technology will be very difficult to bring about the cultivation of the mind and character; nothing will ever replace teaching by human teachers... Thus, advancement and change in the country and the Thai society does not necessarily mean a change for the better except in ways that must be found to transfer knowledge by using textbooks or curricula that are adequate for upbringing humans to become human (King Bhumibol Adulyadej December 1996).

From this statement, it is our understanding that King Bhumibol suggested the distance learning program as a temporary institution for the immediate improvement of Thailand's educational system. As the King, he has the ability to bypass the lengthy bureaucratic processes. He also has almost unlimited financial resources. The people of Thailand trust in the Royal Opinion and are therefore readily willing to donate funds or resources to his efforts. Under these circumstances, the program is finding great success. A similar program would have taken the Ministry of Education years to establish without His Majesty's initiation. However, in the near future, it is the responsibility of the government to ensure that all people of Thailand receive a challenging and fulfilling education.

Figure 4-2: A teacher lectures at Wan Klaikangwon School in front of students and a video camera. The lecture will be broadcast by satellite to over 2,000 schools throughout Thailand.

4.1.7 Recommendations for the Distance Learning Project

From this analysis, we can make several recommendations that we hope could improve the system of distance learning and also the educational system of Thailand. First, it is absolutely necessary for the Foundation and the Ministry of Education to recognize that the system should only be a temporary solution to the problems of teacher insufficiency. Time and money must be appropriated by the related government agencies to ensure that a basic

It is also interesting to note that some of the problems experienced are also evident in other countries. As American students, we are familiar with the challenges of our own model of education. For example, many educators and government officials want a standardized system throughout the country, in order to ensure scholastic equality. Standardization will make it possible to devise evaluation criteria for comparing different school systems and assessing the effectiveness of various teaching styles.

It was our goal during the site visits to acquire an objective perspective on the project, though we found this extremely difficult. As expected, most of the people we encountered were reluctant to make any negative comments towards the system, since His Majesty supported it. Therefore, it was necessary for us to investigate many sources. Fortunately, we were able to receive feedback from one English-speaking teacher at the Phimai Phithayakhom School. We asked her to relate any improvements she thought necessary to enhance the quality of the students' education and her ability to effectively incorporate the distance learning system into her own classroom. Through this discussion, we discovered two problems that deserve attention.

The first is in the scheduling of classes. The distance learning foundation endorses the system's capability for interactive learning through telephone and internet connections within the classroom, such that students of the receptor school can interactively ask questions of the broadcasting teacher. The course is considered a "live" broadcast under these conditions. Unfortunately, there are some heavy restrictions. According to the Phimai Phithayakhom teacher, in order to participate in the live classroom, the receptor school class schedule must coincide with that of the broadcasting school. She tried to explain that although the system promotes consistency and equality of educational tools, it is difficult to synchronize schools of such different sizes and geographic locations. Synchronizing the class schedules also detracts from her capabilities as a teacher in creativity and guidance.

education is provided to all students under their jurisdiction. As previously noted by His Majesty, although the system of distance learning is finding success, no technology can replace the quality of student-teacher interactions. If the educational system relies on distance learning as a permanent method of basic education for remote and rural areas, lack of development and regression will surely arise in the future, especially in comparison with other industrialized countries.

Fortunately, if educational reforms occur, the equipment used for distance learning can be modified to further enhance the quality of learning. Foremost, it is necessary to hire more teachers who are proficient in basic language, reading, writing skills, science and mathematics. As a supplement to the formal education, distance learning technology can offer a wider range of advanced courses than they would otherwise not receive. For example, as attendees to the *Training Program on Distance Learning Technology and Management*, we were fortunate to meet with many educators and ambassadors of other Southeast Asian countries who are interested in expanding their educational systems with a similar distance learning program. Through international satellite broadcastings, Vietnamese, Chinese, Japanese, English, and other languages can be taught to students all over Thailand. The study of language is an advantageous tool in the fields of communication, business, and education in the modern world. Similarly, because each Thai school is connected to the Internet, it is possible for students to explore various interests and communicate with others all over the world. If the international satellite system, Internet and course broadcasts are intertwined, then a valuable resource will be available to all students. The possibilities could be endless for the continuation of education and students of all ages would be allowed to facilely explore interests and complete their educational goals.

As for the implementation of the distance learning and satellite system in other countries, the process may be difficult. There is a vast amount of equipment necessary for proper

operation. We were extremely impressed by the various studio systems, editing equipment, and recording apparatus in addition to the computers, cameras, and televisions necessary for the broadcasting school alone. It would be very difficult for an underdeveloped country to allocate the funds necessary for the installment of such equipment. As a constitutional monarch, King Bhumibol is the most prominent beneficiary of charity from both companies and individuals. Thai people are more than generous in their contributions towards His Majesty's Royal Projects; therefore, the projects find immediate implementation. The existence of a monarchy is a great advantage to the Thai people in this respect. As for the distance learning program, the advantages and disadvantages as we see them have been stated. Additional investigation would be necessary to evaluate the possible success of the distance learning system to meeting the needs of the people in the interested country.

In conclusion, we were left with a few concerns about the future of the project. First, we noticed that a substantial amount of funding was provided by government agencies, such as the Ministry of Education and the Telephone Organization of Thailand. Since these are not private entities, we can assume that they have a finite amount of money in their budget to fund certain projects. If these organizations have a limited budget and they proceed to donate such generous amounts of money to a project initiated by His Majesty, *are other projects deferred due to a lack of funding*? If there are other methods for alleviating the funding problem, *do the Royal Projects prevail simply because they were suggested by the King*? We have previously noted that the Royal Opinion is based on intense research and examination. Although His Majesty has even been referred to as an "expert" on rural development, *is there a way of assessing the cost benefit of the initiated projects in comparison to other alternative solutions*? These questions are directed towards the Distance Learning System of Education, but due to their general context, they can be asked of all of our investigations.

4.2 The New Theory

Figure 4-1: Location of the Huai Sai Royal Development Study Center.

Since his accession to the throne on May 5, 1950, King Bhumibol has been determined to fulfill his coronation pledge to "reign with righteousness for the benefit and happiness of the Siamese people" (Royal Development Projects, March 1999). In this effort, His Majesty has played a significant role in the initiation and implementation of a number of projects aimed at Thailand's development. Underlying each of these projects is King Bhumibol's concept of self-sufficiency. This philosophy of self-reliance is perhaps most evident in the implementation of the New Theory, a method which will ultimately allow rural farmers to achieve self-sufficiency.

Figure 4-2: Khun Prawit Tabitmorn points out several different crops grown in the Princess Mother's Garden.

4.2.1 Huai Sai Royal Development Study Center

Our first-hand investigation of the New Theory project began with a visit to the Huai Sai Royal Development Study Center in the Cha-am District of Phetchaburi Province. The land used for this project site was donated by the Princess Mother; consequently, it is also known as the Princess Mother's Garden. The center at Huai Sai has three major uses: to be an academic center, to serve as a living museum for local farmers, and to help farmers with the successful implementation of new agricultural processes. While we were there, Khun Prawit Tabtimorn graciously gave us an in depth tour of the facilities, including two experimental New Theory plots, as well as some other areas of agricultural research. The techniques used at this site are all His Majesty's ideas; some parts have been modified and other ideas incorporated, but the basis for all the agricultural experiments occurring at Huai Sai is in the King's concepts.

4.2.1.1 The New Theory

To thoroughly understand the potential impact of the New Theory, it is important to have a good comprehension of how this philosophy works. First, the New Theory is not a disjoint project; all of His Majesty's projects have an undertone of self-sufficiency. The New Theory

projects are a major component of this self-reliance idea. The concept of sufficiency is a glimpse into the past Thai ways of living, which includes strong Buddhist values. Major points of both sufficiency and the New Theory are hard work and unselfishness. In order for a family to successfully manage a New Theory farm, they have to be willing to work hard, be less selfish and be supportive of one another throughout the community. The King's goal is to help the Thai people look back towards the agrarian society that was once prosperous and to ensure that they do not become obsessed solely with opening capitalist markets. If the people are able to look to what has worked for them in the past they will be able to create an agrarian based society that is entirely self-reliant. Of course, this process will be slow and will require a vast amount of effort from the Thai farmers.

The actual implementation of the New Theory is particular in its specifications, although His Majesty stresses that these are only guidelines and depending upon the location and available resources, the formulas may vary. A listing of the Office of the Royal Development Projects Board's guidelines for the New Theory can be found in Appendix J. The research center at Huai Sai is home to two experimental New Theory plots; one implemented to the exact specifications of His Majesty's original idea and one altered based on the conditions in Phetchaburi province. The first plot adheres to the 30:30:30:10 formula that the New Theory is based on; this is to say that the area is divided into four sections, each taking a percentage of the land, as shown in Figure 4-1.

This first plot is based on rainwater only; this means that there is no irrigation, no outside water source. This posed a bit of a problem for the success of the plot. In addition, the slightly elevated land occupied by the demonstration area has been detrimental to the first New Theory plot's success.

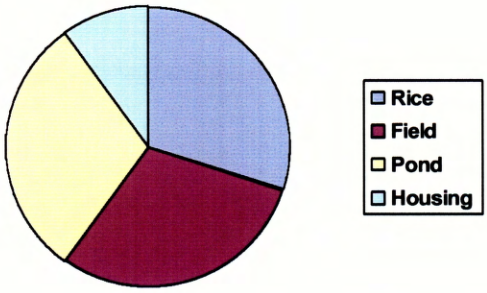

Figure 4-1: New Theory Land Allocation.

The second New Theory demonstration accounts for these deficiencies. Within this second plot, there is access to an external water source; this has created a number of benefits. Besides having more land for planting because there is no need for a pond area, this plot also has the ability to have more than one harvest per year because it does not depend on rainfall as the sole source of water. This ultimately allows for a greater surplus of crops, and thus the possibility of increased profits from market sales. In addition to the external reservoir, the second New Theory plot consists of areas for a vegetable garden, a rice field, fruit trees, a chicken coop, and living quarters. A hard working family chosen by the project site coordinators maintains this second plot. In general, it will require a minimum of three people to manage a New Theory site. It is important that the family has strong managerial skills as well as the desire to gain self-sufficiency, otherwise the New Theory concept will be difficult to implement successfully.

Figure 4-2: Khun Prawit Tabitmorn explains the 30:30:30:10 land ratio characteristic of the New Theory plot.

The demonstrations at Huai Sai are only the beginning of His Majesty's New Theory concept. The entire idea consists of three phases, of which the Huai Sai plots depict only the first. The goal of this initial phase is to enable the individual farmer to achieve self-sufficiency. The second stage of the New Theory implementation involves the consolidation of a group of farmers to form cooperatives. In coordination with the government, the King's foundation, and private enterprises, these small groups perform a number of agricultural, educational, and social activities that benefit the entire community. The third, and final, phase involves further development of the small cooperative's activities. During this stage, a successfully organized cooperative will approach both credit and fuel sources with aims of establishing a rice mill and a small store. A complete description of the New Theory stages according to the Chaipattana Foundation is found in Appendix K.

4.2.1.2 Vetiver Grass

Deeply tied to His Majesty's sufficiency theory is the use of vetiver grass. Vetiver is a native Thai plant that has been used in the past for both medicinal and thatching purposes. More recently, however, it has been used for erosion prevention, conservation of soil

moisture, and mulching. At the request of His Majesty, the Huai Sai center makes extensive use of vetiver grass. Because of its economic advantages and ease of cultivation, vetiver grass has the ability to be used throughout Thailand. At the Huai Sai site, the grass is used to prevent soil erosion in areas surrounding ponds, to conserve the moisture in the soil, and as mulch in the growing of other plants. For example, in one area at the Huai Sai site, cashew trees were planted, but the area was not conducive to their growth, so Khun Prawit Tabtimorn decided to use vetiver grass. The grass was planted every six meters along with some other plants, which were fertilized with the vetiver mulch. After some time, all the plants, including the cashew trees, had grown successfully. A second instance of vetiver grass usage at Huai Sai is in a slightly sloped area where fruit trees are planted. Here the vetiver grass helps to control soil erosion that would otherwise occur during each rainy season. A further discussion of the use of vetiver grass throughout Thailand can be found in Appendix L.

Figure 4-1: One use of vetiver grass is terracing.

4.2.1.3 Other Experiments

In addition to the New Theory and vetiver grass demonstrations and experiments found at the Huai Sai site, Khun Prawit Tabtimorn has also undertaken a number of other agricultural experiments. One example is the growth of a flower that is naturally found in Northern Thailand; Khun Prawit has made it possible to grow this flower at Huai Sai in

Southern Thailand. At first people said he was "crazy" and that he would be unsuccessful, but it worked out quite well. The flower may not have the extremely vibrant color of the Northern variant, but it is still able to provide farmers with added income from its sale.

Another important aspect of the Huai Sai experiments is the agro-forestry demonstration. The area currently occupied by this forest was once entirely barren; it now holds a large variety of trees and other types of vegetation. This particular forest is composed of three types of trees: fast growing trees, economic trees, and fruit trees. Additionally, in areas where sunlight is allowed in, medicinal plants are cultivated. The key to this type of agro-forestry is to maintain a high degree of moisture at all times; this is accomplished by creation of ponds and streams and by more traditional forms of irrigation. Prior to this experiment, farmers would normally cut all of the trees and then plant the soil. In this research, however, the ecology of the soil is maintained; plants are slowly, but continually added until the large trees are able to produce. This ensures that the farmer will have enough for survival while awaiting the growth of the larger trees. According to Khun Prawit Tabitimorn, this is the best way to reforest a degraded forest because you still have some of the natural ecology and are able to add medicinal and other plants that will provide subsistence throughout the process. A major goal of this portion of Huai Sai's demonstration center is to teach the area's farmers that they must take care of the forests surrounding them if they hope to be able to reap benefits from the trees in the future.

An additional component of farming demonstrated at Huai Sai involves crop management. This includes such topics as crop rotation, soil rehabilitation and pest control, each of which are important for successful implementation of the New Theory and for agricultural farming in general. To start, soil maintenance and rehabilitation are integral aspects for a successful farming operation. As previously discussed, vetiver grass can play a significant role in maintaining soil moisture; also helpful in soil maintenance is the

cultivation of plants such as mung and sword beans. The beans are not grown for their nutritional value but rather to act as a fertilizer for the soil, with aims of keeping the soil filled with nutrients for the crops that are cultivated at other times during the year. This concept ties directly into crop rotation.

Another method for maintaining the integrity of the soil is to vary the species of plants that are being cultivated. In addition to helping with the fertility of the soil, this type of crop rotation is also beneficial in pest control. Varying the vegetation and cultivating plants which are unattractive to insects, such as lemon grass and even vetiver grass, provides a relatively successful, natural defense against insects. In addition to these methods, a natural pesticide can be created from a liquid generated by *neem* trees. The seed of the tree is ground to create a concentrated liquid; 700 grams of this concentrate is then combined with 20 liters of water to produce a natural insecticide. With the application of these additional measures, the staff at Huai Sai is generally able to maintain the soil's fertility and to manage any significant insect problems naturally.

Each of the experiments at Huai Sai has a common purpose: to provide the local farmers with living resources and a hands-on learning capacity. This, of course, is a goal that is continually evolving. As times change and new experiments are conducted, the farmers will have to adapt to the resources around them. His Majesty's initiatives as they are being acted out at the Huai Sai Royal Development Center are a large part of this growth and adaptation.

4.2.2 Analysis of the New Theory

Throughout our investigation, we found two problems in the New Theory concept. First, not all farmers are interested in implementing His Majesty's ideas for sufficiency. Most Thai people are set in their ways, especially in the area of farming strategies. As a country whose economy has historically been based on agriculture, farmers feel confident in their own methods and those which have been passed through the generations. They are reluctant to

change despite His Majesty's recommendations. Fortunately, as the New Theory farmers are finding more success, others are intrigued by the new ideas. Those who refuse to explore the new ideas do not pose a problem to the success of the program, except that the community will find greater prosperity if more people utilize the theory.

The second problem questions the continued success of the New Theory. The goal of the New Theory of agricultural development is to provide rural farmers with a method for achieving self-reliance. The attainment of self-sufficiency requires patience and hard work. In order for one farm to prosper, many years of crop cultivation and continued experimentation with different plants are necessary. Otherwise, the family will not reap the maximum benefits of the New Theory concept. From our perspective, this has been a viable farming method for use in rural Thai villages.

Figure 4-1: A woman tends to the crops at the Huai Sai Royal Development Study Center.

The New Theory concept was conceived during the 1970s, a time when the exportation of agricultural products was a major portion of Thailand's economy. Until recently, agriculture has been a leading source of profit. In the 1990s, when Thailand's economy became focused on manufactured exports rather than agricultural, the importance of the Thai farm decreased. There are several explanations for this trend. As the need for skilled

employees in industry increases, educational systems are improved in order to instruct the new workers. With the increased availability of jobs in the city, the younger generation of farmers has slowly abandoned rural Thailand in search of greater income. After the economic crash in 1997, many returned to the farm, though many were run down from neglect. It was during this time that His Majesty further stressed the use of the New Theory in order to achieve sustainability.

At the present time, the New Theory farmers are finding success in their efforts. Most families have increased their yearly income and, in general, have greater profits than those not using New Theory techniques. During many of our site visits, we encountered an issue affecting the future of all Thai farms. With the extended availability of secondary education for rural Thai people, desire to remain on the farm is dwindling. Members of the up-and-coming generation are moving towards the cities to further their education and work in industry. This leaves the question of *who will continue the farming tradition*. With this uncertainty, the usefulness of the New Theory in the years to come is also in question. The King's New Theory can only be successful if there are people willing to partake in its implementation. Convincing farmers not yet using this method of its worth will be a relatively easy barrier to overcome in comparison with persuading an uninterested population to continue farming. The success of the New Theory is dependent on both its use by farmers and the overall continuation of an agrarian base in rural Thailand.

4.3 Water Resources

Water management is a prime interest of His Majesty the King because he realizes that all life is dependent on this natural resource. Three of the projects we studied were concerned with the King's initiatives in this field: the Pa Sak Storage Dam, Monkey Cheeks, and Royal Rainmaking. Each project is tied to King Bhumibol's goal of sustainable

development and illustrates issues important for the future of development projects in Thailand.

4.3.1 Pa Sak Jolasid Storage Dam

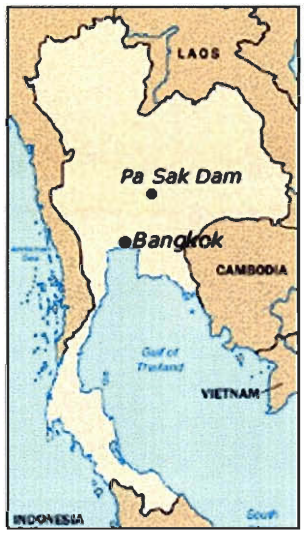

Figure 4-1: Location of Pa Sak Jolasid Storage Dam.

The Pa Sak Jolasid Storage Dam spans a location of the Pa Sak River at Ban Kaeng Seua Ten in Lop Buri Province and Ban Kam Pran in Saraburi Province. The story of the project and an analysis of an issue central to the project are presented.

4.3.1.1 Project Information

Figure 4-1: View of Pa Sak Jolasid Storage Dam.

The Pa Sak River Basin posed two conflicting problems to His Majesty and the Royal Irrigation Department. Due to the long, narrow, feather-like shape of the Pa Sak River, the

regions around it were susceptible to both water shortages and flooding. A solution to this problem was studied in 1965 but action was not taken until decades later following the King's revival of the project. The entire project is scheduled to be completed in 2005 and will ameliorate both problems of flooding and water shortage, but not without an impact on the local environment.

The Pa Sak River is a tributary of the Chao Phraya River. It extends from the Phetchabun Mountains in Loei Province to Ayutthaya, where it joins the Chao Phraya River. Due to the characteristics of the river, the area surrounding it cannot absorb or retain water well. This makes the agricultural, industrial, and residential communities that depend on the Pa Sak River more susceptible to water shortages. In addition, population growth has placed an increased demand on the river. On the opposite end of the scale is the inability of the river to handle the influx of water during the rainy season. This results in flooding of local agricultural areas, the lower Chao Phraya River Basin around Bangkok, and other metropolitan areas. The 120,000 rai (48,000 acres) of flooded land in three districts of Lop Buri and one of Saraburi contain 16 temples, 14 schools, 2 train stations, 8.335 km in two roadways, 24.325 km of railway, and 33 archaeological sites.

In 1965, the Royal Irrigation Department conducted a feasibility study for construction of the Pa Sak Storage Dam. Due to high investment costs at the time, the project was suspended after completion of the study. In 1989, however, King Bhumibol revived the project by suggesting that a second feasibility study be conducted, since the benefit to the people might outweigh the cost. The new study was consistent with the previous in terms of the feasibility of the dam, but with royal support the project began in earnest. Construction of the dam started in May 1994 following the new feasibility study and was finished in September 1999. The full story behind the project is not so straightforward, though. The influence of His Majesty the King certainly removed the bureaucratic barriers to the project

but there were other concerns that needed to be addressed in the construction of this gargantuan storage dam. Principally, local villagers were already using the 114,119 rai (45,647 acres) of land required for the construction of the reservoir.

There were three options considered for the purpose of reducing the water shortage problem in the Chao Phraya Basin, relieving the water shortage for local agricultural, industrial, and consumption needs, and preventing flooding in the Pa Sak and southern Chao Phraya River Basins. The first option was a small-scale project capable of storing 68 million cubic meters (Mm^3) of water. The second, medium-scale option could store 360 Mm^3, but the large-scale, 960 Mm^3 capacity storage dam was ultimately chosen over both the small and medium scale options. To get an idea of the size of this project, consider that the total length of the dam is 4,860 m with a maximum base width of 187.4 m. The dam extends 31.5 m vertically and is composed of three structures - a service spillway, river outlet, and auxiliary spillway. The combined maximum discharge capacity of these three structures is 4,045 m^3/s, distributed 3,900 m^3/s, 80 m^3/s, and 65 m^3/s, respectively. At maximum capacity, the reservoir can store 1,000 Mm^3 and the surface of the water at this level has an area of 170 km^2.

Figure 4-2: During the dry season, the Pa Sak Jolasid Dam provides an ample water supply to the provinces of Saraburi and Lapburi. Additionally, it helps to prevent flooding in Bangkok during the rainy season.

In order to build the dam and reservoir, it was necessary to relocate 7,700 families. Government regulations provided resettlement compensation in several forms but there was still disagreement from roughly 10% of the villagers. Some protested and refused to leave, obstructing construction of the dam. This, we suspect, was due to the Thai resistance to change combined with a lack of understanding the benefit to the country. The villagers' reluctance to move is understandable, since relocating would mean starting over - living in a new environment, starting a new career, and generally adjusting to a new situation. Compensation was provided in three forms - land, housing, and resettlement funds. Since the dam has a capacity greater than 100 Mm^3, regulations stated that land compensation should adhere to the following plan for each family.

- If they own 10 rai, they will be provided with 11 rai.
- If they own 5 to 10 rai, they will be provided with as much.
- If they own less than 5 rai, they will be provided with at least 5 rai.

Housing, electricity, water supplies, and a basic infrastructure were provided for the relocated community. Each family was compensated between 170,000 and 940,000 baht for their land, totaling 3.284 billion baht. The total amount of land acquired for the Pa Sak Storage Dam Project was 16,151 hectares, costing 8.521 billion baht. Those who were reluctant to relocate eventually willingly cooperated, accepting the rationale that the dam would benefit the country as a whole. All the villagers have been fully compensated for their land and now enjoy the benefits from the reservoir. To assist the villagers in their new communities, short courses were offered on animal husbandry, soil and water conservation, and integrated farming techniques. Production and marketing information was also provided in addition to encouraging cooperation with industrial plant development.

The dam was completed in September 1999 and its effectiveness in abating floods was proven during the last few months of the rainy season. As part of the project, the Pa Sak

River flow capacity was doubled to 1,600 m^3/s. However, the project is not finished. Still to come is the irrigation system. This phase of the project is scheduled to span five years and finish in 2005, completing the dual role of the Pa Sak Storage Dam Project.

The Pa Sak Storage Dam Project provides the following benefits.

- A more reliable source of water for consumption in various communities in Lop Buri and Saraburi Provinces.
- A source of water for agriculture for over 26,720 hectares of newly irrigable areas in Lop Buri and Saraburi Provinces.
- A supplementary source of water for 352,000 hectares of the existing irrigation projects in the lower left bank of the Chao Phraya River.
- Flood mitigation on both banks of the Pa Sak River in Lop Buri and Saraburi Provinces and lower areas.
- A source of water for industry in Lop Buri and Saraburi Provinces.
- A large scale fresh water fishery source.
- An alternative water source to alleviate shortage of water for consumption in Bangkok
- A significant recreational area.
- A boost to the economy of Lop Buri and Saraburi Provinces.

The dam cannot be used for the generation of hydroelectric power since the water head amounts to only 30 m.

In our tour of the dam and its facilities we were shown the state-of-the-art control room. There are seven monitoring stations along the river that exchange information about the depth and rainfall. The status of all aspects of the dam are monitored and can be viewed from inside this control room which houses several computer stations, surveillance camera monitors, and two electronic status wall panels.

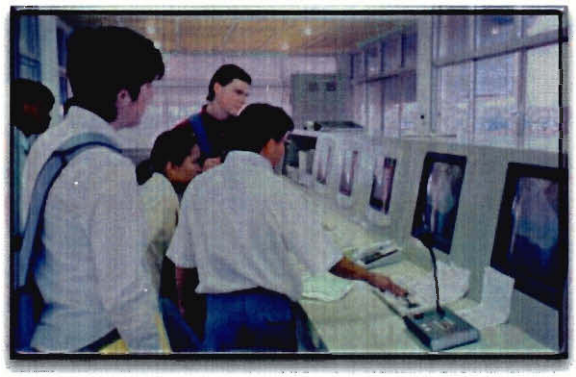

Figure 4-3: We were able to survey the technology used to control the operations of the dam.

The total cost for the project is roughly 23 billion baht, roughly split 15 billion for the environmental impact assessment and 7 billion for construction. Funding was provided by the local and national government budgets; the King provided no money for this project. As is the case with many projects, the Pa Sak Storage Dam Project was initiated by the King and passed on to other organizations. The Royal Irrigation Department submitted their preliminary study to the Cabinet, which approved the project and set the RDPB as the coordinating foundation. The Royal Irrigation Department was authorized to begin construction in 1994. In summary, at the cost of relocating thousands of families and excavating 28 archaeological sites, the Pa Sak River Dam Project has alleviated flooding and lessened water shortages.

4.3.1.2 Analysis of the Pa Sak Storage Dam Project

The story behind the Pa Sak Storage Dam contains an issue about the King's influence that has emerged in our investigation of several other Royal Projects. In the original study of the dam, it was determined that the project was feasible but not practical at the time due to cost. Several decades later, the King revived the idea and recommended a new study. The study is completed, confirming the feasibility of the dam, and construction begins without the

emergence of funding issues. If this was an isolated occurrence of this phenomenon, the change in assessment could be attributed to a stronger economy or a pressing need to implement the project. The project was shelved for three decades, though, and it was only revived because King Bhumibol saw the need for it. His Majesty has a powerful influence in shaping the course of Thailand's development. His recommendations are trusted, though, because he has decades of continuous experience.

4.3.2 Monkey Cheeks

Figure 4-1: Location of the Monkey Cheeks Project we visited.

The Monkey Cheeks Project we visited is located in Chumporn. Our visit provided us with technical information on the project as well as invaluable insight into the understanding of the social and political situation surrounding the Royal Projects.

4.3.2.1 Project Information

Nominally, this is the most clever of the projects, for it provides a conceptual metaphor for His Majesty's flood-relief hydrology project. As explained by His Majesty, the system is analogous to the following:

"A monkey will, if you throw one a banana, open its mouth and swallow the banana whole and keep it in his cheek. A monkey can keep almost an entire bunch of bananas inside its cheeks. Only later will the monkey take the bananas out, chew and swallow them" (Concepts and Theories 172).

In operation, the Monkey Cheeks Project works to eliminate flooding by providing a catchment area where surges of water can be stored. At the site we visited, the most successful of the Monkey Cheeks implementations, a canal was dug extending to the sea to provide a channel for release of the stored water. This canal flows past the approximately 2.5 km^2 lagoon area used for storing water. By means of water gates, the canal and water retention are linked. When heavy rains cause an influx of water to the river, the water gates to both the canal and the adjoining monkey cheek area are opened so that the excess water can be drained from the river to the sea. Flooding is caused, of course, when the rate and volume of the flow of a river become abnormal. The normal flow of a river can be measured as the amount of water that passes through a given cross-section per unit time. In order to maintain the equilibrium of the flow, the two - area and rate - must be inversely proportional. Flooding occurs when the increase in water exceeds the rate of outflow. Mathematically speaking, if the rate remains the same, the area must increase to handle the additional water. When the increase in area exceeds the height of the river banks, flooding occurs. The Monkey Cheeks Project provides additional area for the water to flow into, safely storing the excess until equilibrium is eventually reached. The water gates can then be closed to store the water in the monkey cheeks for when it will be needed. When the dry season comes, the level of the water in the river will be less than it was before and the water gates can be opened to allow the monkey cheeks to empty into and resupply the river.

Figure 4-1: A "monkey cheek" reservoir beside the canal stores water during the dry season.

The need for a method to alleviate the flooding of Bangkok was realized 35 years ago when the canal later employed in this Monkey Cheeks Project was started. Funding issues stalled the original proposal, which was revived and modified by the King in 1997 when it was brought to his attention that the area was suitable for a Monkey Cheeks. An excerpt from His Majesty's Royal Speech on December 4, 1997, expressing his reasoning behind this particular Monkey Cheeks Project may be found in Appendix M. It provides a good summary of the project, but in brief, the King saw the benefits of spending the money for its immediate completion in order to prevent further flood relief expenditures. Shortly after the project was completed, its efficacy was proven by averting potential floods due to tropical storm Linda.

This Monkey Cheeks Project started small, an approach that is the King's manner of demonstrating to the local community that such an idea was capable of solving the flooding problems. The original water gate was joined by several others as it expanded. In 2001, the enhancements to the main water gate are scheduled to be complete, allowing it to channel 460 m^3/s of water into the canal. Combined with the 400 m^3/s capacity of another water gate, the 860 m^3/s drainage total safely exceeds the 800 m^3/s required for complete flood relief. Future plans for the project include a recreational area, additional canals, and an expansion of the lagoon to 5 Mm^3 from 3 Mm^3 in order to create a retaining basin.

Funding was provided by the King's Chaipattana Foundation. Although the Foundation may never receive direct reimbursement from the government, donations to the King and the Foundation may be seen as effective compensation. The improvements mentioned previously will be funded by the Department of Irrigation.

The swamp area used for the Monkey Cheeks Project has been public property since 1932, making it readily available for use from a legal point of view. While there was no opposition to its creation, there have been social impacts affecting the villagers living near the lagoon and the canals. The implementation of this project didn't require relocation but those living near the canals and swamp were told that they would have to obey certain regulations needed to maintain the effective operation of the project. The regulations require, for example, that houses near the canal must have open foundations; concrete blocks around the foundation are not allowed since they would block the waterway. Large-scale projects are prohibited along the river area which is zoned for low density occupation. Houses and small shops are permitted but nothing on the scale of a shopping center, for example. The regulations are not intended to suffocate the livelihood of the people, as the villagers are certainly allowed to grow trees, have small plantations, and lead a normal lifestyle. The people along the canals, however, must be educated on what is acceptable and what is not for the larger benefit of the community. One of the project workers we interviewed put it in the following manner: "Something that you should know about this project is the people who live around the swamp, they have to understand that this project is being done to solve the problem for the people who live in town. So the people outside the town have to understand why they have to listen to what the King is trying to do" (Thongchai).

Figure 4-2: A swamp area designated to control flooding during the rainy season.

More work has to be done to teach the people how they can live in harmony with the project. The laws are not yet in place but they are expected to be passed by April. Until then, regulations are in place that work in conjunction with the influence of the King's involvement in the project. The influence of the King has a predominant impact, though, because the Thais put more faith in their King than in their government. As mentioned previously, the King started the project on a small scale to show that it would work. Seeing its success would help the people understand why it was necessary. The project was implemented in such a fashion to gently convey the message that this is an effective manner to deal with floods. The methods used previously were short-term limited-scope survival techniques. Khun Thongchai Roachanakanan put it in the following manner: "Some people don't understand how these problems can be solved. And some people still have very old ideas about how to solve the problem by filling ... [lift] up the land and put the house up on the hill. I think you will see how the people solve the problem by moving the construction materials to stop the water to protect their lands, their farms. You cannot solve the problem by making the land higher" (Thongchai). The villagers do not have the educational background of the project workers. They have become accustomed to the flooding; it is part of their life and they've adapted accordingly. It is a compromise for them: they aren't forced to move from their homes but in turn they must abide by laws that regulate their use of the land.

Succinctly, their plight is that they love the King but they have no alternatives, nowhere to move to, and no other way to make money.

The King's role in this project was that of initiator and advisor. As we have noted in other projects, King Bhumibol revived a stalled project with what appears to be great ease and efficiency, a testament to his influence. Although the concept of Monkey Cheeks is not an idea unique to His Majesty, the application of it to Thailand is.

4.3.2.2 Analysis of the Monkey Cheeks Project

The issue of the Monkey Cheeks Project deals with another aspect of the King's influence. In section 4.3.1.2 the topic of His Majesty's developmental influence was presented. This project is another example of the driving force of King Bhumibol's involvement. We raise an issue about whether this could create a precedent and the potential consequences of such a precedent. His Majesty has used his influence for the positive development of the country, expediting the completion or initiation of projects. This power is something that King Bhumibol has earned. *Will future kings have to earn this as well or has it become a new right granted to the Monarchy*? If a less well-informed monarch ascends the throne there are potential negative consequences because of this issue. The following chapter provides a more detailed analysis of this issue.

4.3.3 Royal Rainmaking

The oldest and most expansive of the water resource projects we investigated is Royal Rainmaking. Printed information on the project was supplemented by an informative session with members of the rainmaking bureau. We were fortunate to have been allowed the experience of a cloud survey flight.

Figure 4-1: We had the opportunity to observe a cloud survey flight with members of the Royal Rainmaking Staff.

4.3.3.1 Project Information

If there is any magic associated with the Monarchy, part of it must certainly be in the manner in which the King uses science and technology to convince the miserly skies to impart their precious moisture to the land. There is a novel aspect to this project, a certain fascination that we experienced in our initial investigation into Royal Rainmaking. Discussion with project workers, additional research, and a survey flight allowed us to understand the magnanimity of this Royal Initiative, which has evolved from taking borrowed ideas to creating significant improvements through diligent scientific research.

Drought is one of the enemies of life, for without an adequate amount of water, life cannot prosper. This is one of the basic philosophies underlying His Majesty's development initiatives, so he was particularly concerned that drought conditions seemed to occur more frequently and more severely than in the past. During a 1955 visit to the northeastern region by way of the royal plane, he noticed that there were sufficient cloud masses but no rain, despite it being the wet season. He conveyed his ideas for a scientific method to induce rain to privy councilor Mom Luang Dej Sanitwongs who passed it on to Mom Rajawongse Debbriti Devakul, an enthusiastic inventor trusted by the King. His Majesty was aware of the

techniques for creating rain, having encountered the idea in Western science journals, and gave Mom Rajawongse Debbriti Devakul research papers and documents to study on the subject. Cold cloud seeding techniques had been proven successful in the United States so it was a matter of adapting them to Thailand's tropical climate. The project was dormant for 13 years due to lack of budget support, though Mom Rajawongse Debbriti Devakul continued to experiment independently. In 1969 it was revived with assistance from Dr. Sawaeng Kulthongkhum, Permanent Secretary of the Ministry of Agriculture and Cooperatives, who supplied aircraft from the Agricultural Aviation Unit for a test of Mom Rajawongse Debbriti Devakul's research results. Initial funding for the project came from His Majesty's private funds and the Revolving Fund for Agricultural Engineering Development.

The first trial flight was on July 20, 1969 over the area of Khao Yai National Park in a Cessna 180 single-engine aircraft loaded with dry ice. No special equipment was employed in the operation; instead, the dry ice was manually scooped out the windows onto the cumulus clouds. The clouds built up and the base changed from white to dark gray, but no rain could be observed due to mountain peaks obscuring the view. Further experiments, carried out from the Bo Fai Airport in Hua Hin District as suggested by His Majesty, were successful in creating rain. In 1971, the first rainmaking aircraft obtained from the Ministry of Agriculture and Cooperatives was blessed by the King on an occasion in which he invited three officials from Australia to observe and discuss the rainmaking experiment. Of note is that after informal conversations the Australian officers praised the King as an expert in the field of rainmaking. In 1972, His Majesty again demonstrated Royal Rainmaking, this time to representatives from the Government of Singapore. Directed by the King, the operation was successful and within 5 hours, rain began to fall on the excited and impressed representatives.

The Royal Rainmaking Research and Development Institute (RRDI) was established under the Ministry of Agriculture in 1975 for a national scale cloud seeding program which really took off the ground, figuratively speaking. In a response aimed at expediting operations of the RRDI, the government enacted a resolution that merged the RRDI and the Agricultural Aviation Division to form the Bureau of Royal Rainmaking and Agricultural Aviation (BRRAA). The annual schedule of BRRAA is shown in Table 4-1.

Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Warm and dry			**Rainy**						**Cool and dry**		
• Seminar and training • Forest fire protection • Cold cloud seeding experiments			• Warm cloud seeding experiments • Cloud physics experiments • Rain enhancement for agriculture • Rain enhancement for reservoir storage • Measurements • Field research studies						• Analysis and evaluation • Maintenance and calibration • Scientific design		

Source: Chan

Table 4-1: Annual Activities Calendar of the Bureau of Royal Rainmaking and Agricultural Aviation

There is a set schedule for making rain over certain areas but special requests are accommodated. Thailand is a large country and conditions change each year so the schedule needs to be flexible.

Methods used in Royal Rainmaking have been adopted by Indonesia, Malaysia, the Philippines, Sri Lanka, and Bangladesh. Malaysia began a rainmaking program about 30 years ago but their techniques were not successful. Thailand is the first country in this region to have a successful program and, in 1982, became a registered member of the World Meteorological Organization (WMO). As part of the WMO, Thailand has cooperated with Australia, Italy, France, the Peoples' Republic of China, the US, Canada, and other countries in exchanges of information and technology. Shortly after 1986, the Applied Atmospheric Resources Research Program (AARRP) was established in Thailand with collaboration from

the US after the King indicated that the BRRAA needed more comprehensive scientific methods for development of designs and operations. The AARRP has provided modern technology and expert advice from the US for the purpose of strengthening the capabilities of the Royal Rainmaking program. The two phases of the program were designed to, first, establish the basic structure for development, and then, increase the number of experimental units. Phase 1 of the AARRP began in 1988 and finished at the end of 1994. The implementation focused primarily on three critical components of the BRRAA: equipment, people, and experiments. The eight scientific instruments procured, listed below, were purchased by the US expert team.

- An **S-band Doppler weather radar system**, installed at Omkoi District in Chiang Mai Province and operated since July 1991.
- A **cloud physics data recording system**, installed and operated since July 1991.
- **Radiosonde accessories** (1 unit) to measure atmospheric data, installed and operated since September 1991 (a radiosonde is an electronic device with a radio transmitter that can be attached to a balloon to measure temperature and humidity at various atmospheric levels).
- **Satellite imagery receiver accessories** (1 unit) to monitor rain clouds, installed and operated since August 1993.
- 50 **automatic rain gauges**, installed and operated since December 1990.
- A **minicomputer** for data processing and analyzing, installed and operated since February 1991.
- 6 **microcomputers** for data processing, installed and operated since July 1988.
- **Communication accessories**, installed and operated since December 1992.

The Doppler radar, which runs continuously, has a 150 km radius range and completes a full scan every 5 minutes.

The human resources development component consisted of the following training initiatives:

- 35 day core training in major courses.
- Training and experimentation on cold cloud rainmaking.
- Training on computer usage and data management basic software.
- Preliminary training on scientific instrument usage.
- Training on maintenance, repair, and calibration of radar and cloud physics instruments.
- 3 electronic technicians were trained at the US equipment producer company (in the United States) for 2 months.
- 5 scientists studied master degree courses in the US for 2 years.

Experiments were designed for both warm and cold cloud techniques. The four-year process has been completed and was designed to achieve a 90% statistical confidence level in the results. Only three of the four years of data were reliable; the 1992 results were disqualified due to withdrawal of technical assistance from the US in reaction to Thailand's political uncertainties that year. From the remaining data it was determined that rainmaking from cold clouds whose base temperatures exceeded 16° C could increase precipitation by about 125% compared to natural rain. In addition, it was determined that the rainfall area increased by 71% and the rainfall period was 33% longer. To statistically confirm these results, the data from Phase 2 of the AARRP will be required.

Phase 2 of the program was carried out between 1995 and 1999. As stated in the documents provided to us during our visit of the office of the BRRAA, the targets of this second phase are categorized as follows.

1. Obtain both a more precise picture of the effectiveness of rain making and figures which can be physically and statistically verified at a degree acceptable under international standards.
2. Develop scientific instruments and technology so that the BRRAA will be capable of carrying on Royal Rainmaking operations, monitoring, evaluations, and effective rainmaking process development.
3. Strengthen the capability of the BRRAA staff to enable them to use transferred technology in their work to further develop the effectiveness of rainmaking methods in the future.
4. Improve experimental designs suitable to Thailand's conditions (this experimental design is very important for the systematic improvement of Royal Rainmaking effectiveness).
5. Publicize the program's work and cooperate with other countries (it is anticipated that the progressive technology of Thailand's rainmaking, developed under the AARRP, will be recognized internationally, and Thailand will become the center for tropical weather modification activities).

To our knowledge, the cold and warm cloud experiments have been completed and the data are being analyzed. In the continuing experiments, as many variables as possible are held fixed between the control and variable so that the results can be attributed more purely to cloud seeding or non-seeding. In the control flights, the aircraft follows a seeding path but only gathers data, thereby simulating chemical seeding without releasing chemicals. Another identical craft, the variable, will follow the routine of the first but actually seed the cloud with chemicals. The rain volume is calculated from cloud measurement data gathered by the Doppler radar station since ground-based measurements are not always available due to the possible absence of rain gauges in the area of the experiment. Khun Wathana Sukarnjanaset

of the BRRAA explained the experimental process to us and presented plots comparing control and variable rain volume measurements from several trials. The length of the experiment varies depending on the size of the cloud but there is a general consistency among the results. The seeded and non-seeded data points are initially nearly identical and only begin to diverge after the first half-hour to an hour of measurement. In one of the trials, the rain volume of the variable exceeded that of the control by 9%. For statistical confidence in the results of the experiments in Phase 2 of AARRP, 100 samples of cold cloud experiments and 90 samples of warm cloud experiments were taken, with an even split of the samples between the control and variable for each group.

The actual process of rainmaking is divided into three steps: triggering (agitation), fattening (building up the cloud mass), and attacking (bombardment). If there is greater than 60% humidity in the targeted air mass, this process can be used to actually create clouds in addition to manipulating them. The three stages of rainmaking are described in detail in Appendix N. We have provided information of a slightly more technical nature about the chemicals and suggestions for techniques in Appendix O and Appendix P, respectively.

It was certainly a concern of ours whether this process has any side effects. There is the potential for local and global as well as short-term and long-term repercussions; chemicals are being introduced into the atmosphere and rain is being created when it would not naturally occur. To assuage our concerns, Khun Warawut Khantiyanan of the BRRAA told us that none of the chemicals used are toxic. Further, he explained that the concentration of chemicals in the artificially-created clouds is about the same as that in natural clouds. He did concede, however, that further studies are needed to confirm this. Research to assess the environmental impact of rain making is being conducted by the Royal Rainmaking Commemorative Research Center, another organization dedicated to the development of the Royal Rainmaking project. One component of their research program is to study the impacts

of rainmaking on the environment. The study is designed to evaluate the effects of rainmaking on the ecosystem, particularly on the following bio-physical factors:

- Weather conditions, climate, and air quality.
- Surface water level, ground water system, and water quality.
- Soil structure and soil erosion.
- Ecosystems of the forest, wild animals, aquatic animals, etc.
- Agro-ecosystems.

Three of the many ongoing research initiatives for the Royal Rainmaking program concern super-cooled clouds, cloud physics, and the use of rockets. Super-cooled clouds are those with an internal temperature lower than 0° C, the freezing point. Clouds in Thailand which lie in part above 18,000 ft can be classified as super-cooled. Tor Begeson's theory of cold-cloud rainmaking indicates that substances with crystals similar to ice crystals can be used to stimulate crystallization of water in clouds. Some such substances are silver iodide, lead iodide, and sodium iodide. The AARRP presently experiments using silver iodide in a process called "Dynamic Seeding". Aircraft used in this research must have an internal air pressure control system since typically altitudes exceed 21,000 ft.

On top of super-cooled cloud research, literally, is cloud physics research. Specially equipped with scientific instruments for measuring and recording meteorological data (temperature, humidity, cloud water content, cloud updraft and downdraft velocity, size and density of water droplets, etc.), the pressurized twin-turbojet-propeller aircraft used in this endeavor operates around an altitude of 35,000 ft. The craft is additionally equipped with silver iodide flare launchers for cold cloud research and rainmaking.

The feasibility of using rockets to create rain is being investigated. This would potentially overcome the altitude barrier faced by the non-pressurized aircraft primarily used in the Royal Rainmaking program and increase the efficiency of the process. One of the

primary technical issues faced is that of payload capacity; each stage of the rainmaking process requires about 2 tons of chemicals for a total of about 6 tons of chemicals per operation. On top of this and other technical considerations are regulations concerning the launch of rockets. Nonetheless, the research programs of the BRRAA and its associated programs are comprehensive in improving and developing Royal Rainmaking.

The Royal Rainmaking project is part of a larger initiative aimed at total integration of the nation's water resources: underground water, surface water, and atmospheric water. All three are irrefutably linked by the ecosystem. Both groundwater and surface water technologies are well developed and employ effective management techniques. Those of atmospheric water are still in development, as evidenced by the efforts behind the Royal Rainmaking program. This program is part of His Majesty's efforts to promote proper water management techniques for sustainable development of the country.

Figure 4-1: Unfortunately, weather conditions were not conducive to making rain the day of our flight. This reservoir will be filled by Royal Rain on another day.

The Ministry of Agriculture now fully funds the program, which has a budget of about 310 million baht. Of that, roughly 100 million is devoted to the aircraft. In addition to their own planes, the BRRAA uses planes from the armed services. Since the program is a Royal Project, it does receive in-kind donations, such as chemicals and jet fuel. During our visit to

the office of the BRRAA, Khun Sukanya Srakaew mentioned that one year a crop grower donated an entire plane to the program.

A related topic of interest was whether rainmaking is economically worthwhile. The information on the Royal Rainmaking program mentions that one of the research programs of the Royal Rainmaking Commemorative Research Center, mentioned previously for their research into the environmental impact, is to study the socioeconomic impacts of rainmaking on people. This is intended to evaluate the socioeconomic benefits from rainmaking in comparison to the investment costs. When the study is completed, the cost/benefit ratio will take into account operation costs versus the analyzed aggregated benefits to agriculture, industry, fishery, forestry, and the country in general. The answer to this question of economic efficiency from Khun Warawut Khantiyanan conveyed the point that it is difficult to quantify the success and efficiency of the program. This is what we expected from studying His Majesty's philosophies. Qualitatively, the benefits of rainmaking are abundant. In addition to the more obvious benefits such as the immediate relief of drought, rainmaking restocks the reservoirs that are the sources of irrigation for multitudes of farmers. This same water travels along the river where it can be used for consumption in cities and villages. Additionally, the water can be used for generation of hydroelectric power which benefits those far removed from the agricultural sector.

There is also an aesthetic appeal to the rain which certainly isn't quantifiable. In this sense, and along with His Majesty's salient assessment criterion of happiness, the project is successful regardless of the cost/benefit aspect. When there are drought situations something must be done to relieve the suffering of the people. As mentioned, the Royal Rainmaking Commemorative Research Center is conducting research into the socioeconomic impacts of rainmaking for the purpose of improving the project, so there is awareness of the need for efficiency as the project as it develops.

King Bhumibol has been closely involved in this project since its conception in 1955. It was the initiative and funds of the King that began Thailand's research in artificial rainmaking. He has been onboard numerous rainmaking flights, blessed several of the aircraft used, and demonstrated the technique to many foreigners. The King's role goes much deeper than that, however. Appendix P is a summary of the suggestions for operation provided by His Majesty on various occasions. To exemplify the extent of the King's knowledge of rainmaking, select radio transmission copies sent by King Bhumibol to the Royal Rainmaking Units on various occasions are presented below.

- **August 25th, 1972**

  Refer to your R [Radio Transmission]. No. RRKK. [Royal Rainmaking Radio, Khan Station] 3/15 dated Aug 24, 1972. It has been considered. (The result was) possibly due to the operation at Phu Khieo District that was too near (to the target), resulting in rain over Mahasarakham. Should shift the operations area to the west. By seeding in a long strip between Nong Bua District and at a point about 20 *km* to the west of Kaset Samboon District.

  For your acknowledgement and action.

- **March 11th, 1978**

  1. From what have been reported, it seems that the operation is not yet successful.
  2. The morning operation induced some clouds but they later disintegrated.
  3. Assume that it was due to the operation using the hot formula during 10:00-12:00 hr.
  4. At 10:30 hr, clouds occurred at low elevations. Should have used the cold formula to fatten them. At the same time, the chemical formula 1 should have been seeded over or inside the clouds, and the very cold formula seeded at the low altitude.

5. If there were plenty of clouds, the hot formula and cold formula cloud be used alternately.
6. When there were only a few clouds, the application of the hot formula would dissolve them. In which case, the hot formula should have been used only during 08:00-09:30 hr while the air temperature was still low.

- **February 10th, 1994** - an excerpt from a message from the King regarding the operation to increase the water volume of the Chao Phraya River.
  1. Adapt the R.4 method for Plan 1 to be used with Plan 2 to Plan 6 by changing the positions and the targets.
  2. Plan 1 The area near the Chao Phraya River, between Nakhon Sawan province and Chainat Province.
     1) Survey cloud conditions 50 *km* radius around the airport.
     2) Select the area upwind to the airport.
     3) Strip application with formula 1.
     4) Apply formula 6 or formula 9 in circles around the thickest clouds.
     5) Seed formula 1 around the uplifting clouds.
     6) Apply the formula 1 on the top of the clouds and the formula 4 under the base of the clouds.
     7) Apply the formula 3 near to the ground, just downwind from the clouds. The area should be near the Chao Phraya River, between Nakhon Sawan and Chainut.

The King is still involved with the program today. The BRRAA sends him reports each day of rainmaking operations. At the beginning of last year, the King and his people came to set up a Rainmaking special team to do additional studies. More than forty years after the program began with Mom Rajawongse Debbriti Devakul's initial research into adapting

rainmaking techniques to Thailand, it continues to be an integral part of His Majesty's development efforts for his Kingdom.

4.3.3.2 Analysis of the Royal Rainmaking Project

The Royal Rainmaking project demonstrates an important aspect of King Bhumibol's involvement in the projects, namely, that he does have substantial technical knowledge about the projects he initiates. A valid criticism of the projects is the extent of His Majesty's role. He has initiated over 2,000 Royal Projects of various magnitudes and in most literature, it is implied that he is responsible for all aspects of the project from conception to daily management. Two factors cast doubt upon that implication. Firstly, the King has an intense schedule of official duties on top of the enormous amount of time he devotes to project activities. The implied level of involvement in all the projects, though, would require more than a full-time commitment. Secondly, the majority of printed information about the projects is reverently laudatory about the King. This was an issue we encountered in our Background research and were expecting to encounter. The crucial questions raised by these two concerns are *what is the King's actual role in the projects* and *what is the King's actual technical knowledge of the projects*? In other words, *is credit being given to His Majesty simply because he is the King*?

The Royal Rainmaking Project clearly demonstrates that King Bhumibol has significant technical knowledge on the subject of rainmaking and has maintained involvement in the project. The radio transmissions excerpt in section 4.3.3.1 demonstrates, firstly, that His Majesty is intimately familiar with the complex process of cloud seeding, and secondly, that he is still involved in the operation of the program: most of the documented involvement of the King is from the early stages of the program in the 1970s but the last excerpt is from a rainmaking operation in 1994. In addition, the information in Appendix P demonstrates the depth of King Bhumibol's rainmaking knowledge. His Majesty obviously cannot be as

involved in all the projects he has initiated, but that is less consequential than the fact that he definitely possesses the basic technical knowledge required for the initiation of so many projects.

4.4 The Royal Chitralada Projects

King Bhumibol has designated a significant area within his residential compound at Chitralada Palace for agricultural research and experimentation. These Royal Chitralada Projects, which are non-profit, are divided into two types: non-business and semi-business. A full listing of these projects can be found in Appendix R. The projects completed at Chitralada emphasize optimal utilization of Thailand's natural resources and agricultural abilities. The processes used aim to expend a minimal amount of money and time, and require continued progress in the areas of science and technology. The ultimate goal of this subsection of His Majesty's projects is to disseminate information to farmers and all other interested parties through demonstrative methods.

4.4.1 The Dairy Industry

One of the most successful projects at Chitralada stems from the creation and extension of the dairy industry within Thailand. There are three major sections of Chitralada's dairy industry: the dairy farm, the milk collection center, and the milk processing plant. Each division has very specific operations, but all have the objective of aiding Thailand's dairy farmers through demonstrative methods.

4.4.1.1 The Chitralada Dairy Farm

The Chitralada Dairy Farm began in 1962 when His Majesty was presented with several cattle - one bull calf, one cow calf and two in-calf heifers - from a private company, and two more in-calf heifers from the Department of Livestock Development. King Bhumibol used

funds from the sale of a book on musical theories to create a dairy farm at Chitralada Palace. Initially, milk was sold only to palace staff members, but eventually, with an increase in the animal population, sale was expanded outside of the palace walls to private citizens and schools in the area. Profits gained from these sales were directly reinvested into the project, which allowed it to progress in overall milk production, quality of raw milk and promotion for dairy farmers (Royal Chitralada Projects). By 1969 expansion had led to the establishment of the Dusit Milk Powder Plant along with the Chitralada Milk Collection Center, and by 1973 the success of the Center was great enough to allow for its financial autonomy from the Plant. Currently, the Chitralada Dairy Farm consists of the following five work units: dairy, biogas, plant production, manure, and tilapia culture.

Figure 4-1: A display of the various dairy goods produced at the Chitralada Dairy Farm.

4.4.1.2 The Chitralada Milk Collection Center

The second division of His Majesty's dairy industry is the Chitralada Milk Collection Center. Since its establishment in 1969, the goals of the Center have included the following.

- To provide assistance to dairy farmers by purchasing milk that is produced in excess of the market demand.
- To promote the consumption of fresh milk by selling quality hygienic pasteurized and homogenized milk to the general public, especially school children.

- To acquire modern equipment for checking the quality of both the Center's and the Milk Powder Plant's products.

Through the production of fresh milk at Chitralada, King Bhumibol aims to acquaint young people with the value of milk and in doing so improve their health and strength. Because minimum profit is received by the Center, milk can be sold at low prices, thus allowing children to purchase it on their own. The amount of milk produced at Chitralada is minimal, and only sold to a small number of local stores and schools; thus, the low prices do not have any detrimental effects on Thailand's dairy industry as a whole.

4.4.1.3 Milk Processing

The third section of the Chitralada Dairy Industry, Milk Processing, is composed of three plants: Dusit Milk Powder Plant, Dusit Milk Tablet Plant, and Chitralada Cheese Plant. His Majesty decided to build a milk powder plant in 1968 when the milk producers, faced with an oversupplied market, were unable to sell their product. Through the years, the Plant has undergone many improvements to maintain the highest production quality possible. The products of the Dusit Milk Powder Plant are distributed throughout the country with the aim of promoting the consumption of high-quality, low-priced goods. Further, the Plant serves as a model for those interested in operating a commercial scale milk powder plant, namely groups of dairy farmers who have pooled their resources in order to build and operate such a plant.

The Dusit Milk Powder Plant currently produces seven products.

- Sweetened milk powder (whole), packed in 1 lb tins.
- Sweetened milk powder (skimmed), packed in 1 lb tins.
- Unsweetened milk powder (whole), packed in 100 g plastic sachets.
- Sweetened milk powder (skimmed), packed in 100 g plastic sachets.
- Milk toffee, packed in plastic bags of 20 pieces each.

- Distilled water for car batteries, packed in 800 cc and 1200 cc bottles.
- Distilled drinking water, packed in 500 cc and 20 l bottles.

The Dusit Milk Tablet Plant is the most successful division within Chitralada's Dairy Industry, and among all the semi-business productions on a whole. The Plant is able to produce between 10,000 and 12,000 sachets of 15 milk tablets each per day, which are sold through cooperative stores and supermarkets throughout Bangkok for 7 baht/sachet, but because of their popularity, the demand far exceeds the supply (Royal Chitralada Projects).

The final division of Chitralada's milk processing is the Chitralada Cheese Plant. The concept for this portion of His Majesty's dairy industry fell into place when the C.C. Friesland Cooperative of the Netherlands presented the King with cheese production equipment in 1987 in celebration of his 5th cycle birthday anniversary (Royal Chitralada Projects). The objectives of the Plant are as follows.

- To develop cheese production.
- To study the cheese production process and develop production of other dairy products.
- To introduce and promote consumption of the products.
- To explore domestic market and export potential of the products.
- To disseminate various production processes used at the Plant to the general public, farmers, students, and all other interested parties.

A complete listing of the products produced by this Chitralada Plant can be found in Appendix S.

4.4.2 Rice Production and Processing

Next to milk tablets, rice is the most successful product of the Royal Chitralada Projects. Rice has had great importance in Thailand for hundreds of years, as both the staple food of the Thai people and the principle crop of the Thai farmer. As a result, His Majesty has taken

it upon himself to perform a number of experiments to determine optimal cultivation methods for both lowland and upland varieties of rice. The experimental rice fields on the grounds of Chitralada yield approximately 1,000 kg of rice seeds; 40 kg of this surplus is used in the annual Royal Ploughing Ceremony, while the remaining rice is packaged and distributed to farmers throughout the country as a gift from the King.

In addition to the actual rice fields, Chitralada is home to an experimental rice mill. Since its opening on May 8, 1971, the Chitralada Model Rice Mill has had the following objectives.

- To carry out studies and gather data on the most effective rice milling and rice storage techniques.
- To promote direct dialogue between rice-growers and consumers, through an operation run along the lines of a cooperative.
- To carry out purchases of paddy early in the harvesting season directly from the farmers in order to support the price of paddy.

The final portion of the rice processing operation at Chitralada is the rice-husk grinding plant. This Royal Project was started in 1975, upon the donation of machinery and storage facilities by a private individual and the building of a rice-husk grinding factory. Activities of this project include soil improvement, husk compression, and the charring of husk briquettes. The official objective is to experiment on the utilization of rice husk by mixing it with chemicals to produce fertilizers for home-garden crops and flowers, and by compressing it into fuel briquettes to save firewood and conserve forest resources.

Figure 4-1: A variety of rice is milled at the Chitralada Palace.

4.4.3 Fish Culture Project

Another of the Royal Chitralada Projects involves the breeding of the "Pla Nil" fish. This project started at Chitralada in 1965 when Emperor Akihito of Japan, who was the Crown Prince at the time, donated 50 Nile Tilapia (*Oreochromis niloticus*) fingerlings to His Majesty. These fish proved to be extremely prolific, and after just five months the King ordered the creation of six additional ponds to hold the fish. After months of observation, His Majesty had learned that the *O. niloticus* species was fast-growing, hardy, and fertile, and thus it could be beneficial to the lower income families throughout Thailand (Royal Chitralada Projects).

Currently, the Fish Culture Project at Chitralada consists of nine tilapia ponds. "The Chitralada Strain of *O. niloticus* has become one of the most outstanding varieties of this species," and it is fairly well known throughout Asia's tropical countries (Royal Chitralada Projects).

4.4.4 Demonstration Forest

Located within the inner sanctum of Chitralada Palace is a living example of His Majesty's dedication to protecting Thailand's natural resources. Here exists a "demonstration forest" made up of trees and vegetation from throughout the nation. The forest serves as an

arboretum for all those wishing to learn about native Thai trees in addition to providing invaluable information about conservation techniques.

The small scale, low profile research efforts underway at Chitralada provide evidence of King Bhumibol's dedication to improving the lives of the Thai people. The King's self explained role is to "do things that will be useful and that is all" (Baker 242). The Royal Chitralada Projects are a display of his efforts in this capacity. King Bhumibol has not worked for the glory of himself or his family, but rather for the benefit of Thailand. The King's efforts at Chitralada aim to assist the Thai people and ease their hardship. Experimentation and research performed at His Majesty's residence will ultimately be adapted and applied throughout Thailand.

Chapter 5 SUMMARY ANALYSIS

In Chapter 4, Project Investigations, individual analyses were provided for each of the projects. This Summary Analysis covers issues affecting the overall structure of the King's projects. In establishing the Background of this report, we identified four areas that were essential for a comprehensive evaluation of His Majesty's Royal Projects: Buddhism, Politics, Economics, and the institution of the Monarchy. We have divided our Summary Analysis similarly. Questions concerning the influence of these factors are posed in each of the four subsections. These points are important and need to be addressed for development to continue in Thailand.

5.1 Buddhism and the Middle Path

The philosophies of Buddhism are so deeply ingrained in Thai society that the latter cannot be discussed without consideration of the former. This was the impetus for our investigation of Buddhism. One of the tenets of this religion is the idea of a "middle path" which implies a balance of desires in all aspects of life. This concept is embodied in His Majesty's philosophy of sufficiency. The King's vision for the future of Thailand encompasses a return to the once-prosperous agrarian foundation upon which the kingdom originated.

Amid political instability, Thailand was first introduced to the concept of sufficiency nearly three decades ago in His Majesty's Royal Speech of December 4, 1974. At the time people were commenting that the country was outdated, not tuned into the times, and lacking modern things. In that speech, the King replied to these criticisms.

> What others may say does not matter, whether they say that Thailand is old-fashioned or that we are outdated. Anyhow, we have enough to live on and to live for, and this should be the wish and determination of all of us to see self-

> sufficiency in this country. It is not that we will attain supreme prosperity, but we will have a sustainable and peaceful country. If we keep this sustainability, we already can be considered the top in comparison with other countries beset as they are by crises and decline due to greed and rivalry for power, economic and industrial progress and in matters of ideology. So, for me, it will prove to be a birthday present of lasting value and benefit if each of you, with your ideas and power of persuasion, enjoin on others who also have the same intentions, the determination to preserve the community so that we are able to enjoy this reasonable way of life - and I stress the reasonable, sustainable, and peaceful conditions - defending ourselves against anyone who may want to rob us of our innate qualities (King Bhumibol 1974).

Nonetheless, Thailand fell headlong into the rush to become the fifth economic tiger of Asia and His Majesty's words were left unheeded. However, the King continued his development efforts and over the years, further defined his philosophy through action and speech. Appendix Q contains an excerpt from His Majesty's Royal Speech on December 4, 1998 that more clearly spells out his thoughts on sufficiency. Most obviously, sufficiency has been put into practice through the New Theory, but the spirit encompasses the whole of society.

Thailand's current economic base is a mixture of industry and agriculture. The economic development of Thailand began with an emphasis on agriculture but shifted to manufacturing during the boom of the 1980s. The middle path between the two was overlooked as the desire to modernize overwhelmed the country. The King stressed the need to maintain strong agrarian roots during industrial development. Technology should be used where it is necessary but not excessively. As with all things in the Buddhist way of life, there needs to be a balance. The operative questions surrounding this issue are *who defines moderation in a technological context* and *what is the appropriate level of technological integration for the optimal benefit of the country*? The course of Thailand's development is dependent on Thai society's response to these concerns.

Our consideration of the influence of Buddhism has also led us to explore the nature of the Royal succession in Thailand. The beliefs of Buddhism hold that a person's position in

life is a result of the accumulation of merit in past lives. From this viewpoint, the king has justly earned his place at the head of Thai society. Anyone who has accumulated such merit has proven their right to succession and will therefore be a good monarch. Because of this, there is little doubt in the minds of the traditional Thais that their king will serve them righteously. From our Western and Christian viewpoint, however, the monarch is chosen based on familial inheritance. Hence, it is conceivable that there could be an unworthy monarch. We have found in our study of the Royal Projects that King Bhumibol has shown his genuine concern for the people and has used his monarchical influence for the benefit of the kingdom. In a purely Buddhist sense, there are no concerns about the reliability of succession, but there is growing Western influence in Thailand. The Western outlook suggests the possibility that future kings may not be as beneficial to Thailand. Granting immense influence to a single person limits the diversification of ideas, allowing the possibility of corruption. Acknowledging this influence, we question, *can a monarch be detrimental to the development of Thailand*? This concern relates directly to the political effects explored in the next section.

5.2 Political Factors

Throughout Thailand's recent political history, the most constant element has been the King. The complexities of adapting to democracy have made it difficult for the government to effectively respond to the needs of the people. Consequently, His Majesty has evolved as visionary and reliable leader for the development of Thailand.

Unfavorable political factors affecting Thailand's development include a lack of internal cooperation in the government's development activities and a short-sighted vision for the future of Thailand, resulting from the nature of politics. The government is comprised of a number of Ministries, each responsible for a specific sector of the country's operation.

Unfortunately, these branches have a tendency to become narrowly focused on their independent objectives, thus interaction amongst themselves and with other organizations often leads to conflict. This behavior has been noticed by the King, who has commented extensively on the need for collaboration. Each organization has the ability to make valuable contributions to Thailand's development. However, when cooperation is not seen as a fundamental necessity, the result of collaborative development work can be detrimental to the overall progress of the nation.

Compounding this effect is the short-sighted vision and relative brevity of experience characteristic of politicians in general. This is in contrast to the Monarch, who has developed a clear and systematic vision for his country's future over the course of his reign. Throughout his long years of dedication, King Bhumibol has accumulated expansive firsthand knowledge from continuous involvement in large-scale development projects. He has experienced the evolution of his initiatives from inception to completion, and as a result, is able to see development projects in a larger context. No one else has been involved with the Royal Projects long enough to gain this vision. The nature of democracy is a patchwork continuity of progress resulting from the relatively short term of office for government officials. The pressure to produce tangible results during their term of service influences politicians to adopt short-term solutions. As it relates to development, this issue demonstrates the importance of the King as a benevolent central figure with the resources and ability to provide a long-term plan for the country's development.

This lack of vision affects the Royal Projects in another manner. The King's plans for sustainable development require initial sacrifices in order to reach the ultimate goal. Those who cannot see past these sacrifices are hesitant to adopt his methods. King Bhumibol has used the phrase "our loss is our gain" to explain this concept of long-term development. For the future of the projects, the citizens and politicians of Thailand must share in His Majesty's

vision and be willing to accept a loss in order to gain continued benefits. As there are no sure means of accomplishing political and social change, we present these issues to increase awareness of the need for political change but, more importantly, to increase awareness of His Majesty's role in creating a vision for the long-term development of Thailand.

5.3 Economic Factors

One of the most important factors in the lives of Thai citizens is the current economic situation. Despite the teachings of Buddhism which encourages the cessation of desires, growing desire for financial gain has freely invaded Thailand and created socioeconomic disparity. In Thailand's Boom and Bust, the situation is succinctly presented by the authors. "Business reveled in the atmosphere of free-for-all, and this reveling contributed to the speed and strength of the boom. But free-for-all is not the same as good-for-all. Indeed, *free-for-all tends to mean good-for-some.* In simple income terms, the boom converted Thailand into one of the developing world's most unequal societies" (Baker 6). The King's method for overcoming this inequality is based on his philosophy of sufficiency.

Some sectors of Thai society are advocates for modernizing Thailand with the latest technology so that the country can stay with the times. The King sees past this and has diligently emphasized the need to take a step back in order to build a solid foundation for sustainable development in the future. In a gentle manner His Majesty is trying to convey the message of cooperation instead of blind industrialization. Thailand has a set of innate qualities that has allowed the kingdom to prosper through times of social, political, and economic turmoil. Sufficiency emphasizes returning to these Buddhist values without abandoning all things contemporary. At a December 1999 conference entitled *The Sufficiency Economy*, former Prime Minister, Anand Panyarachun, had the following

comments to make on the economics of sufficiency, which are part of His Majesty's philosophy on sufficiency.

- Sufficiency Economics (SE) does not go against the creation of wealth. SE does not go against development and growth, but growth must be balanced and sustainable.
- SE teaches people to be more holistic.
- SE teaches people to stand on their own legs; it does not teach people to turn their backs to the mainstream of globalization and the world.
- SE may be the start of a process, but there are other influential factors that started earlier, such as the thinking process, viewpoints, social values, and culture of the Thai people.

The underlying question surrounding Sufficiency Economics is, *will it work for Thailand*? According to World Bank president James Wolfensohn, "the concept is well-suited for the comprehensive development of Thailand" (Thanong). We are unable to provide an economic analysis for the feasibility of the application of Sufficiency Economics in Thailand. However, we feel this approach has the potential to build the economic and social foundation the country needs to achieve sustainable development.

5.4 The Monarchical Factor

The institution of the Monarchy has survived because it has changed with the times and fit into modern society's demand for democracy. This is primarily the result of King Bhumibol's realistic outlook for the future of Thailand. The people's respect for the King occurs from his interaction and genuine concern for their welfare. He has chosen to remain above politics but accessible to his people. As a result, Thailand has become very dependent on its monarch. James Wolfensohn recently stated that, "the monarchic institution is a source

of enormous strength for Thailand and an advantage that other countries do not have" (Thanong). This statement demonstrates that even foreigners, who may be skeptical of monarchical systems, realize the unique value of the monarchy in Thailand.

The Monarchy is presently strong and genuinely revered by the Thai people. Consequently, it may be difficult for Thailand to survive without this institution upon which the people have grown so dependent. The concern we raise is, *amid political shuffling and continuing external influences, how will Thailand adjust to a less involved monarch*? King Bhumibol's prolific initiatives have set an exemplary standard against which future monarchs will be compared. *Has the intense involvement of His Majesty inflated expectations of the Thai monarchy*?

Our analysis has explored four significant influences on the Royal Projects: Buddhism, Politics, Economics, and the Monarchy. The issues raised are critical points that the people of Thailand must consider to create an environment conducive to the kingdom's continued development. By accepting their role in the continuation of the projects, the people of Thailand would be giving back to their Monarch a memorial of everlasting magnanimity. King Bhumibol has dedicated his reign for the benefit and happiness of the Thai people and their conscientious gesture in nurturing the Royal Projects would be a way to reciprocate.

Chapter 6 CONCLUSION

From the outset of our project, we were intrigued by the idea that the King of Thailand was using technology for the benefit of his subjects, but we remained skeptical about the importance of his efforts. We completed an intense exploration of Buddhism, Thai Politics and Economics, the Monarchy, and the Royal Projects in preparation for first-hand evaluations. The information for our Project Investigations was gathered through site visits, interviews, and literature. A goal of our IQP was to understand His Majesty's use of technology and the philosophies underlying the Royal Projects. Further, we wanted to explore the possible application of these methods in other countries. However, in dealing with such a complex political and social system, evaluation is an enormous task, making it difficult to offer decisive conclusions about the efficacy of the King's projects. The conclusions we have drawn are a reflection of our impressions of the vast number of influences that affect His Majesty's initiatives.

6.1 Requirements for Project Continuation in Thailand

At first glance, the royally initiated development projects appeared disjoint. However, closer inspection revealed an irrefutable cohesion between them. The unifying thread of His Majesty's efforts is his philosophy on sufficiency. Through the Royal Projects, the King aims to create a self-sufficient Thailand that is involved in the global community. Similarly, he has designed a specific path for Thailand's development, which involves integration of traditional Thai ways of life and utilization of available technological methods for achieving sustainable development. In order for his goals to be realized, continuation of both the projects and the encompassing philosophies imperative.

Throughout his reign, His Majesty has had the ability to implement large-scale development projects, which incorporate his vision for the future of Thailand. These projects are the starting point for the long-term goal of combining sufficiency and globalization. Therefore, in order for the Thai people to maximize the benefits of the King's ideas, the projects must continue.

To ensure continuation of the projects, a number of issues must be addressed. Our two primary concerns are funding and the active participation of the Thai people. Realizing the need for assistance in his endeavors, the King established a number of foundations aimed at the organization and completion of development initiatives. Although His Majesty provided the initial financial support for these foundations, their continuation is dependent on donations from Thai people and corporations. In addition to funding, the projects and foundations require the involvement of the Thai people. Their support must follow the example that King Bhumibol has set in his generosity for the kingdom. There are currently hundreds of scientists, engineers, and other researchers working alongside the King, but they alone cannot ensure the continuation of the projects.

In looking to the future, the actual projects are trivial in comparison the underlying philosophies, making the continued implementation of these theories imperative for Thailand's development. Self-sufficiency is His Majesty's plan for rural development. This concept originated in the 1970s with King Bhumibol's New Theory. At the time, agricultural exports were the single largest contributor to Thailand's economy. Consequently, the country's prosperity was directly linked to agricultural success. In more recent years, the economic focus has been heavily swayed towards industry. With this shift, King Bhumibol's philosophy of self-sufficiency has expanded into the larger frame of sufficiency. Buddhist in nature, sufficiency encourages moderation in all aspects of life. Through the application of

this philosophy, the Thai people will be able to maintain traditional ways while embracing globalization.

As one of only a few individuals possessing a vision for Thailand's future, King Bhumibol has become a central figure in the country's development. Through decades of governmental and economic instability, the Monarchy has remained a constant upon which the Thai people can depend. The King's concept of sufficiency allows the Thai people to follow a path of modernization while maintaining their heritage. Further, the moral strength and guidance of the Monarch is an important factor in the continued pursuit of sufficiency.

6.2 Application Outside of Thailand

The potential success of sufficiency extends beyond the boundaries of Thailand. Although the philosophy encompasses aspects of Thai religion, economics, politics and behavior, its basis remains universal, thus allowing for application of the sufficiency philosophy in other countries. Since the inception of industrialization, technological advancement has been a measure of prosperity for many nations. While many have successfully developed and industrialized, others have failed. A complete exploration of the reasons behind these successes and failures would be difficult. However, by taking into account the sufficiency theory, we will interpret one aspect of this exploration.

In his vision for development, His Majesty has focused on the importance of retaining Thai tradition in the move towards globalization. As first time visitors to Thailand, we were fully aware of the distinct customs and social norms inherent to the Thai people. In any country there are many ideas of what constitutes "tradition". Different beliefs will favor different policies, and consequently, these policies affect the country's political, economic, and social structure. Through sufficiency, King Bhumibol is providing a way for Thailand to modernize while providing a safeguard against economic and social instability.

A path similar to King Bhumibol's can be undertaken in other countries. However, in order for sufficiency to be successful, a role model with a vision of the future is needed. This visionary must fully comprehend the traditions of the people and understand both their strengths and weaknesses. Additionally, this person must have the intuition to know what is best for the people and be willing to put forth the effort to assist the people in their advance towards globalization. For Thailand, King Bhumibol is that leader.

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Pa Sak Storage Dam

Anomas Thongtham, Project Manager, Pa Sak River Basin Project: 2 February 2000.

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"His Majesty the King's Kindness Flows Towards the Pa Sak River Basin Today." The Chaipattana Foundation Journal April 1998: 27-29.

This article provided general information focused primarily on organizational interaction, the purpose of the project, and the relocated villagers.

"Pa Sak Jolasid Dam - From Another Aspect." The Chaipattana Foundation Journal Dec 1999: 13-17.

General information about the project from its inception to the present was presented in this article.

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Monkey Cheeks

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Thongchai Roachanakanan, Architect, Department of Town and Country Planning: 3 February 2000.

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Sukanya Srakaew , Warawut Khantiyanan , and Wathana Sukarnjanaset, Director, Chief of Technology R&D Group, and engineer, Bureau of Royal Rainmaking and Agricultural Aviation: 25 January 2000.

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The Royal Chitralada Projects

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Analysis and Conclusion

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This article provided current information on His Majesty's concept of sufficiency.

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Dhiravat Na Pombejra, Department of History, Faculty of Arts, Chulalongkorn University: 19 January 2000.

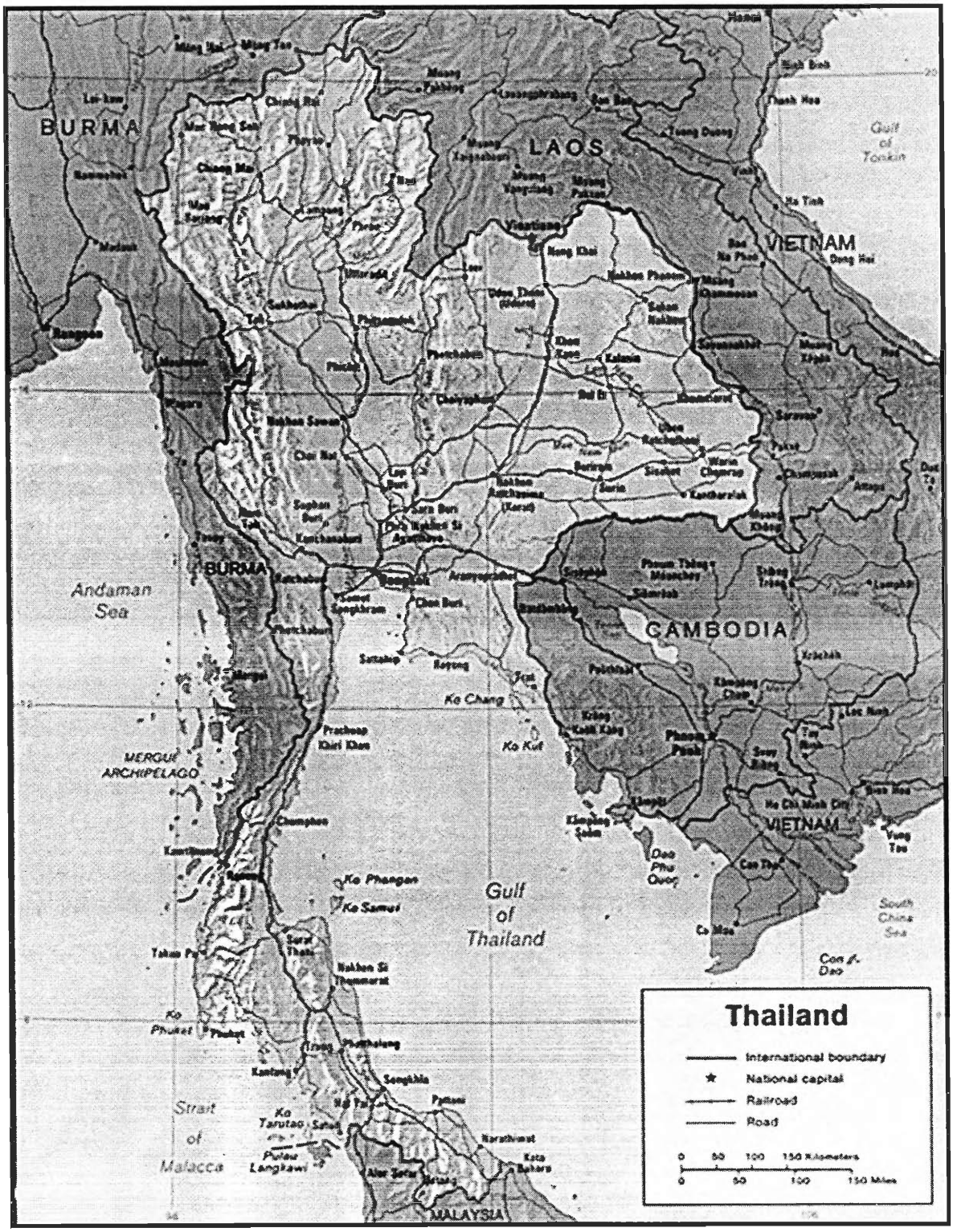
The interview with Dr. Dhiravat was aimed at acquiring additional information regarding the history of the Monarchy. Fortunately, we were also able to obtain his personal impression of King Bhumibol's impact on Thai society.

Suchit Bunbongkarn, Institute of Security and International Studies, Faculty of Political Science, Chulalongkorn University: 8 February 2000.

As a professor of Political Science at Chulalongkorn University, Dr. Suchit related his expertise of politics and economics in Thailand, as well as an explanation of the Thai peoples' high regard for His Majesty.

Appendix A Map of the empire of Rama I in 1809

Appendix B Map of Present Day Thailand



Appendix C Thosaphit Rajadham

Thosaphit Rajadham, or the Ten Rules of Royal Governance, are a set of governing principles that all rulers should abide by; it does not apply only for Kings and Emperors. These rules of royal governance actually came into being before the time of the Buddha. They can be regarded as a political or governing philosophy of the East which creates the framework for those in power to follow. Subsequently, Buddhist philosophers adopted these rules into their Buddhist Truths. These were later recorded in the Bali language.

The Buddhist dictionary explains the ten rules of royal governance as follows.

1. **Dana** – the act of giving or the act of renouncing of one's property; of renouncing that that nourishes ourselves; the assistance or giving (to his subjects); or contributions for the welfare of the public.

2. **Sila** – the act of conducting oneself with an exemplary moral behavior, or more specifically to watch over one's physical actions and the words that come out of one's mouth; undertake everything with integrity; live an exemplary life; be the object of respect from his subjects; not having an issue on which his subjects may harbor doubts.

3. **Parichakka** – the act of donating or renouncing one's own happiness and comfort, including one's own life, for the benefit of the people and for peace and prosperity of the Nation.

4. **Achawa** – integrity or integrity free from pretenses; conducts one's affairs honestly; sincerity; does not deceive (his subjects).

5. **Mantawa** – respectful manners or has an outlook that is not aloof; not rough and hard and ego-centric; has elegance from being well mannered and polished; earns a feeling of love and allegiance without losing respect.

6. **Tapa** – be a moral warrior or prevent defilements and desires from winning over one's heart and mind; not allowing oneself to be overwhelmed by unnecessary lavishments; has a lifestyle that is consistent and ordinary while doing everything to the fullest; strive for developing one's practice of Buddhist philosophy.

7. **Akkotha** – be able to suppress anger or not get into a rage; not give in to being subservient to anger to the point of passing unfair judgement and do other things erroneously outside of the truth; has loving kindness within one's heart that can stop any bad thoughts; pass judgement or do anything with a free mind that belongs only to oneself.

8. **Awihingsa** – not to harass; not to force and dictate, such as imposing exorbitant taxes or undertake unreasonably large human conscriptions; not to be unduly power hungry to the point of forgetting mercy or looking for ways

to single out, harass, and punish a particular person because of personal hatred.

9. **Khanti** – endurance or endurance toward work which is difficult; even though it is difficult and boring there is no giving up despite being mocked and insulted, and one does not loose the strength to carry forward and one does not stop from doing whatever is right.

10. **Avirothana** – absolutely never behave outside of the Dhamma or the Truth; having the King identified firmly with the Dhamma, without being led to lean one way or another after listening to bad or good words or after having received gifts and offerings, or after having experienced feelings or obtained something that one liked or disliked such as praise or gossip or such as happiness or suffering; to be firmly entrenched in the Dhamma, both in terms of the Dhamma that deals with justice or the Dhamma that deals with the principles of administration and governance, or in terms of the Dhamma concerning proper cultural etiquette, and not act outside of these norms, and minimize risks for chaos to occur.

Translation provided by Dr. Woraphat Arthayukti.

Appendix D Royal Project Foundation's Development Centers

Development Center	Location		Population			
	District	Province	# of Villages	# of Families	Population	Tribe
Angkhang	Fang	Chiang Mai	6	601	2697	Lahu Na, Lisu, Yunanese Palong
Inthanon	Chomthong	Chiang Mai	16	510	2,793	Karen, Hmong, Native Thai
Pang Da	Samerng	Chiang Mai	3	155	1100	Native Thai, Hmong
Mae Lord	Mae Taeng	Chiang Mai	2	65	281	Native Thai, Karen
Khun Wang	Mae Wang sub-district	Chiang Mai	7	189	1120	Hmong, Karen
Kae Noi	Chiang Dao	Chiang Mai	7	415	2664	Lahu Yi, Lahu Na, Akha, Yunanese
Huay Lerk	Chiang Dao	Chiang Mai	1	163	1400	Native Thai, Hmong, Karen
Nhong Khiew	Chiang Dao	Chiang Mai	2	496	2472	Lahu Na, Akha, Ka Chin, Lawa
Mae Sa	Mae Rim	Chiang Mai	2	140	1284	Hmong
Nhong Hoi	Mae Rim	Chiang Mai	5	442	2000	Hmong, Lisu
Pa-Mieng	Doi Saket	Chiang Mai	39	730	2986	Native Thai, Karen
Teen-Tok	San Kam Paeng	Chiang Mai	17	349	1226	Native Thai
Mae Tha Nhier	San Kam Paeng	Chiang Mai	10	461	2211	Native Thai, Karen
Mon-Ngo	Mae Taeng	Chiang Mai	17	443	1824	Karen
Mae Sa Pok	San Patong	Chiang Mai	2	325	1741	Native Thai, Karen
Tung Luang	San Patong	Chiang Mai	11	433	2647	Karen
Mae Hair	San Patong	Chiang Mai	11	251	1708	Karen, Hmong
Pang Ung	Mae Chaem	Chiang Mai	13	293	2847	Karen, Hmong
Wat Chan	Mae Chaem	Chiang Mai	17	671	3819	Karen, Hmong
Khun Phae	Chom Thong	Chiang Mai	11	365	1913	Karen, Hmong
Mhok Charm	Mae Ai	Chiang Mai	8	988	4702	Karen, Yao, Akha, Thai Yai
Tung Reng	Hang Dong	Chiang Mai	4	169	7645	Native Thai, Hmong
Tung Rao	Hang Dong	Chiang Mai	4	274	1451	Native Thai, Hmong, Thai Yai
Huay Sieo	Hang Dong	Chiang Mai	5	607	2250	Native Thai, Hmong
Phak Phai	Hang Dong	Chiang Mai	3	321	1766	Native Thai
So-Ngo	Chaing Saen	Chiang Rai	5	139	630	Native Thai, Akha
Huay Pong	Vieng Papao	Chiang Rai	5	139	630	Native Thai, Akha
Huay Nam Rin	Vieng Papao	Chiang Rai	4	90	370	Native Thai, Hmong, Lahu Na
Mae Poon Luang	Vieng Papao	Chiang Rai	4	249	1253	Lisu, Lahu Na, Akha, Yunanese, Lahu Yi
Huay Nam Khun	Mae Suay	Chiang Rai	16	787	4221	Akha, Karen, Lahu Na, Lahu Yi
Pra Bath Huay Tom	Li	Lumphun	12	1979	8842	Karen, Lua
Mae La Noi	Mae La Noi	Mae Hong Son	6	444	2679	Karen, Lua
Mae Sarieng	Mae Sarieng	Mae Hong Son	11	397	2462	Karen, Lua
Pang Ka	Pong	Phayao	1	125	717	Hmong
TOTAL	20	5	294	14098	73425	

Source: http://www.cyber-image.com/royalproject/develop.htm

Appendix E RDPB Project Implementation Procedures

- *Study of Information* – Before visiting a particular area, His Majesty will study the information about the conditions and significant problems within the region.
- *On-site Information* – Upon arriving at the site, His Majesty will continue to investigate the situation by interviewing local people, conducting a survey to determine the viability of the location for potential development, and discussing the matters at hand with the relevant local officials.
- *Study and Drafting of the Project* – Based on His Majesty's initiatives, the agencies concerned will seek more information to plan the operation or draft a master plan that is consistent with what the King has hopes of accomplishing.
- *Implementation* – If the initiatives of His Majesty are feasible, the Office of the Royal Development Projects Board will coordinate with various agencies and assign them the task of drafting the details of the plans and projects. Afterwards, the Office will study and analyze the proposed plans and budget to make sure that they will be implemented effectively and in line with the objectives of the plan according to His Majesty's initiatives. Then the responsible agencies will proceed with the project and the Office of the Royal Development Projects Board will coordinate the plans between the agencies concerned. In some cases, a central organization, which consists of officials from the concerned agencies, is established to be in charge of the task.
- *Monitoring and Evaluation* – After a period of project implementation by the agency, the Office of the RDPB will periodically monitor and evaluate the work. In addition, the King will return to the project site every time he has the chance in order to monitor and observe the progress. If he encounters any problems or obstacles, he will suggest solutions.

Appendix F Schedule of Site Visits and Interviews

Project site visits

16 January 2000 - **Huai Sai Royal Development Study Center**, Petchaburi

17 January 2000 - **Wang Klaikangwon Distance Learning Broadcasting Station**, Hua Hin

21 January 2000 - **Phithayakhom & Phra Parityatitham Schools**, Phimai

31 January 2000 - **Huai Hong Khrai Royal Development Center**, Chiang Mai

2 February 2000 - **Pa Sak Jolasid Dam Project**, Lop Buri & Saraburi

4 February 2000 - **Monkey Cheeks Project**, Chumphon

5 February 2000 - **Royal Rainmaking survey flight**, Hua Hin

8 February 2000 - **Chitralada Palace Experiment and Research Site**, Bangkok

16 February 2000 - **New Theory Project Site**, Saraburi

Interviews and Information sessions

19 January 2000 - **Dr. Dhiravat Na Pombejra**

25 January 2000 - **Dr. Sumet Tantivejkul**

25 January 2000 - Bureau of Royal Rainmaking and Agricultural Aviation: **Khun Sukanya Srakaew, Khun Warawut Khantiyanan, and Khun Wathana Sukarnjanaset**

2 February 2000 - Pa Sak Jolasid Dam: **Khun Anomas Thongtham**

3 February 2000 - Monkey Cheeks: **Thongchai Roachanakanan**

8 February 2000 - **Dr. Suchit Bunbongkarn**

15 February 2000 - **Apilas Osatananda**

Appendix G Qualitative Interviews Excerpt from IQP Handbook

In-depth qualitative interviews are flexible and exploratory interviews in which the researcher adjusts later questions depending on how the interviewee answers earlier questions in order to clarify the responses, to follow promising new lines of inquiry, or to probe for more detail. The interview style is unstructured and conversational, and the questions asked are generally open-ended and designed to elicit detailed, concrete stories about the subject's experiences. The purpose of such interviews is not to identify objective truth or to conclusively test hypotheses but to help the researcher understand the experiences of the participants and the conclusions the participants themselves have drawn from them. In-depth qualitative interviews are most appropriately used when a rich, detailed, holistic picture is needed of people's experience and how they interpret it; when you are interested in explanations of thoughts or behaviors that are rooted in situational or contextual factors; or when, perhaps because your study is exploratory in nature, you need a method that is flexible and can be changed as necessary as the study proceeds. Qualitative interviews are not appropriate when answers are sought only to simple, factual, or quantitative questions. The primary advantages of qualitative interviews are the flexibility they offer and the rich, detailed data they can provide. However, these advantages, as is true for all social science methods, are not gained without cost. There are two main disadvantages associated with qualitative surveys. First, due to the large amount of time and effort they involve, qualitative interviewers can't usually study a very large or random sample of people. This makes it very difficult to claim that the findings of such a study can be generalized to other groups of people that did not participate. Second, since the interviewer in a qualitative interview takes a very active role in determining what data are collected, there is a higher probability that he or she may inadvertently bias the results of the study.

Appendix H Interview Transcriptions

Dr. Dhiravat Na Pombejra

Department of History, Faculty of Arts, Chulalongkorn University
(19 January 2000)

1. **We're under the impression you can give us a background as to the involvement of past kings and their initiatives. What projects have they ... how involved with people have they been? And we were told that's more your specialty along with what you teach.**

Well, my specialty in fact is 17th and 18th century Thailand, rather far in the past by Thai standards. Well I suppose by American standards too. I haven't really studied this aspect. I've studied the monarchy in general and I suppose the first thing that I would say would be that the concept of a monarch actually going out to do a lot of public benefit for his people is actually fairly new in the way that this King has done it. In the past you have the sense of a community with the king at the top and the king offers patronage and protection to his people, to his subjects. But the people don't have many rights. But of course the kings in the past, although they were absolute in theory, they were almost like Gods, compared to Indra, Vishnu, and all that, Hindu gods. They did still have to abide by certain Buddhist moral rules. We call them the 10 Kingly Virtues, maybe you've heard of them. And that's quite old. So you could say according to the 10 Kingly Virtues, the kings had to engage in activities that benefited the people. And the form that this took in the past, in Ayutthaya and the early Bangkok period, would be mainly merit making, alms giving. The king would go on pilgrimage to the shrine of Buddha's footprint, maybe you've been there in Saraburi, and he would throw these fistfuls of gold and silver to the people, who would, in a rather undignified way, scramble for them. But of course there were more positive or more dignified aspect. The king would repair and build temples and monasteries. That's not just to show off that he's making a lot of merit, it's also a kind of, I don't know, construction of public utilities. People to need to go to a Wat, people need to pray to make merit, to meditate, whatever. So the king would build and repair certain monasteries for the benefit of his people. That would be one aspect to do with ritual and religion. Another aspect would be, I suppose, the digging of canals. That's quite crucial. You could say that some canals were just for the greater efficiency of administration. You could get soldiers from one part to another quicker, or get some logistical help in planning a new canal. It's also helped people going from one market to another, selling their wares. When they finish farming they would have the spare time to do some pottery or they would weave some lovely cloth and they could take that and hawk it around in different market. And the canals that were cut in the lower Chao Phraya river basin were very helpful. There was even one canal linking the Chao Phraya river to the Thachin river to the west. This was done in the Ayutthaya period so already there was this concept of communal good. But to compare all that to what King Bhumibol has done is really quite a different story, in my opinion, in my way of thinking. Anyway, I'm talking too much.

No, your input is very valuable to us.

2. **How accepted were past kings? Especially considering that there's a constitutional monarchy now compared with the absolute monarchy before.**

How absolute were they?

How accepted were they among the people?

Oh, accepted. As I was trying to explain, when you look at it in theoretical terms, the people had no choice. They were living in this community and had to have protection from someone. They had to, I suppose in a psychological way, look up to someone as a leader. And the king was there. Thai kingship, as you probably know already, evolved from a kind of tribal leader, a sort of paternalistic leader like in Sukhothai period, early Sukhothai period, then down to Ayutthaya when the kings became more remote from his subjects. And they were living in huge palaces enclosed in walls like a city within a city. And they only appeared in public about twice a year, to offer new robes to the monks in a grand procession by water or by land on elephant back and all that. You have remnants of that today with the Royal Barge Procession. That was from the Ayutthaya period originally. But the kings were very sparing in their public appearances and even when they appeared in public, the people were not allowed to stare them in the face, gather around and look at them. They had to prostrate themselves on the ground and bow their heads. It's not quite true that people would shoot an arrow in their eyes if they looked at the king, I don't think that's true, but as a mark of Thai respect, it's part of Thai custom to pay respect to somebody older and higher in rank. In terms of the king, the kingship, that was sometimes taken to rather extreme lengths, by modern standards. So if you talk about acceptance by the people, then you would have to look at another aspect of kingship which is, can a king stray so far from the 10 Kingly Virtues that he becomes *un*acceptable to the people. There were no popular revolutions, there were only peasant revolts in the further provinces. There's no example of a king's tyranny triggering off a revolt which meant that the people did not accept him anymore. There were plenty of palace revolutions, *coup d'etat*, well, old style *coup d'etat*. So I think that ... I don't know, you can go about it in a rather circuitous way, the argument. That, for example, when a commoner usurped the throne, that's happened twice in the 17th century, he was very conscious, always, of his not having royal blood or not being a prince and having got rid of the old royal family. My students have always asked me, how was this possible if the kings were so absolute and so highly revered? How could a commoner just take over in the palace, kill all of the little princes, and then become king and rule for twenty years, die in his death bed, you know? Maybe they did use Buddhism to explain how they accumulated merit. It was so high that ... and the accumulated merit of the deposed ministry had run out. It sounds a bit comic to us now, but it is possible to argue like that in a Buddhist sense, that the word bun, and bun meaning merit in the Buddhist sense. If you do something good, it's a merit; if you do something bad it's a demerit. We don't call it a sin, we call it demerit. Your personal tally goes up or down and if somebody can prove that he has a lot of merit, by being good as a leader, good as a soldier, or whatever, or show some characteristics which attracts people to him then he could say that he has bun

barami, has charisma and merit that make people flock to him and enable him to topple the old ministry. There are other ways that the older kings and the past kings could emphasize their merit, and that's by building and repairing palaces and temples and monasteries and Wat. This proves that you're rich enough, strong enough, have sufficient control of your manpower to build all these lovely temples. I suppose conversely, that the king could point to the old dynasty ... that they had run out of their store of merit and point to them not having ruled well.

3. What is the process for choosing a monarch in Thailand? What do you see as the future direction for the monarchy?

In the past, even up to this day, like in the period I studied - 17th and 18th centuries - even to this day there is a lot of argument among people who studied this period, scholars, about whether there was actually a hard and fast law about succession. I mean in Europe it's quite easy to find a law that only a ... in most cases the eldest son of the reigning king would succeed. But in 17th and 18th century in Ayutthaya in Thailand, it seems to have been very pragmatic. The king would usually appoint his younger brother, the oldest of his younger brothers, as his kind of second king or uparat, we call it uparat, like viceroy or crown prince. And this was for reasons of convenience because if ... because this person would be an adult, fully grown up person with probably administrative experience, political experience, with enough manpower at his disposal to be of use to the king. Sometimes too close to him, but usually useful. And the kings would usually appoint the brothers instead of the sons because the sons would be too young. And then towards the end of the reign, like in 1628 as the most prominent example, the king would realize that he had not long to live, he was dying, and then there would be a lot of jockeying for position at the court, all these factions formed. *Which team shall I attach myself to in order to survive, politically*. And all the officials at Khunnang would find a prince of their choosing, of their choice, to support for the succession, for the throne. And it would usually end with two factions fighting each other. The faction of the king's brother and the faction of the king's eldest son. Because usually by the end of the reign, the eldest son would be, what?, 16, 17, 18, maybe older - 20, be a grown man by those standards. They died very young back then. And so we would have this uncle against nephew struggle at the end of a reign, the king's brother, the king's son. And sometimes, well usually the uncle won because he had been there for so long, he had the position of uparat, like the crown prince position. He had lots of followers, he had officials helping him, he had political experience, whereas the son would usually be gotten rid of somehow. But there were times when the sons won. The situation would be rather fluid, this is my point. And if you look at European evidence about this, Siamese laws of succession, for certain period they would say the king's younger brother, the uncle, had prior right of succession above the son, above the king's son. And then at another period, the European writer, this time a Frenchman, would say, well the king's eldest son had prior right of succession. So even among primary documents written by outside observers there's this contradiction. So I think Thai historians have now been debating whether there was actually a law at all. Siam had lots of laws, but it wasn't the legalistic, civil society, not in those days. (And I wonder if it is now. [laughing]) But in those days it certainly wasn't. The king's word was law. And so you could interpret that the king's deathbed choice should have been law. And the king's deathbed choice to be his successor was usually his son. Fathers loved

their sons, usually more than their brothers [laughing] who had been competing with them since childhood. We can go all Freudian about this. So that was the situation in the past. Since the fifth reign, I suppose, of the Bangkok dynasty, succession has been more regular. We don't have any bloody succession conflicts at court anymore. And really, the present reign is, on a superficial level, quite straightforward. The Crown Prince as the eldest son should succeed. But, I have a lot of Western friends who set a lot of store by this sort of equivalent position that Princess Sirindhorn has. The Crown Prince is Sayam makut ratchakuman, in Thai, and Princess Sirindhorn is Sayam makut ratcha kumari, really equal in rank. But that's to look at it in a rather innocent way. If you look at the complexities of what really goes on in the palace and how the royal family functions, it is highly unlikely that Princess Sirindhorn will stand up to her brother and say, *look, I've got equal rights*, or anything like that. As for the future, I cannot predict it, I'm a historian. As to what will happen about the King and his people, technology advances of the monarchy, I don't know. I suppose the institution of kingship would be so strongly entrenched in Thai society, and what kingship does, the present King has been going around building dams and giving advice on irrigation, substitute crops and all that, flood prevention. I suppose that Royal projects, Royal initiated projects, would continue, but deep down I have doubts because even now, some of the Royal projects are running out of steam. The King's getting older, the people who have helped him are very tired or got old. And also I think the King wants the administration to grow up. Why should he do the work? He's only initiated things as a kind of guideline. But you could say that it's the duty of the administration to do all these things. Once a project, a Royal project, has come of age, I think the intention is to pass the work on to the government or institutions who should be responsible for it. I don't know. With a new king, it would depend on the new monarch, on his or her personal initiative. I see this present reign at first becoming, the King becoming very prominent in public life. Partly owing to the military strong man at that time, Sarit, early 60's, he wanted to promote the King to bolster his own prestige and position. Of course, that benefited the monarchy. This king was very very hard working, *is* hard working, and I suppose got himself into a position of great moral strength through his work. I don't know, it's partly institutional thing but also partly and crucially a personal thing. (I hope I don't get arrested for that.) [laughing]

4. Is there a feeling of the people as to who should succeed?

I don't know, I can't speak for the people, but dinner table conversation, sort of normal Thai gossiping, would favor Princess Sirindhorn a lot. That does *not* equal "public opinion", however.

Is that because she's more similar to her father?

Perhaps, yes. Very hard working. Also, she's someone with a special gift for relating to people, she gets on well with people, she puts people at ease. And she really does a lot of work.

Is there apprehension about a queen as opposed to a king next in line?

I suppose the only apprehension would be on succession, who would then succeed after that. I don't see any other apprehensions based on gender.

5. To switch gears a bit, we were wondering how common people can make merit apart from visiting temples and being charitous to the monks? Buddhism is also part of our background research to help understand culture.

How can people make merit, in a way which is not connected with the monasteries? I'm not an expert on Buddhism, but I think in my interpretation and my understanding of it, my parents, grandparents, talking to monks, I suppose that you can make merit any minute of your life. If you do something that shows charity and loving kindness to other people, that is a merit, a meritorious act. Nowadays, you have lots of worthy causes in society, you contribute to slum children, that's making merit as well as contributing to a charity, to a modern charity, but in religious terms. You can interpret that as making merit, too. But of course in some parts of popular Buddhism, the weight seems to be on the side of making merit at temples. That's why you have thammakai phenomenon. If you make merit at a temple it's directly, to do with the monks and the monks will help you. *You give 10,000 baht, you get a special Buddha image which will make you rich in two weeks*. That is really a distortion of the Buddha's teachings I feel. Apart from being arrested for *lèse-majesté* I will be lynched by thammakai. [laughing] I think you can make merit anytime. Be kind to your father, be kind to your children, be kind to your maid, be kind to your colleagues, your students, is making merit.

6. In exploring the project we've come across His Majesty's ideas of sufficiency and self-sufficiency. We're wondering if they're related to Buddhism, and if so, how closely, do you feel?

I find that it's more related to what used to be the Thai way of life, which also includes Buddhism but is not specifically Buddhist, I don't think, except that for the basic philosophical level, we should not desire, I think, too much, or desire things at all to get to Nirvana. If you have an economy which is so bent on expansion and profit, maximizing profit and all that, there is a basic contradiction of Buddhist ideals. Philosophically, if you want to attain Enlightenment, you must not hope for things, want things, to eliminate desire. I think there's more to it than that. This thing about traditional Thai society being agrarian, rice growing and Thailand having such abundant natural resources. I mean not gold like South African but I mean that you won't starve if you're a bit above lazy, you're not too lazy. Go out and pluck a banana from any tree, there's fish in the water and rice in the field. That kind of Thai ideal. Villagers and agrarian communities were self sufficient. People supported each other in a community like that. I think the King's point also is to have people to become less selfish, to support each other in a community. He's always making these rather roundabout comments on how politicians are fighting each other and people are being too selfish in pursuit of their personal interests, interests of their families, clans, group. Self sufficiency would mean going back to a more ideal, traditional way of life. I don't think he's advocating that we all close down factories, but he's just saying don't get so obsessed about industrializing or opening up capital markets and things

like that. Look at what we've already got, past strength which may even affect present and future strength.

7. What are your feelings on the relationship between King Bhumibol being a constitutional monarch and all his projects versus if he was an absolute monarch? How involved do you think he could or would be if that was the case?

Good question. I suppose it depends on how kingship, or how exposed to the outside world Thailand was, in that hypothetical scenario we're building up. I think that even absolute monarchs would have to read what was going on globally unless it's a very secluded mountain kingdom like Bhutan, or something like that, which is a very small state and even Bhutan is feeling the pressure of having to open up eventually. Can't charge people $600, or whatever they charge, to get in. Then keep them, according to the old system. I think an absolute monarchy would be almost impossible in a country like this because it's so open to trade, and reception of ideas, to education, and Western educated elite, universities which are taught by people educated by the West or according to Western principles and methodologies so it would be almost impossible, an absolute monarchy. But assuming that the king was absolute, I think this King would be involved in public works, projects anyway. I know this is a mischievous point, but he would be too busy governing this unruly court, and have far less time to go about building dams, planning them. He would be trying to keep this guy docile and other factions from forming. [laughing] I think it would be impossible.

8. What, if any, is the influence of Western and modern education on Buddhism in Thailand?

The influence of Western ideas on Buddhism. Some people say that it started in the third and fourth reign of the Bangkok period, Rama III and Jodie Foster's lead [laughing], Rama IV, King Mongkut. I suppose more contact with the West at that time, especially dialogue with Western Christian missionaries, may have, I'm not 100% sure, may have probably influenced the way that King Mongkut when he was a monk tried to reform Buddhism. There was a new sect of Thai Theravada Buddhism which began in the third reign and the fourth reign, Dhammayutika nikaya. This is a Buddhism which is more concerned with personal efforts to attain Enlightenment, a more rigorous, some people say, rather merciless effort of thinking, rationalizing the old way to Enlightenment. It's a bit of every man for himself. You have to find your own path to wisdom, you had to find your own path to Enlightenment. You must not get attached to any sect or person too much, you must not be superstitious, you must not pay too much heed to supernatural things. It's a kind of reform movement, it moves away from popular Buddhism and so forth, which is a mish mash of animism, Hinduism, Buddhist miracles, non-Buddhist miracles. That kind of thing, I think King Mongkut was going against that. It's hard to say whether that was out of Western influence or not, but maybe partly, maybe it was almost autonomous intellectual development of Thais. They had come to a point where they wanted to change religion, but I think that's very difficult to have in history. There must be a certain personalization of ideas and I think the ideas then would be trying to defend

Buddhism against Christianity, make it more rational, make it universalistic. And I think that happened in mid 19th century. Since then, of course, Western influence has ... to give you a rather easy example, one of my MA students recently was a monk. One of the first things I had to do when entering the room was to do this to him [small bow with hands clasped near face], which was of course quite funny because the only Thai person, the only time I've ever waied a student. But I respected him because he was a monk. He had a computer, he was reading David Wyatt, he was reading Marxist theories on history. If you have monks, I suppose the elite educated monks, exposed to this kind of education, it has to change. I'm not sure how it will develop. Of course you have the negative aspects like the thammakai, how to sell. They do it to just obviously sort of market, with a capital m. And that is, I suppose, a product of business administration forces, and things like that. Some of the top monks were educated in management, marketing, and business, and it shows. [laughing] Very good propaganda.

9. **What is the current state of the practice of Buddhism in Thailand and in Bangkok? We've seen it likened to Christianity in the United States whereas a lot of people claim to be Christian but they don't actually practice. Is it a similar thing happening here or is it still true Buddhism permeating the culture?**

There are several versions of true Buddhism, I think that's why people are fighting, I mean almost at each other's throats from time to time. I suppose that Buddhism is not just a philosophy, contrary to what some people think. In a way, true Buddhism is a philosophy. It is not about the worship of a deity or anything like that, but it is your finding your way to Enlightenment. Things don't work like that in a society and Buddhism is, therefore, also social practice, also a means of getting people together, communal activities like, the most convenient example would be my family, people living in small family compounds. How Buddhist are they? We aren't ideal practicing Buddhists. An ideal practicing Buddhist would do a lot of meditation. Only my wife does meditation. Most other people in my family don't but we consider ourselves Buddhists in philosophical terms. If we had to explain certain things, or react to things like disappointment or death, we would try and react the Buddhist way, that it is the result of the accumulation of merit or demerit. I'm not so sure about myself. Other people in my family react like that. I'm rather atheistic. [laughing] But we're also Buddhists in another sense that, I claim to be unorthodox, but if I fell down the stairs and died in five minutes time, I would be cremated in a temple. [laughing] Every year we have merit making at a certain temple, I suppose we call it a kind of family temple because we make merit at this monastery all the time, in the middle of Bangkok. We would make merit to pay homage to ancestors. So that's a mixture of ancestor worship and Buddhism. Relatives who die, we go to the monasteries, the Wat for services, for cremation. Sometimes on our birthday we would offer food to the monks in the morning. Sometimes my aunt, on the birth or death day of my grandparents, she would offer food to the monks in the morning. We do things without thinking that it's Buddhist or not Buddhist. You could still say that we're Buddhists in that. I think that several other Bangkok families have about the same level of commitment as we have. But many are much more attached to going to a Wat, and actually entering meditation classes with revered teachers like Wat Sapathum here, he's a very famous meditation teacher, the one that's next to the World

Trade Center. That monastery became quite rich because people flocked there to make merit as well as learn meditation. I don't know whether later on, too much city life, urban life, actually dilutes Buddhism. I'm not sure. I don't think so. In a way, city folk are more demanding of their Buddhism, more demanding that the monks be good, that the monks be learned, that their teaching has a certain coherence and logic. More and more sects appear, like the European reformation, like there was the Santi Asoke movement which was mainly urban with the past people following a certain monk who has since been defrocked. One of their revolutionary ideas was that you can be a good Buddhist without having to worship a Buddha image and they banned Buddha images from their homes of worship. Wow. That's similar to Calvin. You don't need a picture of the Virgin Mary and child, or Christ taken down from the cross, like that. Study your bible, get to God. I think that kind of thing may happen increasingly.

10. Coming from the West, especially America, we don't really understand the reverence for the king. There's nothing like that in America. Could you provide us with a perspective on how people reverence the king and where that comes from, even since the monarchy has changed since past times?

It's very very difficult to answer, personally. The usual stock answer would be that the institution of the monarchy has always been there ever since Sukhothai or pre-Sukhothai down to the present, therefore it's built up this immense prestige and the king has become an object of reverence. But I don't think this really explains it. If you look at it in more detail, what's happened in the past hundred years, then you ask, then, why there is so much respect for the monarchy, for the king. Partly, it's because of the good fortune of the Thais to have had King Chulalongkorn, Rama V, and this present king. Chulalongkorn was crucial to the reforms, or modernization, Westernization of Thailand, or Siam into Thailand. I suppose that people credit him with having saved the country and all that. So I think that Chulalongkorn was important, not only for instituting all these reforms but it was during his reign that the nature of Thai kingship changed. As I told you earlier, they used to be very remote from their subjects. They would hardly appear in public. King Mongkut was more visible, maybe because when he was a monk, before he became king, he just wandered around the country and saw a lot of how people really lived and therefore he was more familiar with people. But King Chulalongkorn really did forbid prostration, in front of the king. People could just bow or curtsey, although nowadays that's changing too. [laughing] We're going back a bit, prostrating oneself again, but maybe that's the strength of Thai culture, customs. The kings became more visible, more, I don't know, more well known to the people as people, and not just as demigods. I think from then on, the monarchy and the people became closer. I would not say close in the sense that the Queen of the Netherlands stands in her queue in the supermarket, you wouldn't find any Thai king doing that. [laughing] But there's a very very clear change from the past when they would hardly ever appear in public and there would be elaborate palace laws, alapine laws, forbidding this and that, all kinds of horrify penalties for flying kites over the palace walls, get your finger chopped off. That kind of thing went out, from Chulalongkorn down to King Bhumibol. So it's partly the evolution of the monarchy into a more modern form of institution. To you it still appears very unmodern, but in the context of Thai history, this is as modern as it gets. [laughing] We don't have soap stories like Princess Diana

and things like that. People do meet the Royal family much more often. They're seen to be serving the people in many ways. What they get in return is not just a grudging acceptance but sometimes a great reverence. That, I suppose, is a cultural thing, the way that Thais greet, all the people, revered people, revered monks, revered phuu yai. You have to pay a lot of respect to them. Therefore, all the more respect for the king, who is the most high of all the phuu yai. All this is indefinable loyal blood, royal charisma, whatever. But then again, you have to start looking at whether 50% of it, or 80% of it is personal achievement of this King, and that I really don't know. It's a sort of institution versus personality kind of analysis. I think it's the strength of the monarchy or the particular strengths of this king that's given him this kind of amazing power, moral power.

11. Just one closing question, how will you remember King Bhumibol?

He's still with us. [laughing]

What are your impressions of him?

I look up to him a lot. As a historian, I see his reign as a remarkable period in Thai modern history. As I say, I have the deepest respect for this King, I think he's gone through some difficult times and he's come out of it very well. Part of it is due to luck but most of it is due to his own hard work and, I don't know, sometimes almost uncanny ability to stay above the fray, above all the fighting and conflicts. And then playing a key role when things threaten to get out of hand, like in, obviously, 1992 or 1973. As a historian it's fascinating because you have this, what you just said, this constitutional monarchy, but what is this King doing? Why is he doing all this if it's a constitutional monarchy? Why does he have this kind of reserve power, as one of our former Prime Ministers called it. He has the power, but it's not executive power, it's not actual power, but he has a kind of reserve moral power, I would say. When he does come in and say *stop fighting, people stop*, even two generals have to stop. In terms of institutional history, it's fascinating, that in an age when a king is supposed to have very little power, he does have this kind of influence. Apart from that, I think that, as a historian, again, I would also be fascinated to see people writing theses, dissertations on the institution of the monarchy during this reign. There are both positive and negative aspects which you can write about. From the King's own personality and the King's own actions it's almost all positive, but what I'm sometimes uncomfortable about, as a person who's been corrupted by the evil West [laughing], is all this flattery and image building, which one cannot deny has gone on, not in any sinister way, in the style of Hitler and Speer, or anything like that, but there has been a lot of excessive image-building. On the balance I would say that the King is above all that and his achievements would seem to be very good, regardless of what the propaganda says. And for me personally, the King is very significant because he was the one who anointed my wife's and my forehead when we were married. Many couples every year get married by the King so ... and we're still together so ... [laughing] it must have worked. But of course history has a way of looking at personalities and issues. Who knows what the historians of the next generation will say, but for somebody who's been in this country during the reign, I would say that I've been very grateful that things haven't been as bad as they could

have been. Part of the credit, a lot of the credit must go to the King during certain crucial stages of our rather troubled political history.

Dr. Sumet Tantivejkul

Secretary General, Chaipattana Foundation
(25 January 2000)

The following are notes from our interview with Dr. Sumet.

Discussion of the New Theory plot at Saraburi

This was the first implementation of the New Theory. It depicts a good combination of the old practices of the Thai way of life because in the old times, everything began with the temple. The monks prayed there, social activities were based ther, and so on. His Majesty has mentioned that at the present time, life is a little bit far away from the temple. The morals of the people are not at their best. He used the fact that the people come to the temple as an opportunity to teach more than just religion. His Majesty bought a small piece of land behind the temple to show them techniques of rice farming and crop management. This area eventual become the original New Theory plot. It uses the 30:30:30:10 sections.

The farmers do not know how to manage their farms. They produce rice, pineapple and so on, working only once a year, but spending all year round dependent on the mercy of nature. If there is a good rainy season, they will survive. That is why performing a diversity of activities on your land, having chickens, a fish pond, is good. It is as if you have your own 7-Eleven behind your house. You can shop on your own without paying. Then with the excess you can go to the market and make money for saving. People do not save anything. We try for sufficiency first and after that the rest of the land you can produce for the market.

Huai Hong Khrai Discussion

This site has an economic forest. Here the land has many functions. The trees must be chosen with great attention. It is fascinating. The philosophy is that the forest has been destroyed, this project began about 10 years ago, when we made the first survey. When it rains, in two minutes time the water has washed down everything. The idea is that the first drop of rain arrives at the top of the mountain, but it can be used until it arrives at the valley below. In reforesting the area, and conserving the forests, it is important to stick to the original, do not introduce anything new. We slow down the water by using check dams. This way the water spends months travelling down the mountain until it arrives at the valley below (as opposed to the two minutes). This is irrigation, it gives the trees time to grow.

At the middle of the mountain we have a medium size dam to collect the water. We can use this water for fish and to irrigate the trees. Then at the bottom of the mountain we have another dam to collect all the water. Here we have rice fields. This is total natural resource management.

I am not an expert, but it is very fascinating.

Normally, before the winter, winter in Thailand is not as yours, but now we're entering summer, but, normally the leaves fall. Around the project, all the leaves have died and fallen, but in the project area, it is all still green. This is because the humidity is still kept in the area. Also, once the humidity is still in the area, no forest fires occur. The area is a wet firebreak.

Dr. Suchit Bunbongkarn

Institute of Security and International Studies, Faculty of Political Science, Chulalongkorn University
(8 February 2000)

1. **What is the government's role in helping the people of Thailand, especially with respect to the Ministries?**

That's a broad question. Can you be more specific?

The King is very active in the initiation of projects. What does the government do, what projects do they have? And how are the Ministries involved in taking care of the country?

How many Ministries [are] involved in the King's project? I would say that every Ministry [is]. What do you mean by helping the country, helping the people? What aspect?

In the United States we don't have the Ministries as such, and we've noticed that occasionally the King's projects have sort of bumped heads with some of the Ministries and you have to work around them but in other occasions they work together. I guess we're wondering what's the interaction between the Ministries and the King's projects?

I would say that depends on if you want to focus on the King's project. The King's project is more or less on rural development and particularly how to enhance the people's well being in the rural area, particularly in the agricultural sector. So, the Ministry involved definitely is the Ministry of Agriculture. I would say [it's] heavily involved in the King's projects. To some extent the Ministry of the Interior and Defense [are] more or less involved in the sense that [they] provide manpower. At the planning agency would be an officer attached to the National Economics

Development Board. I would say that the most important Ministry would be the Agricultural. There might some other Ministry such as Public Health also involved.

How are they involved? Like the Ministry of Irrigation.

For instance, the Irrigation Department which [is]attached to the Ministry of Agriculture [is] involved in many aspect ranging from the conception of the plan to implementation, building, everything. Irrigation would be involved in building small dams to irrigate, to supply water to the farmers. Then I would say that the Forestry Department [is] also involved to some extent, in terms of how to take care of the forest and how to settle issues of people encroaching into the forest, so on and so forth. I would say that the Forestry Department as well as the Irrigation [is] also involved since the beginning of the project.

2. **In some of the projects we've been researching we noticed that the King's role has been simply to initiate an idea or make suggestions. It seems like his influence is very powerful. We were wondering what's the nature of his influence, which is often sort of "magical" in context?**

Oh, it's not real magical. He is influential because he has built up his charisma for so many years. Also, he is influential because of his long years of dedication in rural development. He has been involved in the rural development I would say more than 30 years, consecutive, without any disruption, without any stops. The accumulated knowledge and experience that he has in the past 30 years makes him the most influential in the area of rural development, because no one [else has this]. Even government officers, even researchers, because no one has been involved in rural development consecutively for 30 years. Even any officers, they come and go; the researchers, they come and go. Only the King stays there for the rural development so he knows every single detail of his project, since the beginning to the end. He always comes back to see the result of it. He remembered every single detail of that area, of his idea: whether this has been implemented or not. The officer concerned cannot argue against him at all because that officer is not knowledgeable compared to the King. That's where he builds influence. It's not magical. [It's] expertise [and] knowledge, accumulated for more than three decades in that particular area. And he has been concerned about rural development, about irrigation, [and] water supply. He is an expert on hydro-engineering in smaller scales so he knows quite well the geography of the landscape [and] the country. He [has] developed a number of expertises [in] his experience. So that's where his influence comes [from], [it's] not magical.

3. **Along that line, what is the theory behind a constitutional monarch in Thailand?**

Our constitutional monarchy is very much similar to [what in] Western thought would be the British. More or less the king is under the constitution and he has adopted the parliamentary system since 1932. But our parliamentary system is not that effective, our party system is not that strong or highly institutionalized compared to countries in the West. So once in a while the King was encouraged to come up to

help resolve crisis. This doesn't mean that the King is above the constitutions; the King is also under the rule of law. He has to comply with the constitutions. In times of crisis the people invited him to resolve it and he knows how to manipulate it effectively.

4. You mentioned about the ineffectiveness of the parliamentary system. Why is that?

Well, because our democracy is new. Also we changed our system of government from [an] absolute monarchy to [a] constitutional monarchy in 1932, that's over 60 years ago. Compared to the West, compared to your country, in the U.S. you have developed democracy for more than 200 years, Great Britain even longer, [and] France even longer. So you have quite a lot of experience in terms of political institutions [and] parties. But in our country, it's quite new. The oldest party of Thailand is some 50 years old, that is, the democrat party is the oldest. The rest is very new - 20 years, some 5 years. It requires time to develop.

5. What are they facing? What issues prevent them from being more efficient?

I would say that the basic problem would be how to respond effectively to the needs of the people. We need to do something more to respond to the people's demands. That would be one of the demands: to become more and more sophisticated, more and more diversified. It's not very easy for government institutions or political institutions to meet that. For instance, in the case of the economic crisis we have had for the past 3 years, the demand of the crisis is very complex. The rural people wanted something. The urban people wanted others. And somehow it's not very easy for the government to compromise and reconcile the diversities. It's not very easy at all. That would be one of the challenges to the political [and governmental]institutions: how to satisfy all the needs of the people. Particularly it's been more diversified. It's become more complex because of the crisis, because of the big change. The other thing would be how to make the system, particularly the government and bureaucracies, more accountable, more honest. That would be one of the problems. We can see that the corruption is one of the major issues. It's not very easy to eradicate it [or] resolve it. But we are trying to do it under the new reform program, under the new constitutions, [and] under the notion of good governance. [We are] trying to make everything more transparent, to make it more accountable to the people.

6. What is the likely future of the country and the government without the monarchy?

I don't think the Thais would want to see that - the country without the monarchy because the monarchy is an integral part of society. It's not only the institution [as] we can call it, it's called *the* institution, the lifeblood of the country.

So what changes do you foresee in the monarchy?

What changes do you mean?

Like when it changed from absolute to constitutional, it always gets refined in the new constitutions and whatnot. Do you foresee it pretty much staying as it is now or do you expect it to change in the future?

It's more [likely] to stay the same because our monarchy is not absolute. Our monarchy is constitutional in that what I told you, the King is under the constitution. He has to be under the law. So we cannot see any drastic change in the monarchical institution. The King could be less active because of his old age. He has to be very selective with going [out to] all the Royal Projects but he's still concerned with the poverty of the people, with the hardship of the people. He's concerned how to make things better with the people and how to give recommendations to the government officers to resolve these problems - the poverty.

7. With respect to King Bhumibol, how much of his prosperity and reverence for him has been due to his personality versus his duties as a king?

The King has been well recognized about his honesty [and] his dedication to the people. What do you mean by prosperity?

He's very active, he's very involved in the development of the country. He really cares for his people and he does know a lot. Over the course of his 53 year reign he has done a lot for the country. And how much of that is from his sense of duty as opposed to his personality and just him as a person?

I don't think I get you on that idea.

We read that there are the 10 Kingly Virtues and as a king he does have responsibilities to the country. But it seems he does a lot of the projects from his own desire to help the people and from his own personal attributes. Where do you see the split on King Bhumibol?

Do you think that what he's doing is more due to who he is and his own personality or is it something that he's doing just as his job?

It's quite difficult to say. I would say that both, as a person [and] as an institution. Both in a way that as a King he is responsible for the wellbeing of the people. As a person, he's a man who always loves the people, because he was brought up in very special circumstances: [he was] educated abroad [and], he wasn't brought up in the palace. He was brought up in a small village in Switzerland, so the environment was like very common people rather than living in the Grand Palace and [not seeing] anybody outside. So it's quite, quite different. So I can see that it's both, [a] combination.

8. Can you explain the reverence for the king?

[It's] not very easy for me to explain it.

We're trying to get a perspective. There's nothing like that in the United States and we've studied it, but we're interested in people's firsthand perspectives on how they understand the reverence for the King.

It's a matter of faith, it's a matter of culture [and] region. It's very difficult to explain to a country that doesn't have this institution. You cannot explain why you have a faith in Christianity, or why you believe in God. So we can say that it's not scientific, you cannot prove this scientifically, but once you are in trouble you say *oh, my God! God help me.* It's the same thing but a king is more tangible, you can see him as a person, you can go up to see him at home - *please help me, I have trouble.* But it's a combination of faith, of tradition, [and] of culture, that has been with us for a thousand years. And the institution has been changed, it has adapted itself to the present and modern environment. The monarchy that we have this day is, of course, quite different from centuries ago. The present King [tries] to make himself next to ordinary people, he talks with the people, he discusses the scientific method of the results with the people. He didn't use his magical power. I would say that he is very realistic in technical problems: get the information, study, [and] try to experiment [with] it. He's a realist. [The monarchy changes] as the policy changes, that's why the monarchical institute in Thailand survives, because it fit in modern society. It fit in democracy, compared to monarchical institutions in other countries that failed because [they] cannot cope with the demands of modern society, [they] cannot cope with the demand for democracy. But in our case - now we have democracy - we have modernization, we have modern concepts - Western concepts - and the question is *why [has the] monarchical institution survived?* Because it has been able to adjust itself to the changing environment.

How has it adjusted?

The king tried to, first of all, agree with the constitutions. He's a constitutional monarchy. He tries to project himself as person, as well, and also he tries to subscribe to the modern idea of a concept in helping the people. For instance, he's the first one among the Thai, I would say, using the Internet, computers, so on and so forth. And you have to encourage people to get involved in that. Look at the last speech on the King's birthday, his last birthday. He mentioned about the Y2k issue and he said we should understand more about this Y2k, and you cannot understand Y2k unless you know English. So he asked the people to study more about the language, about the English, because the computer and English go together. You [can] never understand computers so easily unless you command the language. At the same time, it doesn't mean you have to drop Thai; no, Thai is our native tongue so you have to study Thai, but at the same time you have to be concerned about your English proficiency to understand the hi-tech things because the hi-tech things come in the English language. That's why: he's a modern man. At the same time, he never forgets about the rural population. He's a man who can combine the local with the global aspect. It's not very easy. It's not very easy. The rural project is a local thing and he applies modern techniques which fit in the local, the particular local. He [is] using computers, he [is] using [the] Internet.

Do you expect that this trend will continue? The king will be aware of the future as being local and global?

Uh-hmm.

Subsequent kings will also change with the times? Or do you think that's a personality attribute of -

We agree that the personality will change. The idea of a new king cannot be the same as [other kings]. It's a different person. But I would say that the basic function of the king, of the monarchical institution would be the same. It would be the same. But the interest of the king as an individual might be different [and] the role might be different, but the basic function would be the same. The present King has been too good and it's not very easy for anybody to follow him. That's respect, you see. For any time of crisis it's not very easy for anybody to imitate him [on] how to resolve the crisis. It's not very easy. So, I would say that in the future we have to rely more on the government system, on the government, on parliament, or bureaucracy to help develop the country.

9. What will the people have to do in order to make the changeover to a new king who isn't as active as King Bhumibol?

They don't have to do anything except that they have to try to help themselves more. The King also tries to do that at the moment.

10. Along similar lines, what changes does the government have to make in the future? Where do you see it heading?

In what area?

What changes do you foresee for the government?

It's a broad question. I would say that the country [will] become more democratic [and] more effective in responding to the needs of the people. Also, we agree that a number of issues and problems remains, like corruption [and] money politics. But these will gradually get better. It's not a quick development. It has to go step by step.

Appendix I Notes From Project Site Visits

Monkey Cheeks (Kaem Ling)

Thongchai Roachanakanan, Department of Town and Country Planning, Monkey Cheeks Project, Chumphorn Province
(19 January 2000)
Notes Summary from the session with Khun Thongchai

The King visited the province and found an interesting problem: many big storms hit that province each year, causing flash floods. The King had different ideas about how to solve the problem and had his own resources to solve the problem. His method involves introducing examples. People don't have to spend a lot of money like the way other departments did before.

When storms hit in the northern part of the province, there was a big influx of water. The Irrigation Department had done something before - they started digging a canal to drain the water to the sea, but it wasn't enough. The King visited in 1996 or 1997 and told the Department of Irrigation to speed up the project: they have to finish the project within 30 days. His Majesty paid money to do so. The canal can solve the problem.

People involved in the project mentioned to the King that there is a big swamp, and a Monkey Cheeks project could be developed there. The King visited and gave recommendations on how to start the project and solve the problem. People should understand the geography. They were not allowed to have a big project that can cause lots of problems later. This morning there was a meeting with local officers to propose future plans and explain the maximum level of water in the swamp - 5 m above mean sea level. The area they want to use for the Monkey Cheeks is about 2.5 km^2.

The depth of the canal varies from 1 m to 5.3 m. The people were told that they could stay where they were living but only under certain conditions - e.g. their house has to have an open foundation (on poles above the ground), they are not allowed to build concrete blocks around house. The land use plan was shown to community leaders. In the future, they will not allow any kind of development along the river. People can have projects, just not big projects. The area is defined as low density. There was feedback from the people.

Questions and Answers with Khun Thongchai

1. **What sort of projects are able to be done in the area?**
   For example, small house, small shop house. Not the shopping center.

   This was just swamp area before you initiated the Monkey Cheeks project?

In fact, the Monkey Cheek project, the original one was small, very small. The King was thinking about how to make this swamp bigger so that if we have a lot of water coming down from the north, it is like a safety factor to make sure we won't have any problem later. That's why we use the water level, 5 m above MSL, as the boundary to show the people that it's a really critical situation if a lot of water comes from the north or any big storm hits this town.

2. **What happens is that the water from the rivers from up north will collect in here and filter out into the sea?**
   Yes.

3. **Are there any side effects to the community and the land around the project?**
   We think a very little impact. Very little. There are just some areas that the people have to follow the new regulations that you cannot make the big houses like in Bangkok, shows, newspapers, or magazines, like the concrete block. No more.

   Why is that?
   Because it blocks the waterway. That's why we chose this picture to tell the people, it doesn't mean that we don't allow you to do anything, but at least you can have some kind of a plantation. You can grow vegetables but at the same time we have to remind you that you should not have the big trees like coconut trees. The people in this area love to grow coconut trees but they shouldn't forget that they will lose money if these trees die because of flood.

4. **Is there a lot of resistance to these regulations?**
   So far we have had a public hearing. We will see the people I think next month, maybe March, maybe April. That depends on how fast we can work.

5. **Who funds the project?**
   It is part of the King's foundation. The government will repay back.

6. **I understand that the project was started originally some time ago and they weren't making enough progress and the King saw the area and kind of picked up the slack, invigorated them to continue. How much of it was the King's idea as opposed to what was already started?**
   Only the King can do that. Only the King can say, yes, you have to finish this project shortly. Not next year, but next month.

7. **How much of the idea of the project was the King's?**
   100%.

8. What has to be completed, what's left? I don't understand the project fully. There's like a canal system, and then there's this big reservoir.

It is our job to complete this master plan that will be controlled by law, the planning law. We should have this law by April, theoretically.

Physically for the project, all the groundwork has been done? All the canals and whatnot are finished?

Mostly, but we will have more canals in the future. I think the Department of Irrigation is asking for more money. I think the budget will approve these purposes soon, maybe 200 or 300 million, I don't know. Our director general has just said last night about how much money we have to spend in the name of Town and Country planning. For example, if you think that we need something like to make the river or the canal bigger, we are ready to give you money. That means the money can come from many places, many departments, not just from the King or the King's foundation.

9. The purpose of the project is to prevent flooding in Bangkok?

Yes, but the King has more ideas about how to introduce the local people what kind of plantation the people should have.

10. The project is definitely working right now?

Yes, very good project.

11. Besides the zoning, besides building the houses, how else do you prevent flooding?

For example, we will not allow the people to fill the land. Some people don't understand how these problems can be solved. And some people still have very old ideas about how to solve the problem by filling, to lift up the land and put the house up on the hill. Tomorrow I think you will see how the people solve the problem by moving the construction materials to stop the water, to protect their lands, their farms. You cannot solve the problem by making the land higher, no. So far, no.

12. Are there plans to educate the people, what they should or should not do?

We hope that the King may be the answer, the good answer. We tell the people that it is the wish that the King would like to see a kind of activities, work harder to solve the problem like this.

How would the King spread his message to the people about what they should do?

The King explains to the people what should be done, what should not. I think a good example is the King's project; this is a kind of demonstration, to show the people, to convince the people that if you follow this way, this is a better solution.

So as of right now, the people are not educated about this, or they know a little bit?

It is difficult to tell you that. He's given a demonstration project and then made the project bigger. The King started by having a small project to show the people how the project is working. After that, the project will become bigger, to make sure the people understand.

13. If you have recommendations, say you see this as a problem, that you want the people to become more educated, how would the King know about this?

Some people have a very good education but it doesn't mean that they will follow everything. Everyone knows this project. Something that you should know about this project is the people who live around the swamp, they have to understand that this project is being done to solve the problem for the people who live in town. So the people outside the town have to understand why they have to listen to what the King is trying to do. No compensation. It has been known as a public area for years, for decades, for many many years, since 1932 as I told you.

14. When were the original canals started?

35 years ago.

15. Would you say that a lot of Thai people understand the King's projects or do most of them just accept it?

Most people accept that. Just small group who will lose the profit, the property. A very small group.

16. Relative to the Monkey Cheeks project, the government right now is in the process of putting laws into place to keep people from building houses. They're in the process or do the laws actually exist right now?

That is what we are doing now.

About how long do you think that will take?

The policy is really clear. As quickly as you can - about 3 months, if we don't have any more problems.

What would be a problem, for example, that might arise?

The legal process, which is very complicated. Before you can have a new law you have to pass it, and it's not easy to do. We're afraid it is a time we will have a new government. We are trying to finish this project before we will have the new government. That's a very critical period. I think you may learn something about Thai politics.

Notes from the site visit on 4 February 2543

In the works is a project to increase the maximum flow through the water gates from 300 m^3/s (presently) to 460 m^3/s. They need to drain 800 m^3/s though. This expansion should be complete by the end of the year. In addition, another canal was

improved to 400 m^3/s so the total drainage will be 860 m^3/s. The improvement was funded by the Department of Irrigation. There is still some flooding.

The Monkey Cheeks project is similar to a project in Illinois, USA. There are other Monkey Cheeks projects (one in Bangkok), but they aren't as successful as this one.

The Department of Irrigation proposes an idea to the King, he makes suggestions, refines it, makes it work, or funds it (or combinations of the previous). Either that or the King sees a problem then asks the Department if they've done anything about it. The workers and people can directly tell the King problems when he goes around the country.

The King may not get direct reimbursement for funding government projects but public donations more or less make up for that.

The swamp area floods in the rainy season. People began encroaching on that land for personal use. They built a canal around the flood area to section it off and deter people from using it. There are also land-use regulations. The swamp area, the "monkey cheeks" of the project, is 3 Mm^3 and they want to expand it to 5 Mm^3.

The people around that area are used to the floods. They live free. The King hasn't yet directly talked to the villagers. It's impossible to *force* them out of the area; it is their home. There are punishments for not obeying the regulations (comprised of restrictions on housing, farming, etc.). It's a compromise: the King doesn't force them to move but sets regulations to enforce the boundary around the swamp. The people love the King but they have no alternatives, they have no where to move, no other way to make money. They're accustomed to a lifestyle.

The King said regulations must be in place, though the laws aren't official yet. It takes 100 days to enact official regulations.

The idea was tested using one water gate. It worked so the project was expanded. It was completed in time for tropical storm Linda. They want to increase the capacity to create a retaining basin.

Royal Rainmaking

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(25 January 2000)

Notes Summary from the Royal Rainmaking session

History

Thailand was the first Asian country to successfully implement an artificial rainmaking process and to this day continues to be in the forefront of rainmaking technology. Within Thailand, the concept was brought about in the 1960s when there was severe drought. A lot of clouds, but no rain. Based on the King's initiative, studies of the US methods for cloud seeding were made with hopes of adapting the techniques to Thailand's climate. In 1975 the government recognized the benefits the project would provide the farmers and Royal Rainmaking was established under the Ministry of Agriculture.

Side Effects

There are no significant chemical differences between artificial and natural rainfall. There are no toxic chemicals used in the rainmaking process, however, to ensure that no environmental damage is being done, plant samples have been collected and are being tested. So far, there have been no detrimental but further studies must be done to verify these initial findings. The chemicals used are the same as those found in natural clouds. Chemical concentrations were determined by performing both laboratory studies and actual in flight experiments.

The Technical Process

The techniques used in the Thailand's Royal Rainmaking process have been enhanced by technology sharing with other nations participating in similar artificial rain projects. For example, US experts have provided technology for measurements and experiment design. The measurements that are pertinent to successful rainmaking missions include wind direction and speed. Each morning these measurements have to be made. Then using a number of meteorological techniques, it is possible to determine a target area over which the artificial rain will fall.

Due to the use of unpressurized aircraft, cloud seeding cannot occur at any elevation higher than 10,000 ft. It is believed, however, that the rainmaking process could be more efficient if the planes could fly higher, for example up to 20,000 or 35, 000 ft. Larger clouds are 14 to 16 km high, with the aircraft limitations, only up to 10,000 ft of the cloud can be modified, therefore the entire body of the cloud cannot be altered to produce rain. There is some preliminary research being performed in the realm of using rockets for artificial rainmaking, but there are a number of regulatory issues surrounding the use of missiles. Further, the rockets are unable to hold large amounts of chemicals as necessary for the rainmaking process. Each mission requires about 2 tons of chemicals, with the three steps performed, there are a total of 6 tons of chemicals released per day.

Economic Aspect

Artificial rain is currently funded by the Ministry of Agriculture with a budget of 310 million baht. For the airplanes alone, expenses reach nearly 100 million baht. It is difficult to discern the whether the project is economically beneficial or not. In terms of drought relief, however the benefits are easily visible. The rainfall provides water for the dams for electricity, this same water flows down the river to irrigation areas and then continues into the city for general consumption. There are many

qualitative benefits which outweigh the actual financial costs. Easing some of these costs, the project receives of donations of chemicals as well as other necessary components for the process, i.e. jet fuel. One year crop growers, beneficiaries of the rain, donated an entire plane to the project.

Involvement of the King

The King is actively involved in the Royal Rain project. He started the idea of artificial rainmaking in Thailand both conceptually and financially. Also, he has made a number of trips to cloud seeding stations for planning the future of artificial rain, as well as to demonstrate the process to foreign visitors. Further, the daily operation of the project is reported to His Majesty. He studies each of the experiments and the operations involved in them. Starting last year, the King and his people came to set up a special team to perform research, one such experiment was cloud seeding during the dry season. The King is still actively involved.

Other Water Resource Projects & Artificial Rain's Future

The Royal Rain Project works in conjunction with projects concerning other aspects of water resource development, such as dams. The dam projects provide information on inflow and water level, this cooperation allows further exploration into techniques for increasing water levels. The making of artificial rain also goes hand in hand with irrigation projects. Cloud seeding is one of Thailand's most effective water resource management tools, there for a major goal is the project's permanence and continual evolution of technology to increase accuracy of the techniques. Some of the new experiments involve the use of silver iodide. Experiments are performed by flying planes into the clouds and collecting the data. The control is simple data collection; the variable is dropping the chemicals in addition to gathering data.

Pa Sak Jolasid Dam

***Anomas Thongtham*, Project Manager, Pa Sak River Basin Project, Lop Buri and Saraburi Provinces**

(2 February 2000)

Notes summary of the presentation from Khun Anomas

History

In 1965, a feasibility study was performed on the Pa Sak storage dam project, but due to lack of funding, the project was suspended. However, in February 1989, recognizing the need for a dam in the area, King Bhumibol revived the project.

Necessity

The Pa Sak Dam is needed for three major reasons: to alleviate flooding in Bangkok during the wet season, to provide a water supply for agriculture and consumption, and to reduce water shortages near the Chao Phraya river.

Impacts

The previously flooded areas helped by the project comprise 18,259 hectares in 3 Lopburi districts and 1 Saraburi district. Affected by this water resource management effort were 7,700 families. Before construction could begin, 28 archaeological sites had to be excavated. In addition, 2 roadways and 1 railway were built.

Resettlement

Between 1995 and 1998, the Project acquired a total of 16, 151 hectares for just over 8,500 million baht. Some of this land was purchase from villages in accord with the following resettlement scheme.

- If 10 rai is owned, provided with 11 rai.
- If 5-10 rai are owned, provided with equivalent amount.
- If <5 is owned, provided with a minimum of 5 rai.

The total cost of this resettlement was 3,284 million baht, with between 170,000 and 940,000 baht being provided to each family for resettlement. The compensation came in three parts: cost of land, cost of structures (houses), and resettlement compensation. Approximately ten percent of the villagers disagreed with the project because of the need for relocation. Eventually, all villagers were moved and fully compensated.

Funding

Government budgets have provided the funding for the creation of the Pa Sak Dam. The total cost of the dam is approximately 23,000 million baht, with 15,000 million of that cost being for environmental assessment.

Benefits

The Pa Sak Dam is used for both irrigation and flood control, however the head of the water is not at a sufficient height, only 36.5 m, to provide hydroelectric power. Other benefits of the project include the following.

- Water consumption for the provinces of Saraburi and Lopburi.
- Water source for industry.
- Alleviation of water shortages in the Bangkok area.
- Flood control in the Pa Sak river area.
- Large scale resource for fresh water fish.
- Recreational area.

Construction

In the creation of the dam, there were three options to consider: (1) a small scale project with water storage capabilities of 68 Mm3, (2) a medium scale project able to store 360 Mm3 of water, and (3) a large scale storage dam with a capacity of 960 Mm3. This third option was chosen to be constructed across the Pa Sak River. The dam height is 36.5m, and the maximum retention level is 43 m above Mean Sea Level (MSL).

In addition to the storage reservoir, there are three other structures making up the Pa Sak Dam. The first is a service spillway which has seven openings and a maximum discharge capacity of 3,900 m3/s. The second is a river outlet with a discharge capacity which is maximized at 80 m3/s. Finally there is an auxiliary spillway with the ability to discharge water at a maximum rate of 65 m3/s. The construction of the dam was complete as of September 1999. However, the irrigation aspect of the project is still in progress, though schedule for completion by the year 2005.

Appendix J New Theory: Do's and Don'ts

What follows is a list of guidelines from the Office of the Royal Development Projects Board for what should and should not be done during attempted New Theory implementations.

Do	Do Not
1. Adjust the calculated 30:30:30:10 ratio to suit the local topographical and environmental conditions. 2. Grow enough rice for household consumption throughout the entire year. 3. Study the soil condition for its ability to retain water; consult officials before digging a pond. 4. Fill the cultivation area will topsoil recovered from the digging of the pond. 5. In order to reduce household food expenses, utilize the empty area around the house for horticulture and herbal plant cultivation. 6. Raise livestock that are complimentary to each other, such as chickens, ducks, or pigs, around the pond or housing area. 7. Raise fish in the pond, for protein consumption and for selling in the market as a supplement to the family's income. 8. Grow vetiver grass around the pond to prevent erosion of earthen embankments. 9. Create unity among local people by jointly working together as *Long Khaek** to realize successful outcomes. 10. Consult officials from Department of Land Development, Department of Agriculture, Royal Irrigation Department, Department of Agriculture Extension, chiefs of district, district and subdistrict agricultural officials and other offices concerned.	1. Do not think that the application of the New Theory is impossible if agricultural area owned is more or less than the assumed 15 rai; the ratio scheme can be adapted to suit the actual size of land owned. 2. Do not hesitate to set aside a part of land for constructing a pond; and if there is an existing pond, it is not necessary to dig a new one, improvements can be made so that the pond is able to store water. 3. Do not destroy the rich topsoil while digging a pond. 4. Do not cultivate plants or perennial trees, which need a lot of water, around the pond edges 5. Do no practice mono cropping. 6. Do not change to practice New Theory if the current farming activity is working out well. 7. Do not follow the concept if the area is not suitable for practicing the New Theory. Try to find other suitable way of farming to suit the local condition. 8. Do not be discouraged and lazy.

* *Long Khaek* refers to the traditional practice of mutual help gathering for activities such as rice harvests.

Appendix K The New Theory Stages

First Stage

1. This procedure is designed for farmers who have small plots of land (about 15 rai).
2. The main goal is to enable the farmer to achieve self-sufficiency, beginning with a frugal existence. Such an endeavor will demand solidarity throughout the community.
3. The production of a sufficient amount of rice for yearly consumption will require 5 rai of paddy land per family.
4. To ensure the above production, water is required at the rate of 1,000 cubic meters per rai. Thus, 5 rai will require 5,000 cubic meters of water. For each plot of land (15 rai), 5 rai of paddy land and 5 rai of farmland will require 10,000 cubic meters of water per year.

   This tentative formula has been set up:

5 rai	Paddy land.
5 rai	Farm crops & orchard.
3 rai	Pond. (4 meters deep, holding about 19,000 cubic meters of water)
2 rai	House & other uses.
15 rai	Total.

5. The most serious difficulty is that a pond filled only once a year will suffer an evaporation rate of approximately one-centimeter for each dry day. This means that in one year, supposing that there are 300 dry days, the level of water will subside 3 meters. In the tentative case, ¾ of 19,000 cubic meters leaves only 4,750 cubic meters of usable water. Therefore, an external water supply is required.
6. Another problem is the large initial expense of implementing the New Theory. To cover this expense, the farmer will need assistance from the government, the Foundation, or private funds.

Second Stage

The second stage is to be initiated only after successful implementation of the first phase. This stage consists of having the farmers consolidate themselves in the form of "groups" or "cooperatives". The activities performed by these "groups" include the following and are completed through cooperation with the government, the Foundation and private enterprises.

1. Production (seeds, land tilling, irrigation, etc.).
2. Marketing (rice drying courts, barns, rice milling machine, marketing of products).
3. Livelihood (krill paste, fish sauce, food, clothing, etc.).
4. Welfare (health, credits).
5. Education (school, educational scholarships).
6. Social work and religion.

Third Stage

In this final stage, the cooperative will approach a credit source (bank) and a fuel source (oil company) for the establishment and running of a rice mill and cooperative store, for credits, and for the elevation of the standard of living. These activities will benefit the farmers as well as the bank and company in the following ways.

1. The farmers sell rice at a good price (the price will not be cut); the bank and the company will get consumer rice at a low price (they buy paddy rice directly from the farmers and will mill it themselves).
2. The farmers buy consumer goods at a low price (it is a cooperative store buying goods at wholesale price).
3. The bank and the company will be able to redistribute their personnel.

These excerpts from Concepts and Theories of His Majesty The King on Development concerning the three stages of the New Theory were released by the Chaipattana Foundation on March 15, 1994, February 12, 1995, and February 13, 1995 respectively.

Appendix L Uses of Vetiver Grass

Throughout Thailand, vetiver grass is widely used for both soil and water conservation. The following are brief descriptions of the many ways in which vetiver grass can be used in both of these activities as discussed in "Concepts and Theories of His Majesty the King On Development".

1. Contour Planting of Vetiver Across the Slope

This type of planting yields the best results when mature vetiver grass is used to form tightly packed rows. When rainwater runoff occurs, water-borne sediments encounter the rows, the vetiver traps the silt and reduces the runoff speed. This allows more water to seep down to lower layers of the soil, while allowing the rest to flow through. The vetiver root system, which can penetrate the soil up to 3 meters, is able to effectively hold the soil and prevent it from being washed away. Over time, the sediment accumulated at the front of the vetiver row increases, eventually forming a natural terrace.

2. Solving the Problem of Gully Erosion

The technique using vetiver consists of planting one horizontal line of the grass above the gully, and then lining up bags of sand or earth to serve as breakers in an attempt to reduce runoff velocity while the vetiver is taking firm root.

3. Vetiver Planting on Sloping Land

In the North and South, vetiver grass should be planted in hedgerows in areas of hillside ditches and bunds or on the outer edge of step terraces, at the beginning of the rainy season. Furrows should be ploughed and vetiver slips planted therein at the rate of 3-5 slips per hole. Hedgerows should be spaced at vertical intervals of not more than 2 meters. Vetiver will grow and form a dense hedge within 4-6 months.

In dry areas, the grass should be cut once every 1-2 months to a height of 30-50 centimeters to accelerate tilling. Grass cutting must be carried out everywhere; the cut leaves should be used for mulching.

4. Conserving Soil Moisture

Vetiver is grown with fruit trees in the initial stage of their development, or in alternate rows with other trees. For example, in Malaysia, the grass is planted in lines between rows of rubber trees. When the vetiver is about one year old, its leaves can be cut for use as mulch around the tree bases to conserve moisture, as vetiver leaf cuttings will not harbor diseases or pests.

Vetiver cultivation to maintain soil moisture may be done in three ways:

- Planting vetiver rows in parallel with rows of fruit trees at an interval of about 1 meter, and using vetiver leaves to cover the tree bases to conserve soil moisture and to increase soil fertility.
- Planting vetiver in half-circles around each fruit tree, at the radius of 1.5-2.0 meters from the base of the tree. This technique is termed "*Huang Sui*" (Chinese grave, with semi-circular headstone in masonry or concrete) by His Majesty.
- Planting vetiver in a half-circle facing uphill to trap silt carried by runoffs and to accumulate it around the base of the tree.

5. Preventing Damage to Step Terraces and Hillside Ditches and Bunds

In sloping areas, it has become a popular practice to grow rows of vetiver along the edges of step terraces or along hillside ditches and bunds to prevent damage to these costly structures.

6. Controlling Gully Erosion

Vetiver should be planted across gullies horizontally or in an inverted "V" shape, called "Sergeant's Stripes" by His Majesty, pointing against the water flow direction, to prevent the formation of deep gullies. The grass can also be grown in overflow ditches along contour lines to retain water and help spread it to crop cultivation areas. Growing vetiver in this way traps silt and slows down surface runoff.

7. Preventing Silt Infiltration in Irrigation and Drainage Canals, and Farm Reservoirs and Ponds

Growing vetiver in rows along both sides of irrigation canals prevents the inflow of silt. In planting vetiver around ponds to trap silt, one row should be grown along the top water line and additional 1-2 rows planted above the first one, depending on the space available up to the pond's edge. In the initial stage, additional planting should be carried out if necessary to ensure a dense vetiver row. Silt from runoff will be trapped by the vetiver, while water will slowly seep through and drain into the pond. Vetiver roots will stabilize the soil along the bank; it will also reduce the pond-dredging costs.

8. Rehabilitating Deteriorating Soil

In the Deteriorated Soil Rehabilitation Projects at Khao Cha-ngum, Ratchaburi Province, and Nong Phlap, Prachuap Khiri Province, vetiver grass was planted in rows across the slope on deteriorated laterite soil. Erosion had stripped off the topsoil and made the soil dry, hard and devoid of natural vegetative cover. Growing vetiver helps reduce runoff velocity, allows water to permeate deep into the soil and provides sufficient moisture for trees to grow.

9. Vetiver on Hardpan Soil

A study was conducted on the growth of vetiver on hardpan soil at the Huai Sai Development Study Center. Hardpan is a rock-like layer of aggregated sand, clay, limestone and minerals. It was found that vetiver roots were able to penetrate the hardpan, breaking it up and making the soil more friable as well as increasing its moisture content. Many tree species, such as the neem tree (*Azadirachta indica*), brown salwood (*Acacia mangium*) and *Pterocarpus spp.*, can be grown along a row of vetiver. When fruit trees are planted together with vetiver, the roots of the grass will break up the hardpan before the tree roots reach it.

10. Preventing the Collapse of Road Shoulders

Vetiver may be planted along roads on back slopes and side slopes to prevent the collapse of road shoulders. The grass stabilizes the soil and diverts the water channels in the road shoulder area. It should be planted across the slope to prevent landslides or collapses.

11. Preventing Contamination of Water Sources

Nowadays, in order to achieve higher plant growth and output, chemical fertilizers are being increasingly used, especially nitrogenous fertilizers as soils in the tropics often lack this element. Nitrate from the fertilizers, as well as heavy metals and toxic chemicals from pesticide and herbicide spraying, if allowed to seep into water sources, will cause environmental pollution. Experiments at the Huai Sai Development Study Center have proved that vetiver planted in lines across the slope can reduce the loss of topsoil to a certain extent, while its root system, compact and penetrating the soil vertically, forms an underground barrier that prevents water-borne soil and toxic substances from flowing down to the water sources below. Moreover, it is believed that, compared to other plants, vetiver should be more efficient in absorbing certain heavy metals and chemicals in view of the capacity of its root system to reach greater depths and widths.

Appendix M Royal Speech Excerpt on Monkey Cheeks

The following excerpt is taken from His Majesty's Royal Speech given on the 4th of December in 1997.

So even if money had to be invested to prevent severe flooding, it must be done. A man was sent to look into the situation and he took pictures both by land and by air. And when I examined the map, I saw that there was a place that could be used a s a "monkey cheek"; it was a natural location; there was a big natural lagoon called "Nong Yai" (Big Lagoon). That big lagoon was a big place as its name indicated. But it was not big enough because people had infringed on its area, and it was shallow. But the important thing was that there was a canal nearby. However, that canal had not yet been dug through; there was a distance of about one and a half kilometer that had been left undug. The water flowing into this canal could not yet reach the sea to prevent it from backflowing and flooding the town. So I inquired about the plan for the completion of the project. They said the budget for it had already been approved, but the money was not yet available. They understood that the project would be completed next year, in the year 1998.

I thought that ways had to be found to make use of this canal, in which so much money had already been put in, to use it in the event of seasonal tropical storms. That is why pledged support for those concerned which included the Irrigation Department, the provincial authorities and the private company so that they would promptly complete the planned project in the space of one month instead of one year. I assured them that if they needed support, I would lend that support; so work was begun. Furthermore, I instructed them to make a culvert with a water gate connecting the lagoon to the canal that was going to be completed. I told them that I gave them one month to complete the work; they shook their heads saying that such work required time. I said that I would furnish the funds; one part would come from the Rajprachanukroh Foundation which would provide the expenses for the piping form the lagoon into the canal and the water gate.

As for the digging of the canal, the Chaipattana Foundation provided eighteen million baht which, when the official budget is available, I would like to have the Foundation's money back. But I do no know if the government will be able to provide this sum of money or not. However, it does not matter; the Foundation will not mind sacrificing this sum of money. I took this course of action with the view that, even if money is tight, an investment to improve production, for one, and an investment with the object of preventing unnecessary spending, for another, is worth it. The reason is that if we don't do it, I believe that the floods, both in rural areas and in urban areas, governmental as well as private properties, will create havoc and much more money would have to be spent. If there is no damage, no unnecessary money will have to be spent; the people will be able to live a normal life, and the result of their work will mean a good income for them. Apart from the income, they will receive the service from, for instance, the X-Rays machine that I have just mentioned, which could properly serve the people who are sick. That is why the investment of more than eighteen million baht toward the success of the project within that one month should be worth it; the people's as well as the government's money will be saved.

The water gate has proved its efficiency when the tropical storm "Linda" came. At first, I thought that it would hit Chumporn; the Department of Meteorology had forecast that the storm would enter the vicinity of Chumporn. In fact, I thought that it

would go past Chumporn and slam further north into the province of Prajuab Khirikhan and the province of Petchaburi. Thus, Chumporn would not bear the brunt of the storm. Even so, as the Thatapao Canal - it is called a canal - that is, the river that flows past the town of Chumporn, has its sources in the province of Prajuab Khirikhan, it was therefore expected that the water would come down in torrents. When the storm came in, rain fell from the north of Chumporn all the way up to Petchaburi. There should have been floods, but as the water had been drained out of the "Big Lagoon" into the canal that had been dug to allow the water to flow freely to the sea before the water from the storm arrived, the "Big Lagoon" was able to receive the water that came down and gradually drained it out to the sea, which is the function of the lagoon as a "monkey cheek". Finally, the Chumporn town and the adjacent areas did not suffer the new flood even though there was a severe storm. This can be considered a great victory for the Chaipattana Foundation. The Chaipattana Foundation has lived up to its name. (*Chai* means victory and *Pattana* means development.)

Appendix N Rainmaking Process

First Stage - Triggering

The intent of the first stage is to build the clouds vertically. The air mass, which consists of water vapor, is sprinkled with chemicals of a low critical relative humidity. The intent is to disturb the equilibrium of the air mass upwind of the target site, accelerating cloud formation. The sprinkled chemicals cause an exothermic reaction when combined with water. This heat, coupled with that of the distillation occurring around the chemicals, causes the air mass to rise. As the air mass rises, its temperature drops and the water vapor condenses, turning the mass into a cloud.

Assuming other conditions are conducive to cloud formation, flight tracks are determined after the wind velocity and direction have been studied. Factors that could constrain cloud formation are temperature inversions, low moisture content, or stationary weather conditions. Much more information has to be considered when planning rainmaking because there are many factors that influence weather conditions. Some of these include topographical data (mountains, forests, sources of moisture, etc.), visual cloud characteristics, low pressure patches, weather fronts, and typhoons. It is a complex process. These factors determine the type and amount of chemicals that are required, the altitude where the chemicals need to be seeded, and the application rate of the chemicals, which affects the seeding track patterns.

Second Stage - Fattening

Following the increase in height of the clouds, the second, and most critical step is taken to build up the volume of the clouds. Exothermic and endothermic chemicals are alternately applied in order to increase the number of water droplets in the cloud and cause mingling of air masses. Water droplets collide and group together, building up the overall amount of droplets in the cloud quickly. The increased temperature of the cloud, caused by the distillation process and the reaction of the chemicals, creates updrafts in the cloud which stimulates activity and prolongs the life of the clouds in addition to heightening the peak of the cloud. The height of the cloud is proportional to the amount of rainfall.

There must be a balance between the weight of the water drops and the updraft force lest the clouds disintegrate. Knowledge and experience in the art of rainmaking are therefore essential for making real-time decisions based on observations of changes in cloud conditions. The choice of chemicals, rate and altitude of application, and flight patterns must all be adapted to the changing conditions of the clouds. The operation cannot proceed unless this step is executed successfully.

Third Stage - Attacking

The final stage of the process induces the rain from the clouds. Endothermic chemicals are applied at the base or simultaneously at the base and peak, the latter being very efficacious, in order to reduce the internal updrafts and increase the density

of the clouds. This decreases the temperature of the clouds and causes rapid distillation, increasing the volume of contained water. Another technique used to force the clouds to rain is the application of extremely cold chemicals to the air mass directly below the cloud base. This temperature reduction below the base causes an updraft at the same time as the horizontal and vertical pull is reduced, lowering the base of the cloud and expediting the transformation from cloud to rain. Appendix P has information on flight paths and techniques suggested by His Majesty the King.

Appendix O Development of Rainmaking Chemicals

The initial tests of rainmaking techniques, in 1969 and 1970, involved imitation and variation of the methods used in other countries. Initially, granulated dry ice was used in conjunction with plain water for seeding. Modification was made of this approach by using a concentrated table salt solution instead of plain water. At the end of this early period of experiment and development, the above-mentioned technique was further modified by applying it create a cold curtain above the target area for the purpose of attracting rain clouds. Developments up to the present are listed below. This has been adapted from *Our King and Royal Rainmaking*.

- **1971**
  The methods from the above set of initial experiments continued to be used. In the fall of 1971, sodium chloride (NaCl) in a form of powder was first used in Royal Rainmaking operations. A very dry table salt ground into a powder resembling flour in appearance, this chemical was later called "Royal Rain Salt Flour" or formula 1.

- **1972**
  In January of this year, calcium chloride (CaCl) powder was first successfully used in a trial to disperse fog and clouds. Later in the year, a concentrated urea solution was tested in the attacking stage of the rainmaking operation, forcing the clouds to rain. The four chemicals used at this stage were:

– sodium chloride powder (Royal Rain salt flour)	formula 1
– dry ice	formula 3
– calcium chloride powder	formula 6
– concentrated urea solution	

- **1973**
  Urea powder replaced the concentrated urea solution due to technical problems in spraying the solution. It was proven to be more efficient when urea was applied with other chemicals. At the end of 1973, calcium carbide (CaC_2) powder was tested in the triggering stage. Different ratios of mixed chemicals were tested though the chemicals used during this year were the same as the previous with exception of urea powder (formula 4) replacing the solution.

- **1974 - 1976**
  No new chemicals were introduced this year but those in use included:

– sodium chloride powder (Royal Rain salt flour)	formula 1
– dry ice	formula 3
– urea powder / concentrated urea solution	formula 4
– calcium chloride powder	formula 6
– calcium carbide powder	formula 9

- **1977 - 1980**

In mid-1977, a mixture of ammonium nitrate and urea was tried (NH_4NO_3 : urea : water = 1 : 1 : 2) since this solution could drop the temperature to between -5 °C to -7 °C, increasing the efficiency of the attacking stage. Due to technical problems with spraying a concentrated ammonium nitrate solution, a powder form was tested and proven efficacious, introducing formula 19 to the list of Royal Rainmaking chemicals that now included:

– sodium chloride powder (Royal Rain salt flour)	formula 1
– dry ice	formula 3
– urea powder / concentrated urea solution	formula 4
– calcium chloride powder	formula 6
– calcium carbide powder	formula 9
– ammonium nitrate powder or concentrated solution	formula 19

- **1981 - 1982**
  In mid-1981, calcium oxide powder (formula 8) was tested for use in the triggering stage but otherwise the chemicals used during this period were the same as in 1977-1980.

- **1983**
  A concentrated solution of T.1, the solution derived from an electrolysis process resulting from Mom Rajawongse Debbrihi Devakul's studies, was tested in the attack stage of the rainmaking process. After additional research, formula T.1 was able to be produced on an industrial scale during this year.

- **1984 - present**
  Present development is focused on producing the smallest sized chemicals, ideally less than 100 microns. In conjunction with this, research is being conducted into methods to prevent lumping of chemical particles so that they may be stored for longer periods of time. The eight chemicals used include:

– sodium chloride powder (Royal Rain salt flour)	formula 1
– dry ice	formula 3
– urea powder / concentrated urea solution	formula 4
– calcium chloride powder	formula 6
– calcium oxide	formula 8
– calcium carbide powder	formula 9
– ammonium nitrate powder	formula 19
– T1 powder	formula T.1

The chemicals are grouped into the three categories of exothermic, endothermic, and distilling agents. The first group increases the surrounding temperature when they react with moisture. Included in this group are calcium chloride, calcium carbide, and calcium oxide. The chemicals in the second group decrease the surrounding temperature when they react with water. Of the Royal Rainmaking chemicals, urea, ammonium nitrate, and dry ice are of this endothermic nature. The last group of chemicals are used as nuclei for cloud condensation and only slightly, if at all, decrease surrounding temperature when they absorb moisture. In this category are sodium chloride and formula T.1.

The triggering stage of rainmaking uses calcium chloride, calcium carbide, calcium oxide, a mixture of sodium chloride and urea, or a mixture of urea and ammonium nitrate. In the second stage of fattening, the chemicals used include sodium chloride, chemical formula T.1, urea, ammonium nitrate, dry ice, and sometimes calcium chloride. The final stage, attacking, uses urea, ammonium nitrate, dry ice, a mixture of sodium chloride and dry ice, and the solution of urea and ammonium nitrate.

Appendix P Suggestions on Royal Rainmaking Techniques

The following is a summary of His Majesty the King's suggestions on Royal Rainmaking techniques, compiled by Khun Saneh Warit, Director, RRDI.

1. Planning Technique of Royal Rainmaking Operations

A researcher who is going to be a good planner on the Royal Rainmaking operation should possess a firm determination to work on rainmaking, a firm mind, cheerfulness, and artistry (i.e. to observe delicate atmospheric changes), and to try to understand the natural mechanisms of cloud and rain formations. He/she should also possess good inter-personal psychology to work with others in unity, and should learn the following techniques:

1) Before every operation, study the operation target and area boundary.
2) Study and analyze the topographical features of the operation's target area and its vicinity, and how they related to the distribution and amount of rainfall, in order to determine the major and minor target areas.
3) For every operation, the area where the environment is most suitable for raining (i.e., a forest, a mountain range, green cultivated land, or land with higher rainfall statistics), should be given priority as a major target for the convenience of making moisture patches. Then the target area can be extended to cover the minor target area which is less suitable. Hence a supplementary operation could be performed if there were enough dense clouds.
4) Determine the tracks for chemical seeding from selected areas where natural clouds usually occur (i.e., high mountain ranges, mountain tops). These areas are the source to supply clouds to be transported to the target area. This is to exploit nature to get the highest result.
5) If the area described in No. 4) can not e located because the target area is a wide flat plain, or the wind current is not suitable, the formation of middle level or high level clouds should be considered. Whether the target area is irrigated or rainfed should also be taken into account. These factors affect wind velocity and the change of wind direction at different altitudes. They also affect the formation of the updraft wind in each local area.
6) Study and analyze on a daily basis, the relation between synoptic scale and mesoscale meteorological data for the local area, to understand how it favours rain.
   6.1. Macroscale meteorological data provides data related to the timing of cloud formation, rainfall distribution, and fluctuation. It can be used to supplement precision and accuracy of mesoscale meteorological data.
   6.2. Mesoscale meteorological data informs a reearcher of the origin of cloueds, types and amount of clouds, and the timing of rain. The dta includes velocity and direction of upper wind currents, relative humidity and temperature at each atmospheric level, etc. (The researcher should study the data and try to predict where/when clouds and rain occur daily in order to gain experience for rainmaking at each location.)
7) Establish the steps for rainmaking using chemical seeding, and study the capability and number of aircraft to be used in daily operation. Accordingly

one can effectively adjust the operation to the movement of rain clouds and focus on a continuous operation, concentrating on inducing cloud formation and rain.

8) Regularly and closely monitor results of the operation by visual observation and by radar. Effectively coordinate with local organizations to obtain rainfall observation reports. Study and analyze operation results to find out what caused them and improve the operational plan for the next day.

2. Technique of Prying Clouds from a Mountain Top and Fattening of Clouds

A high mountain range or a mountain top is comparable to a natural cloud factory. It is necessary to learn the technique of taking a cloud from the mountain without disintegrating and reducing the chance of rain.

1) The technique of prying clouds from a mountain range.

Use hot formula chemicals and cloud nuclei formula chemicals in suitable amounts and proportions to seed on the upwind side of the clouds. If the temperature at the base of the clouds is high, supplement them with cold formula chemicals, seeing in front of the clouds (downwind), at the height of 1,000 *ft* above the base of the clouds. If the relative humidity at the elevation where the clouds form is somewhat low or this an inversion wind current, the clouds could easily disintegrate because the air mass (the clouds) would be pressed down b wind sheer to the downwind of the mountain. In this case, apply chemicals with low critical relative humidity to the cloud downwind.

2) The technique of cloud fattening and slowing cloud movement.

Use hot formula chemicals at the upwind side of the clouds and use chemicals with low critical relative humidity together with hot formula chemicals, seed alternately at the top or the shoulder of the clouds, on the upwind side, close to the clouds, at an altitude of 9,000 *ft*. At the same time, another aircraft applies the cold formula chemicals at a height of 1,000 *ft* above the base of the clouds. This results in two aircraft flying simultaneously in parallel, making an angle of 45 degrees to the horizontal line. This flying technique is called "Sandwich" flying.

3. Monitoring and Evaluation of the Rainmaking Operation

Monitoring and evaluation of rainmaking operations are to examine the results of daily operation in order to improve efficiency of the operational plan for the next day. Continuously monitor the water situation in the target area to prevent any damage from excess water possibly caused by the operation. This also automatically increases the effectiveness of the rainmaking. The steps for monitoring and evaluation are as follows:

1) Before any rainmaking operation begins, there should be a detailed assessment on water requirement of the targeted locality. Study the rainfall distribution pattern, amount of rainfall, and rainfall timing, in order to select and determine the major and minor target areas according to detailed operation planning procedures.

2) Set up a rainfall observation network. Determine the number of locations to install daily rainfall measurement equipment and install them at the right location, according to analytical and statistical processes.
3) Establish an effective communication network between each observation location and operational unit so that the units receive reports regularly, and use them to obtain the best results.
4) Require the Royal Rainmaking meteorologists and scientist to survey the target areas periodically to gain knowledge on the topography, local community's opinions and other useful information for rainmaking. This approach allows researchers to study local information themselves and develop good interaction between the operation units and local community.

4. Aviation

The aircraft plays an important and essential role in Royal Rainmaking operations. Aircraft are high-priced and costly to maintain. They also require special flying techniques. Therefore, the Royal Rainmaking researchers should take care and study in detail the rainmaking aircraft focusing on the following points:

1) Study in great detail the specifications and capability of each type of aircraft and each individual to be used in the Royal Rainmaking operations to ensure a harmonious link between the aircraft and operational techniques.
2) Dedication and attention of the aviators and the mechanic crews given to an aircraft makes them reluctant to fly too many flights for rainmaking, as the heavy tasks may shorten the aircraft's life. The chemical particles used in rainmaking usually corrode an aircraft's structure and its components. Therefore a good understanding of rainmaking principles and techniques must be made to the aviation crew in order to get unity in work.
3) Fear of vertigo due to inadequate flying equipment can make and aviator hesitate to take a risk flying into dense clouds, or taking off when there is dense cloud cover. He may fly short to the planned position because of fear of being unable to return to the airport in time. The rainmaking researcher must learn how to cope with these kinds of situations and try to understand them, to ensure good communications among one another.

Appendix Q 1998 Royal Speech Excerpt on Sufficiency

The word sufficiency has another meaning, a wider meaning. It does not only mean self-sufficiency but also means to have enough for the individual to live on. This sufficiency was mentioned to those who were present here, in the hall - when was it? 20 or 24 years ago, in 1974. From 1974 to 1998, it is 24 years, isn't it? On that day, I said that we should strive to have enough to live on. To have enough to live on, of course, means sufficiency economy. If everyone has enough to live on, everything will be all right. Furthermore, if the whole country can subsist, the better it would be, and Thailand at that time was on the verge of insufficiency. Some individuals had plenty, but some had practically nothing. In the past, there was enough to live on, but today, impoverishment is creeping in. We must, therefore, implement a policy of sufficiency economy so that everyone will have enough to live on. This sufficiency means to have enough to live on. Sufficiency means to lead a reasonably comfortable life, without excess, or overindulgence in luxury, but enough. Some things may seem to be extravagant, but if it brings happiness, it is permissible as long as it is within the means of the individual. This is another interpretation of the sufficiency economy or system. Last year, when I mentioned the word sufficiency, I mentally translated it and actually spelled it out as self-sufficiency; this is why I said sufficiency for the individual. In fact, this sufficiency economy has a wider meaning than just self-sufficiency. Self-sufficiency means that the individual produces the things to fulfill his own needs without having to purchase them from others; the individual can live entirely on his own.

Some people literally translate it from English into Thai as stranding on one's own feet. Some say that this expression is rather odd. Who would stand on our feet? If anybody stands on our feet, we would definitely get angry. Anyway, if we step on our own feet, we would surely stumble. These are perhaps rather strange thoughts, but they derive from the expression: to stand on our own feet which means to be independent. This means that our two feet are firmly set on the ground, so we can stand without stumbling. We don't have to borrow other people's feet to support us. However, sufficiency or to have enough has more a extensive meaning that this. The word to have enough is sufficient; sufficiency is moderation. If one is moderate in one's desires, one will have less craving. If one has less craving, one will take less advantage of others. If all nations hold this concept - I don't mean sufficiency economy - this concept of moderation, without being extreme or insatiable in one's desires, the world will be a happier place. Being moderate does not mean to be too strictly frugal; luxurious items are permissible, but one should not take advantage of others in the fulfillment of one's desires. Moderation, in other words, living within one's means, should dictate all actions. Act in moderation, speak in moderation; that is, be moderate in all activities.

Appendix R The Royal Chitralada Projects

The Royal Chitralada Projects are of two types: non-business and semi-business.

What follows is a list of some of the projects within each of these categories.

Non-business projects

- Culture of *Tilapia Mossambica*
- Culture of *Oreochromis Niloticus*
- Biogas Production
- Experimental Rice Fields
- Upland Rice
- Demonstration Forest
- Medicinal Plant Garden
- Green Fuel
- Water Pollution Control Through Water Hyacinth Cultivation
- Water Hyacinth as Potting Material
- Plant Tissue Culture
- Rattan Project
- Propagation of the Unique Characteristics of Jack Fruit Trees at the Grand Palace
- Soil-less Culture
- Royal Candle Factory
- Culture of *Spirutina Platensis*
- Scientific Experiment Laboratory
- Research and Development Unit

Semi-business projects

- Chitralada Dairy Farm
- Chitralada Milk Collection Center
- Suan Dusit Milk Powder Plant
- Milk Tablet Plant
- Cheese & Ice Cream Plant
- Vegetable & Fruit Juice Plant
- Vegetable & Fruit Drying Plant
- Vegetable & Fruit Juice Cannery
- Experimental Rice Mill
- Rice-husk Grinding & Compressing Plant
- Liquid Fuel Research Project Plant
- Saa-paper Factory
- Organic Fertilizer Plant
- Fish Food Factory
- Mushroom Culture

Appendix S Chitralada Cheese Plant Products

In addition to gouda and cheddar cheeses, the Cheese Plant portion of the Chitralada Dairy Industry produces the following seven products.

1. Ice Cream: vanilla, strawberry, coffee, chocolate, coconut milk, taro, mint chocolate, double chocolate.
2. Milk Toffee: coffee, chocolate.
3. Pasteurized Skimmed Milk.
4. Butter.
5. Butter Cookies.
6. Sweetened Condensed Milk.
7. Drinking Yogurt.