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STATUS AND POWER: LINKING HOUSEHOLD POWER DYNAMICS WITH WOMEN'S PARTICIPATION IN LIVELIHOOD PROJECTS

Introduction

Does women's work outside the home such as in public office or in wage employment lead to their improved intra-household bargaining? While there is a general agreement that it positively affects some aspects of gender relations, it does not systematically result in gender equality. Its implications are more nuanced than simplistic. If we look at the history of Khmer society, we can see that women have always been economically active, evident in records from the late 13th century (Chou 1967). Yet women still occupy lower status at home and in the society, leaving them at a disadvantage in many aspects of life and career (MOWA 2014).

Women have always been economically active but still occupy a lower status in Cambodia. Takeo, January 2016

More women in positions of power in government or leadership roles in rights movements does not guarantee equality, however (Markham 2013; LICADHO 2014; Domingo et al. 2015). Income-earning opportunities might result in women's improved command over financial matters but not necessarily other family affairs (Malhotra and Mather 1997; Doss 2013). While their involvement in activities outside the home can lead to less domestic violence or give women the choice to leave an abusive relationship (Kabeer 1997), it can also subtly reinforce or even trigger violence (Hughes et al. 2015). Indeed, in some societies such as Cambodia and Thailand, sociocultural norms and decorum can be more powerful in determining gender power relations than income or position in public office (Mutakalin 2008; Pen 2016).

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In this Issue

What can be drawn from the literature exploring diverse cultural contexts is that women's ability to lead or govern or earn and use their own income is not the only catalyst of change in gender relations. Change also depends on such factors as the relationships women have with family and peers, the types of work or social activities they engage in, and wider economic, sociocultural and other external influences (Sultana 2013). Added to this complex nexus are the degree to which gender relations have changed, the types of decisions women can make, and the types of intra-household gender relations that remain intact due to the influence of traditional norms.

To understand changes in gender relations in the Khmer family this article draws on a case study of women's participation in rural livelihood projects. Specifically, it examines what aspects of intra-household bargaining have been altered as a result of participation, and attempts to identify the driving or restraining factors that influenced any change that may have occurred. The reason for the focus on NGO-run livelihood projects instead of wage employment or public office is threefold: these projects aim to build women's capacity to improve agricultural production, food security and incomes; they usually embed within them gender ideologies; and paid rural jobs are mostly limited to seasonal agricultural work.

Background to the study

The article draws on in-depth qualitative research conducted between 2013 and 2015 in Battambang, Kompong Speu and Mondolkiri provinces as part of my doctoral project (Pen 2016), which engaged 87 rice farmers (55 women) in semi-structured interviews and group discussions. Information was also collected through observations, community meetings and informal chats with villagers and local authorities over six months of ethnographic fieldwork. The villages visited during fieldwork had an active presence of development projects, resulting in the majority of the study participants being project beneficiaries: 68 of them (44 women) had joined savings groups, rice banks, cow banks or forestry communities.

The study focused on women heads of household because of the unusually high proportion of single women-headed households taking part in local project-related groups: 21 of 55 female interviewees head families alone and seven share headship roles with their husband, well above the national average of 25.6 percent (NIS 2008). That most of these women took part in local groups raises legitimate questions as to whether 1) the projects influence a change in their status from housewife to household head, and 2) project participation is conducive to their well-being and intra-household bargaining power.

The analysis is guided by Kabeer's (1999, 435) concept of empowerment, understood as "the process by which those who have been denied the ability to make strategic life choices acquire such an ability". She identified three interrelated dimensions of power: resources, agency, and achievement or well-being outcomes. Access to and control of resources (material, social and human) serve to improve women's capacity to exercise choice, whereas agency determines women's ability to define their goals in life and to realise them through bargaining, resistance or manipulation. Both resources and agency determine women's capability to choose different ways of being and doing what they value. The achievement dimension is hard to grasp and difficult to measure because of contextual differences in values and ways of being and doing.

Women as household heads – an exception?

A literal understanding of the words *mé krousa* (household head) and *mé phteah* (housewife) helps cast light on a larger issue of intra-household gender inequalities. The way these words have been used and understood in everyday life partly serves to reproduce and reinforce gender inequalities. They carry an implicit sense of perceived hierarchical difference in status and attached tasks and values. *Mé* is literally translated as mother or someone in a high position of authority or supervisor-like role; *krousa* refers to a household or family in a broader sense; and *phteah* is a physical shelter for the family.

The position of *mé krousa,* very often held by the husband (Lee 2006), is conferred with guardianship of family members and responsibility for their moral and material well-being (Mao and

Vann 2010), as well as management and decision-making authority within the family (NIS 2008). The title *mé phteah* is accorded to a married woman whose traditional role is to manage and perform domestic tasks (Chuon 1967).

The statistically significant larger numbers of male-headed households in national censuses (NIS 2008, 2015) suggest that women gain headship status in exceptional circumstances. Among the participants, some took on the headship role after the death of their husband, divorce or desertion. Others became heads because their husband was sick and unable to work. Male outmigration has also created a shift in gender roles, with wives left behind assuming temporary headship, such as the case of Tim, a 33-year-old from Kompong Speu, whose husband migrated to Thailand.

What is more interesting is that some female participants headed their nuclear family by dint of their wealth, education or family background. Kunthea, a 30-year-old household head inherited a house and farmland from her parents; her husband moved from another commune to live with her. Sar became head of her family of nine for a different reason. Outspoken and literate, she moved to Kompong Speu to live with her husband who, unlike her, could barely read and write. Sar served in the army during the 1980s and has been politically active ever since. At the time of study she was serving as the village head and the leader of a self-help group.

Other married women emphasised their status as heads or co-heads of their households, contributing perhaps to the above-average proportion of female household heads in the study. This divergence from national census data may have also been influenced by how questions were asked. All participants were free to define the meaning of household head based on their own understanding rather than conform to what is recorded in the Family Book. For these women, the fact that they manage a household, care for children, keep and control household finances and earn their own income is already enough to proclaim themselves as the family head and to have equal status with their husband.

The headship experiences recounted by the study respondents indicate that women's engagement in livelihood projects does not necessarily lead to a change in gender relations or transition to headship status. Many of the female participants had already assumed headship before joining a project. Caveats aside, intra-household power relations are complex and constantly changing. Plus, becoming head does not mean having more power. The following discusses what changes are made possible through women's participation in livelihood projects.

Measuring change – resources, agency and well-being outcomes

The most immediate change was in the participants' access to resources: agricultural skills training, health and hygiene education, interest-free loans and the distribution of seed, livestock, food and housing materials from the projects.

Changes were also visible through their exercise of greater agency manifested in decision making through participation, negotiation, resistance and manipulation. Albeit difficult to measure change in intra-household bargaining, participants who head or co-head their households expressed having more confidence and autonomy in decision making about farm activities and household expenditures, and their own health care, travel and private goods. However, decisions related to major transactions such as land, house and farm equipment or migration were still made jointly by husband and wife, as in the case of Tim whose husband migrated to Thailand.

Improvements in women's social capital are also important benefits of self-help groups (Basargekar 2010; Hiwasa 2013). In my case study, the groups created spaces for women to socialise and build support networks. Women who were both project beneficiaries and group leaders had more opportunities. Usually starting from a very basic skill such as literacy, they learned leadership and public speaking skills, necessary for them to lobby local government, resulting in some becoming politically active and elected to the local council (Banteay Srei 2013).

One crucial aspect of these material, social and human capitals is women's strengthened fall-back position, which refers to the outside options that determine how well-off they would be should marriage or trust break down (Agarwal 1997). A case

in point is that of Kimmao, a 50-year-old mother of five from Battambang, who joined a self-help group in the early 2000s. Illiterate in the beginning, she was encouraged by NGO staff to learn to read and write so that she could take a more active role in the group. Once literate, she started working as a volunteer to facilitate the activities of her group. Kimmao's marital history has been one of conflict and disruption. After years of domestic dispute, which she was unwilling to talk about, Kimmao was deserted by her husband; she raised her five children almost single-handedly. At the time of study, her youngest daughter was studying grade 9 and her two eldest children were school teachers. Although Kimmao had recently conceded headship on the return of her husband, she maintained her parental authority over her children and continued to be the key decision maker. Sitting several metres away from her husband, Kimmao said without hesitation that,

> Whenever they [the authorities] ask to put the name of the family head on official paper, I give my husband's name. But in reality, I am the head. I manage everything myself. I've worked to support my children through school to become teachers. The real household head is me. I also make decisions in the family including about major purchases. Nobody would dare do anything without my permission.

The shifting gender roles described above underscore the importance of strengthening women's human and social capital, which should be an essential feature of livelihood improvement approaches. The resultant increased agency was reflected in women's sense of accomplishment, pride and self-esteem. In Kimmao's case, her sense of achievement stemmed from her newfound literacy, improved farming skills, better income and community responsibilities. What was the most important to her was a long-term positive outcome for herself and her family as a result of her hard work and investment in her children's education.

> Before nobody wanted to be friends with us. Now people in the village talk to us because I have two adult children who are teachers. Even if we are not rich, we have knowledge that no one can steal.

Participating in groups that create spaces for networking and mutual support, and taking on household headship in difficult circumstances, are beneficial for women's general well-being in the long run. These experiences can be considered "portable assets", a concept first coined by Bird et al. (2010) in relation to women's education and capacity to rebuild their lives after the loss of physical assets and later reframed by Chant (2015) to also include women's experience of headship. In my study, women with such "portable assets" displayed more confidence and seemed more adaptable and capable of withstanding future shocks and less afraid to assert their authority. For instance, Kimmao was not afraid to claim to be the "real household head" during the interview in the presence of her husband.

Women with experience of household headship and local leadership, and awareness of the concepts of human rights and gender equality learned from the groups, are less likely to tolerate physical violence, unlike other women who might continue suffering in silence for fear of divorce or abandonment (Brickell 2014). Their denunciation of violence is manifested in their view of the concept of "fire in the house": although they agreed that family issues should be kept within the family, physical violence is for them a serious violation of a woman's human rights and needs to be reported.

Conclusion: equality starts at home

This article has explored the relationship between women's engagement in community-based development projects and intra-household bargaining. Through the lived experiences of participants, it shows that the types of activities that women engage in, livelihood improvement projects in this case, can be significant factors that drive change in gender relations. Such projects provide women with not only resources and skills to improve their incomes but also spaces for socialisation and peer support.

Although gender division of domestic chores remains largely intact and women continue to perform the role of housewife, their construction of their own status in the family and their participation in decision making reflect their gradual empowerment as they actively manipulate and defy the notion of male headship and claim their productive and

reproductive contributions as vital to sustaining family well-being.

Because family is a place of constant power struggle, the accumulation of women's economic, social and human capital opens up a new opportunity for them to challenge and (re)negotiate the existing patriarchal system. For this reason, efforts to address gender inequality should not overlook the importance of this micro-social setting where the seeds of genuine gender equality are sown.

State and non-state actors working to address gender issues should put more emphasis on intra-household gender dynamics that go beyond addressing women's economic status in order to have a better chance of improving women's agency and well-being. In other words, they should proactively promote women's ability to participate fully and equally in household decision making because crucial to the empowerment of women is their voice in decisions that matter to them – decisions that affect them and if not favourable are at least not detrimental to them, and decisions that can potentially weaken gender discrimination and lead to equal well-being outcomes for all household members.

On a final note, the analysis is exploratory and based on the experiences of women with leadership roles in project-related groups. More research is required to explore the effects of these groups on members who have no project role and the impacts of employment and gender-blind community-based development projects on women's lives.

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Student Engagement in STEM Education: Global Trends and Implications for Cambodia

Introduction

Science, technology, engineering and mathematics (STEM) skills have long been recognised as a key driver for a nation's innovative capacity and global competitiveness. Indeed, research shows "there is a close fit between the nations with leading and dynamic economies, and the nations with the strongest performing education and/or research science systems" (Marginson et al. 2013, 14). The success of many Asian economies, including Hong Kong, Taiwan, Singapore and South Korea, which have invested heavily in science and innovation over the last several decades, is a testament to that fact. They have consistently outperformed their counterparts in international assessments of science and mathematics, such as the Program for International Student Assessment (PISA) and the Trends in International Mathematics and Science Study.

STEM skills can deliver lasting social benefits, providing innovative solutions to such development challenges as climate change and infectious diseases. At an individual level, STEM professionals have more job opportunities and command higher salaries than their non-STEM counterparts. STEM workers earn 26 percent more than their counterparts in the United States, where recent growth of STEM jobs has been three times as fast as that of non-STEM jobs (Langdon et al. 2011). Investment in STEM clearly yields competitive advantages for nations and individuals.

Despite the growing job market, enthusiasm to study STEM subjects at university has been waning. While most OECD countries have successfully expanded higher education access, they have produced three times more graduates in social sciences, law and education than in STEM, causing concern about potential undersupply of STEM workers to sustain global competitiveness. Further, the underrepresentation of women and girls and poor and minority students in STEM fields can reinforce social stereotypes, gender disparities and social stratification (Marginson et al. 2013)

STEM education is now more important than ever, especially in developing countries like Cambodia. Yet, despite 15 years of rapid higher education expansion, the majority of Cambodian students gravitate towards business majors and relatively few take STEM courses (Figure 1). The resultant mismatch between education provision and labour market needs has led to serious skill gaps, though this problem is not new to Cambodia. From 1989 to 1994, although the agriculture-based economy lacked capacity to absorb STEM graduates, universities produced relatively high numbers of graduates in basic sciences (1267) and engineering and technology (787), as opposed to commerce (371) and foreign languages (407) (MOEYS 1996 cited in Chhem 1997). Even vocational training has been of limited relevance to employment: "… what they [students] learn in school doesn't prepare them necessarily to go to work" (Allen Tan, Director of Global West Lab, cited in Phnom Penh Post, 3 July 2016).

These challenges can and must be overcome if the goal of Cambodia's Industrial Development Policy (IDP) 2015-25, to modernise its industrial structure from labour-intensive to high-skilled value-added industry by 2025, is to be achieved. The blocking of new licences for university courses in business and management announced in December 2014 has already turned attention to the skills and knowledge most in demand, including STEM.

Despite the heightened involvement of policymakers and stakeholders, the literature on Cambodia only vaguely touches upon the concept of STEM. In response, this paper aims to contribute to the better understanding and promotion of STEM education and research in Cambodia. The paper first discusses the evolution of STEM and current thinking on the design of STEM education. It then presents an overview of students' interest and enrolment in STEM at the global level. The final section reflects on STEM education in Cambodia

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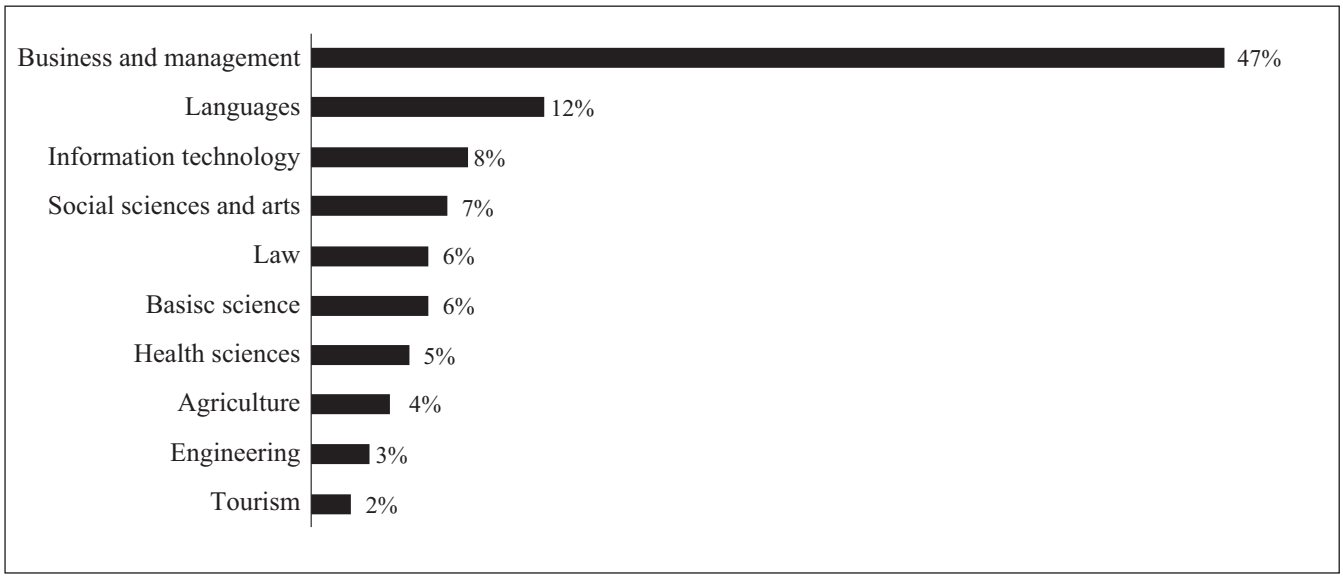
Figure 1: Undergraduate training distribution by discipline, 2011



Source: Mak 2015

and proposes some recommendations for future lines of research.

STEM concept

The acronym STEM (known in the 1990s as SMET for science, mathematics, engineering and technology) was coined in 2001 to stress the importance of these disciplines. There is no uniform definition, and thus the term often "carries different meaning for many different groups of people" (Khine 2015, 209). Its scope has been variously interpreted, with many institutions, policymakers and researchers either including or excluding health and agricultural sciences (Koonce et al. 2016). Even today there is still confusion between the term STEM and stem cell research and plant stems (Keefe 2010 cited in Bybee 2013).

There has since been a discipline shift within STEM pedagogy, bringing together traditionally separate subjects to form integrative "approaches that explore teaching and learning between/among any two or more of the STEM subject areas, and/or between a STEM subject and one or more other school subjects" (Sanders 2009, 21). In short, the "term 'integraTIVE' implies an ongoing, dynamic, learner-centered process of teaching and learning distinct from 'integraTED,' which connotes a static, completed teacher-centered process" (Wells 2013, 29).

Indeed, some scholars contend that scientific literacy should be the aim of STEM education: "education … must involve them [students] in both learning the knowledge of STEM disciplines and reacting to situations that require them to apply that knowledge in contexts appropriate to their age and stage of development" (Bybee 2013, ix-x). Others take a more philosophical view and consider the economic, sociocultural and political aims of STEM initiatives, STEM content and the assumptions underlying STEM teaching (Chesky and Wolfmeyer 2015). A more practical standpoint holds that STEM education has to intersect high-quality STEM content, effective pedagogy, and sensitivity to equity and diversity concerns (Greene at al. 2006). What is clear is that STEM is not about teaching each subject, but a curriculum paradigm whereby the subjects are related and taught in a progressive and interactive manner.

A recent change in emphasis from STEM to STEAM to include liberal arts in the mix exemplifies the move towards integrative STEM education. Yet teaching STEM as an integrative endeavour remains a distant reality in most countries, including in the United States, where efforts to implement an integrated curriculum began some 20 years ago, with many still treating STEM subjects in isolation (Wells 2013).

Student engagement in STEM education

Students' choice of higher education major

A large body of literature suggests that higher education choices are affected by socioeconomic

status, gender perceptions, cultural values and academic aspirations. Leppel, Williams and Waldauer (2001, 389) note how male "students whose fathers are in professional or executive occupations were more likely to choose to major in engineering and the sciences", traditionally male-dominated areas; also, female students with highly educated parents tended to choose science rather than female-dominated fields such as education. This is confirmed by the conclusion of Latifah's (2015) research on Malaysian students studying in the UK, that science education is more for the minority educated elite.

Parents' gender ideology can influence women's pursuit of a STEM career. An OECD study (2016, 193) on PISA questionnaires filled in by parents reveals that "Boys are significantly more likely to expect to work in science, technology, engineering and mathematics (STEM) occupations; and parents are more likely to expect their sons, rather than their daughters, to work in a STEM field, even when boys and girls perform at the same level in mathematics".

The successful promotion of STEM at all levels in many East Asian societies is "deeply rooted in eastern philosophy and cultural notion of education and influence of parental encouragements" (Khine 2015, 3). This echoes the conclusion of a cross-country analysis (Marginson et al. 2013, 14) that "success in education and science is due less to talent than to hard work" – the Confucian tradition of learning and self-cultivation.

Student aspirations do not necessarily translate into enrolment figures, as a longitudinal study of higher education in South Africa illustrates: in 2002 the enrolment rate in science, engineering and technology of 37 percent was lower than student intent of 48 percent (Cosser 2010). A similar study on students' intent to study STEM suggests that enrolments are influenced by high school maths achievement, degree aspirations, academic interaction and financial aid (Wang 2012).

Students' experience in STEM degree programs

Many studies examine educational experiences by looking at students' perceptions of teaching and learning quality. Using online-rating data, Chang and Park (2014) identified four factors that affect student satisfaction: teaching methods and practices; teacher knowledge and preparation; teacher attitudes; and student workload and teacher expectations. Similar work by Calvo, Markauskaite and Trigwell (2010) on the experience of engineering students found that supportive teachers and their ability to explain clearly are the most significant and workload and infrastructure the least significant factors affecting student satisfaction. Other factors correlated with student satisfaction and better learning experiences include course length, class size and teachers' expertise.

Other studies consider ethnicity and gender. Kendricks, Nedunuri and Arment (2013) stress how a nurturing "institutional environment" (i.e. designed to provide a sense of belonging and cultural identity) allows minority students to develop self-confidence, self-esteem and a positive outlook on their life and career. Similarly, Deemer (2015) posits that classroom experience and laboratory environment sway how students' value science education – a positive experience correlated with women science students deciding to pursue a career in their chosen field.

A comparison of undergraduates' levels of satisfaction with teaching and learning resources found that STEM students had a more positive overall experience than non-STEM students (Pawson 2012). However, non-STEM students had a better experience of teaching than their counterparts; specifically, male students reported lower satisfaction with teaching – an intriguing finding that merits attention in future research.

Relevance and practicality of STEM programs

To understand the relevance and practicality of STEM education, many studies examine the links between higher education, especially investment in science and technology, and economic growth. Advances in innovation, entrepreneurship and productivity achieved by many Asian societies in the last 50 years are largely due to their highly skilled workers and strong research capacity. Take the case of South Korea, where a seamless continuum of education policy has been aligned with structural changes in industry and employment since the shift from import substitution in the 1960s-70s to export-oriented industrialisation in the 1980s.

Heavy investment in science and technology was also responsible for rejuvenating China's economy and social base. In the 1980s, when the country embarked on economic reforms to re-join the world economy, science and technology was one of four top priorities that would set it on a robust growth path (Agelasto and Adamson 1998).

Analysis of the supply and demand for STEM talent is a useful way to understand the relevance of STEM education. Despite hesitant growth and uncertainty, demand in many European countries for STEM expertise is increasing, with some 7 million job openings forecast until 2025, in part due to high numbers of STEM workers reaching retirement age (Caprile et al. 2015). Current shortages are pronounced in technological occupations, particularly engineering and ICT, and demand for professional services and computer specialists is expected to rise.

Paradoxically, while it seems clear that the fastest growing jobs will require a science education, interest in STEM tends to decline as a country's economy grows and the standard of living improves, with students more interested in business, law and social sciences (McNeely and Hahm 2012). This trend of avoiding STEM careers is evident in South Korea, where although STEM fields are well established, university students, including those doing STEM majors, give more priority to job security; they prefer careers as government officials, teachers and doctors rather than in science and technology (Jin et al. 2012). Moreover, the competition for STEM jobs is tough, as industry demands highly qualified graduates with advanced technical knowledge (Jang and Kim 2015).

Limitations of the global literature

Much of the international literature is quantitative, with little empirical evidence from Cambodia. The use of standardised questionnaires limits responses to predefined constructs. Also, such variables as race and ethnicity are of limited relevance in Cambodia, which remains largely ethnically homogenous. Indeed, it is clear that our understanding of student engagement in STEM fields cannot be detached from social, cultural, economic and political factors. Context matters in comparative education research (Crossley and Watson 2003).

STEM education in Cambodia and implications for future research

The modest body of Cambodia-specific literature highlights the trust that many Cambodian students place in their family, especially parents, when deciding what to study at university (Peou 2015), and that they tend to choose majors to match their career aspirations rather than their values and interests (Un 2014). In a recent survey, around 60 percent of students cited personal interest as their main reason for choice of major (AUPP 2015). Notably, future skills demand barely seems to feature in higher education decisions. Even these few glimpses illustrate the complexity of cultivating STEM talent in Cambodia.

As future lines of research on Cambodian students' engagement in STEM education and careers, we propose the following topics. First is the question of what causes students who worked hard in the science stream at secondary school to opt for non-STEM majors at university. A new study on STEM learning achievement among Cambodian lower secondary school students noted that they lacked awareness of STEM opportunities and career prospects: "those [students] who took more number of extra classes in science/math, however, tended to like a career in non-science/math fields" (Eng and Szmodis 2016, 294). Even though over the last five years an average of 70 percent of grade 12 students opted for the science stream, the percentage of tertiary enrolments in basic science and engineering majors was much lower at 10 percent (Puth 2016).

To better understand students' experience of STEM and to determine the factors responsible for the problem of poor quality graduates, future studies must pay attention to the confluence of curriculum, course content, pedagogy, gender, teaching and learning resources. Such research will help improve graduates' employability skills and technical knowledge, which often do not meet the requirements of employers who complain that what students learn is of limited relevance to market needs (Khieng, Madhur and Chhem 2015).

Further analysis of STEM education as synonymous with human capital development must be grounded in sociocultural values so that economic growth can ensure social equity and harmony.

Concluding remarks from Chhem (1997, 115), which are well aligned with STEAM or integrative STEM education, remain relevant for today's Cambodia: "the accumulation of human capital … is only one instrument needed … Complete human development in Cambodia, especially of the leaders of the new millennium, is an essential aim for the full realization of the national identity of Cambodia".

In a similar vein, research on embedding STEM education and career choices within the wider macroeconomic and sociocultural context should consider such factors as public perceptions and attitudes towards gender equality, society's attitudes towards science and technology, economic development, working conditions and institutional settings (Caprile et al. 2015). In so doing, impact analysis of industry-university linkages would serve as a useful approach to ensure the relevance of STEM education to Cambodia's vision of a knowledge and skills-based economy.

The multidimensional nature of STEM education adds another layer of complexity. To obtain a full and clear picture of the topic, studies have to be pragmatic, holistic in scope and inclusive. Thus mixed methods approaches are imperative to future research on how to engage students in STEM education, as is framing such research within integrated science education or scientific literacy, including axiology (STEM purpose), ontology (STEM content) and epistemology (STEM pedagogy).

Finally, to learn from global best practices, studies addressing the development of STEM education in Cambodia should use a comparative approach. Due care and caution must be exercised, however, to avoid the ad hoc adoption of international education policies and practices without adequate consideration of whether they can properly respond to the new demands of Cambodia's labour market and the real needs of Cambodian society.

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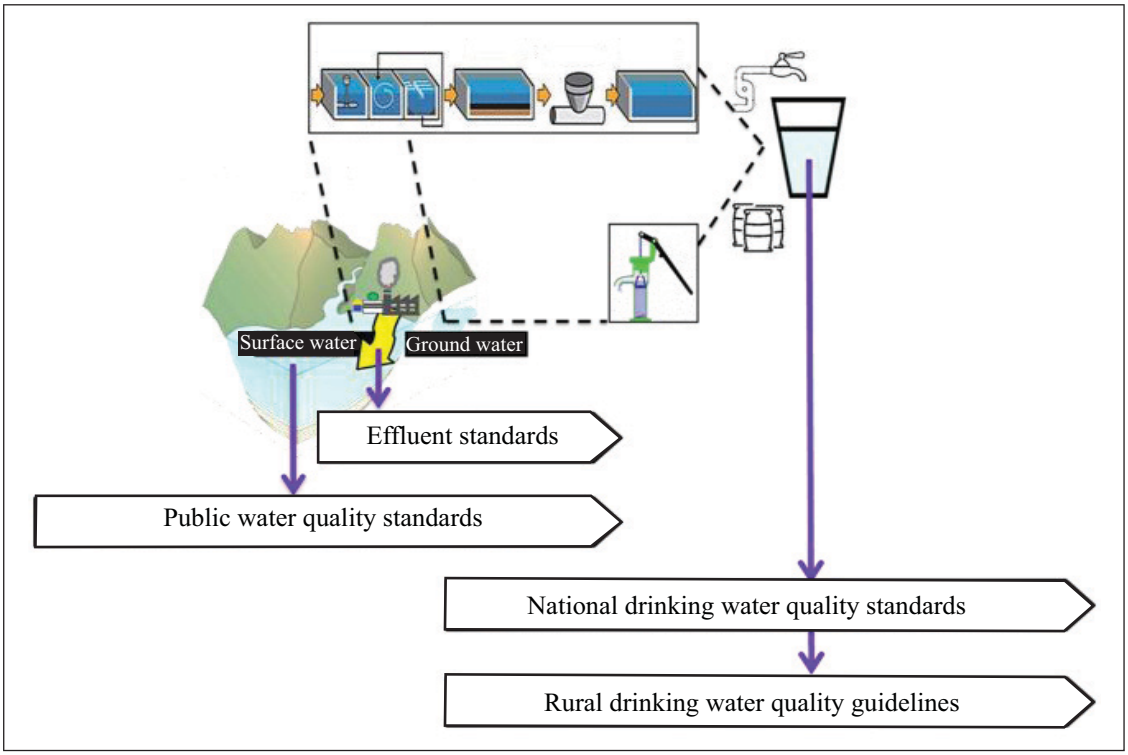
Cambodian Water Quality Standards: A Focus on Interconnection

Introduction

Clean water is essential to human life and environmental health. Recent water quality problems in Cambodia's surface water caused by algal blooms and pesticide pollution have highlighted the importance of regulatory controls. Drawing on a literature review of water quality parameters and national guidelines, the study suggests that an efficient strategy for reducing the harmful effects of water contamination is comprehensive water pollutant management based on interconnected water quality standards (W. Cunningham, M. Cunningham and Saigo 2003; UN-Water 2011; WHO 2011; 최지용 and 신은성 1997; 한대호 and 최지용 2009).

To protect human and ecological health and ensure safe drinking water, Cambodia has developed three water quality standards (see Figure 1). The quality of surface water such as in a river, wetland, lake or ocean is maintained in accordance with public water quality standards, and the concentration of wastewater pollutants discharged into public water areas or sewers is regulated under effluent standards. The Ministry of Environment (MOE) manages these two water quality standards under the Sub-Decree on Water Pollution Control, which has not been updated since its release in 1999. Drinking water quality must satisfy the requirements of national drinking water quality standards (NDWQSs) which are regulated by the Ministry of Industry and Handcrafts (see Figure 2).[1]

Figure 1: Existing water quality standards in Cambodia



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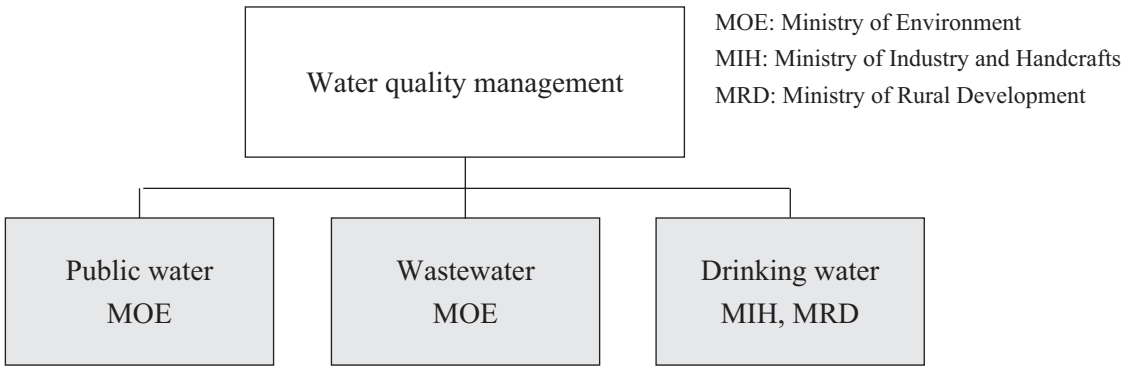
1 Interviews with representatives from the Royal University of Phnom Penh and the Ministry of Environment.

Figure 2: Ministries responsible for management of water quality standards



The NDWQSs were revised and national rural drinking water quality guidelines (NRDWQGs) separately established in 2015. This was achieved with support from the Water Quality Partnership, initiated by Australia's Department of Foreign Affairs and Trade (DFAT) and the World Health Organization (WHO) to assist countries in Southeast Asia and the Western Pacific in establishing and implementing water safety plans (WSPs). The main aim of a WSP is to identify and manage risk at each critical step of the water supply system from source to consumption. In Cambodia, the Ministry of Rural Development (MRD) is responsible for the management of rural water supply systems, and has incorporated the implementation of WSP into National Strategy for Rural Water Supply, Sanitation and Hygiene 2011-25 (Water Safety Portal 2016; WHO 2014; MRD 2011).

This study investigates Cambodian water quality standards by reviewing the recently revised and established NDWQSs and NRDWQGs to suggest improvements, especially for better interconnections between them.

Methodology

To identify the key characteristics and practicality of the new standards, the study compared current Cambodian drinking water quality standards with both former standards and the results of drinking water quality analyses conducted by several research groups. Major effluent and surface water contaminants and their measured values evaluated by previous studies were also compared with existing water quality parameters and standard values. In addition, the study looked at the relationships between some of the parameters of Cambodia's water quality standards for effluent, public water and drinking water to understand how the different standards are connected for better integrated management of water pollutants.

Terms related to water quality that apply to this study are defined in a short glossary at the end of the article.

Findings

Characteristics of current drinking water quality standards

The updated NDWQSs applied to water supplied from urban purification plants are considered more practical for implementation in Cambodia than the previous standards. Comparison of former and current NDWQSs in Table 1 identifies three key changes. First, the number of parameters is significantly reduced from 53 to 27. This means that levels of pesticides, benzene, trihalomethanes, selenium and nickel no longer have to be monitored in urban drinking water even though they are recommended parameters in the 2011 WHO guidelines. As a result, former organic parameters are mostly excluded. Second, the revised standard values are higher than the previous ones, meaning that drinking water quality standards are less stringent. And third, exceptions to parameters have been introduced; for example, groundwater is examined for hardness, iron and manganese only if it is used for drinking.

The results of drinking water quality analyses (Luu, Sthiannopkao and Kim 2009; Shanghai Laboratory 2013; Vanny, Jiwen and Seingheng 2015) indicate that water purification plants meet most of the new NDWQSs, though excessive concentrations of some parameters were measured in tap water. Notably, supply could be contaminated through corroded pipelines from purification plants to consumers, leading to the presence of colour, turbidity and total coliforms in drinking water. Pipe corrosion in water distribution systems can stimulate microbial growth and cause increased bacterial levels in tap water. To prevent microbial contamination, sufficient quantities of disinfectant in the form of free residual chlorine must be maintained throughout the pipeline system. But the minimum standard value of residual chlorine in drinking water was lowered from 0.2 mg/L to 0.1 mg/L when the NDWQSs were revised.

In rural areas, NRDWQGs are applied to several drinking water supplies (e.g. piped water, collected rainwater, dug or tube-well water). Of the 27 NDWQSs, only 14 are included in the new national rural guidelines. Among them, arsenic and fluoride testing is recommended only for drinking water sourced from groundwater. Guidelines for turbidity, residual chlorine and total hardness in rural drinking water are designated differently from the standard concentrations applied to urban drinking water. Based on the analytical results of tube-well water quality (Buschmann et al. 2007; Luu, Sthiannopkao and Kim 2009; Phan et al. 2010), four water contaminants – iron, manganese, total hardness and turbidity – detected in some wells exceed guideline

Table 1: Former and current drinking water quality standards and guidelines (mg/L)

		2004 DWQSs	2015 NDWQSs		2015 NRDWQGs	
Total		53	27	9	14	3
No.	Parameter	Standard value	Standard value	Exception	Guideline value	Exception
1	Aluminium	0.2	0.2	alum used	-	
2	Arsenic	0.05	0.05	groundwater	0.05	groundwater source
3	Copper	1	2	copper pipes used for household plumbing	-	
4	Fluoride	1.5	1.5	groundwater	1.5	groundwater source
5	Hardness	300	300	groundwater	500	
6	Iron	0.3	0.3	groundwater	0.3	
7	Manganese	0.1	0.1	groundwater	0.1	
8	Residual chlorine	0.2-0.5	0.1-1.0	chlorine used for disinfectant	0.2-0.5	chlorine used as residual disinfectant
9	Sodium	200	250	coastal areas	-	
10	Ammonia	1.5	1.5		-	
11	Barium	0.7	0.7		-	
12	Cadmium	0.003	0.003		-	
13	Chloride	250	250		-	
14	Chromium	0.05	0.05		-	
15	Colour	5 TCU	5 TCU		-	
16	Lead	0.01	0.05		-	
17	Mercury	0.001	0.006		-	
18	Nitrate as $N0^{3-}$	50	50		50	
19	Nitrite as $N0^{2-}$	3	3		3	
20	Odour	acceptable	acceptable		acceptable	
21	pH	6.5 - 8.5	6.5 - 8.5		6.5 - 8.5	
22	Sulphate	250	500		-	
23	Taste	acceptable	acceptable		acceptable	
24	Thermotolerant coliforms or E. coli	0 per 100ml	0 cfu or MPN /100ml		0 cfu or MPN /100ml	
25	Total dissolved solids (or conductivity)	800 (~ 1600 uS/cm)	800 (1600 uS/cm)		800 (1600 uS/cm)	
26	Turbidity	5 NTU	5 NTU		10 NTU	
27	Zinc	3	3		-	

Sources: MIME 2004; MIH 2015; MRD 2015

values. Moreover, aluminium, sulphate, barium and lead, which are not included in rural drinking water quality guidelines, are present at the levels of NDWQSs in certain wells.

Connections between water quality standards

The quality standards prescribed for effluent, public water and drinking water have no organic and only six inorganic parameters in common (Table 2). In other words, current water quality standards cannot ensure the monitoring of water pollutants in a consecutive water system from source to consumption. This is mainly because the updated drinking water quality standards exclude most organic parameters due to the high cost and technical complexity of analysis tests for identifying organic compounds. Apart from these six parameters, none of the other standard values for public water and drinking water overlap, whereas effluent and drinking water quality standards share an additional nine parameters (Table 3).

Effluent standards, unlike those for drinking water and public water, do not include microbial parameters such as for total coliforms and E coli. Yet E coli have been detected even in treated effluent found in natural wetlands, especially in the rainy season (Visoth et al. 2010; Sovann et al. 2015). For chromium, the concentration of 0.05mg/L applies equally to quality standards for public water, drinking water and effluent. This is a stringent requirement for the discharge of wastewater from any pollution source into protected public water areas. Chromium, aside, target concentrations of pollutants in effluent are 2 to 100 times higher than in public water and drinking water (see Table 2). As a reference, Korean and Japanese effluent standard values are generally 10 times higher than those for public water quality because wastewater is diluted as it is released into water bodies (환경부 2005; Takatoshi Wako 2012).

The interrelationships between certain effluent and drinking water quality standard parameters are found to be non-logical. Specifically, quality standards for mercury, copper, nitrate and zinc concentrations in effluent are more stringent than those in drinking water, as indicated in Table 3.

Table 2: Interrelationships between water quality standards (mg/L)

Water quality standards		Effluent	Public water	Drinking water
Overlapped parameters /total parameters		6/52	6/30	6/27
		23/52	23/30	
		15/52		15/27
			6/30	6/27
No.	Parameter	Standard value	Standard value	Standard value
1	Chromium (Cr^{6+})	0.05	0.05	0.05
2	Mercury (Hg)	0.002	0.0005	0.006
3	Arsenic (As)	0.1	0.01	0.05
4	Cadmium (Cd)	0.1	0.001	0.003
5	Lead (Pb)	0.1	0.01	0.05
6	pH	6 – 9	6.5 – 8.5	6.5 – 8.5

Table 3: Common quality standards for effluent and drinking water (mg/L)

Water quality standards		Effluent	Drinking water
Overlapped parameters/total parameters		15/52	15/27
No.	Parameter	Standard value	Standard value
1	Chromium (Cr^{6+})	0.05	0.05
2	Mercury (Hg)	0.002	0.006
3	Arsenic (As)	0.1	0.05
4	Cadmium (Cd)	0.1	0.003
5	Lead (Pb)	0.1	0.05
6	pH	6 – 9	6.5 – 8.5
7	Copper (Cu)	0.2	2
8	Nitrate (NO_3)	10	50
9	Zinc (Zn)	1	3
10	Ammonia (NH_3)	5	1.5
11	Chloride (ion)	500	250
12	Chlorine (free)	1	0.1 – 1
13	Iron (Fe)	1	0.3
14	Manganese (Mn)	1	0.1
15	Total dissolved solids	1000	800

Recommendations

In sum, the updated drinking water quality standards and newly established guidelines exclude most organic parameters such as trihalomethanes and pesticides because of the practical difficulties and limitations of chemical analysis. However, the quality standards for public water and effluent have not been updated since 1999, meaning that many organic parameters are still in place. Even so, among 25 parameters of public water quality standards for human health, only chromium is being monitored.

A practical approach to correct identified shortcomings would be to investigate prevailing contamination

of ground and surface water and update water quality standards periodically, taking into account the feasibility of measuring and monitoring water pollution. Coordinated inter-ministerial efforts to increase interconnections between water quality standards should focus on the revised national drinking water quality standards to develop a more comprehensive approach to water pollution control. Based on the key findings, the study offers a few suggestions for improving water quality standards.

- ***National drinking water quality standards:***
  - Consider re-adding total coliforms as a parameter to monitor pathogens risk caused by intrusion or regrowth of bacteria in pipelines. Pathogenic microorganisms present in surrounding soil or water can enter through breaks and leaks in distribution pipelines; therefore, careful management of aging pipes is also needed at the same time.
  - Apply higher minimum value of residual chlorine in areas with high potential for bacterial contamination. WHO recommends that residual free chlorine should be at least 0.2 mg/L at point of delivery which is twice that set for urban drinking water in the revised NDWQSs.
- ***National rural drinking water quality guidelines:***
  - Establish individual water quality standards for different water sources (e.g. rainwater, well water, piped water) in rural areas, and consider setting standards for aluminium, sulphate, barium and lead in tube-well water.
- ***Public water quality standards:***
  - *Standards for bio-diversity:* Specify a range of standard values depending on regional water quality or water use.
  - *Standards for human health:* Stipulate a limit of detection (i.e. the lowest concentration likely to be reliably measured and at which detection is feasible) for parameters with standard values of zero or that are far too small for analysis.
- ***Effluent standards:***
  - Consider adding total phosphorous and biological parameters (e.g. total coliforms).

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Glossary of terms related to water quality

The following definitions apply to this article and are reproduced in good faith from *Drinking Water Quality Standards* (MIME 2004, 4-6).

cfu: a colony-forming unit is a measure of viable bacteria.

coliforms, total: both fecal and non-fecal bacteria from humans, animals, and decayed organic matter that are able to ferment lactose at either 35 or 37^{0}C within 24-48 hours.

disinfection by-products: these are formed by the reaction of excess disinfectant chlorine with organic substances found in water, especially surface water.

groundwater: any water found beneath the surface of the ground in rock crevices and in the pores of geologic materials.

inorganic parameters: non-carbon based chemicals such as arsenic, cadmium and iron.

monitoring: routine collection of water samples for analysis to determine water quality, usually done by water supplier.

NTU: nephelometric turbidity unit – a measure of the turbidity (cloudiness) of water as measured by a nephelometer.

organic parameters: carbon-based chemicals such as pesticides.

residual chlorine: excess chlorine in treated water, usually between 0.2 to 0.5 mg/L, which indicates sufficiency of chlorination and an assurance of protection from pathogens.

surface water: freshwater on the Earth's surface, such as stream, river, lake, pond or reservoir.

TCU: true colour unit – a measure of colour of filtered water sample that could come from iron or dissolved organic substances.

trihalomethanes: the main disinfection by-products produced in highest concentrations. Chemical compounds formed by reaction of excessive chlorine in water with naturally occurring organic substances.

turbidity: characteristics of cloudiness of water. The amount of solid particles that are suspended in water that can cause scattering of light. Low turbidity is essential for effective disinfection.

uS/cm: microsiemens per centimetre is a unit of measurement for the electrical conductivity of water.

water quality standard: a level for a water constituent which does not result in significant health risk and which ensures acceptability of the water to consumers.

Continued from page 5 **Status and Power...**

LICADHO. 2014. '*Good Wives': Women Land Campaigners and the Impact of Human Rights Activism.* Phnom Penh: LICADHO.

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Economy Watch—External Environment

This section describes economic indicators of major world economies and economies in Southeast Asia.

In the second quarter of 2016, real GDP growth in Indonesia was 5.2 percent, compared to the previous quarter's 4.9 percent. This growth could be the result of government efforts to boost the economy. Growth in Malaysia declined from 4.2 percent in the previous quarter to 4.0 percent. This slower growth is due to decrease in exports and slow expansion of manufacture. Singapore's economy grew by 2.1 percent, 0.3 percentage points higher than the preceding quarter. Thailand's economy expanded by 3.5 percent, 0.7 percentage points higher than the preceding quarter. Vietnam's growth decelerated to 3.5 percent, from 5.5 percent in the preceding quarter because of drought that affected agriculture.

Growth in China was 6.7 percent, the same as in the first quarter, and was driven by supportive policies and a robust property sector. Hong Kong's economy grew by 1.7 percent, higher than the preceding quarter's 0.8 percent. South Korea's growth was 3.2 percent, 0.5 percentage points higher than a quarter earlier. GDP in Taiwan expanded by 0.7 percent, recovering from contraction during the last three quarters.

The EU-12's real growth in the second quarter increased from 1.5 percent in the previous quarter to 1.6 percent. Japan's economy expanded by 0.8 percent in this quarter, which was attributed to robust investment growth stimulated by high corporate profits and low interest rates. In this quarter, the annual growth rate in the United States was 1.2 percent, lower than expected because of dollar appreciation, weak global demand, low oil prices and election campaigning.

World inflation and exchange rates

Inflation rates in some Asian and ASEAN countries rose, but Singapore and Japan faced deflation. Inflation in Cambodia was 3.1 percent. In Indonesia inflation was 3.5 percent. Singapore has experienced deflation for six consecutive quarters since the first quarter of 2015. In this quarter the deflation rate of Singapore was 0.9 percent. Thailand experienced inflation of 0.3 percent in the second quarter of 2016 for the first time after five consecutive quarters of deflation.

In the second quarter, inflation in China was 2.1 percent. Inflation in Hong Kong was 2.6 percent, and in South Korea 0.9 percent. Taiwan's inflation was 1.3 percent. Inflation in the euro area was 0.2 percent. Japan faced deflation, of 0.4 percent, for the first time since 2012. The United States had annual inflation of 0.7 percent in this quarter.

In the second quarter of 2016, the exchange rate of the riel against the dollar was KHR4056.3. It depreciated by 0.8 percent from a quarter earlier, and was almost the same as in the previous year. The Thai baht appreciated by 1.1 percent from the preceding quarter, and the Vietnamese dong by 2.7 percent. The Chinese yuan appreciated by 0.12 percent and the Japanese yen appreciated by 6.4 percent from the previous quarter.

Commodity prices in world markets

Prices of major commodities in world markets increased in the second quarter compared with the preceding quarter. The price of maize rose by 7.0 percent to USD171.1/tonne, palm oil 10.4 percent to USD647.8/tonne and rubber 18.3 percent to USD1408.1/tonne. Prices of rice increased by 27.6 percent to USD465.0/tonne, soybeans 27.6 percent to USD418.7.0/tonne. The price of crude oil increased 43.3 percent to USD44.7/barrel, and as a result prices of gasoline and diesel fuel rose by 34.3 percent and 30.9 percent, respectively.

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Table 1: Real GDP growth of selected trading partners, 2009–16 (percentage increase over previous year)

	2009	2010	2011	2012	2013	2014	2015				2016	
							Q1	Q2	Q3	Q4	Q1	Q2
Selected ASEAN countries												
Cambodia	0.1	6.0	7.1	7.3	7.4	-	-	-	-	-	-	-
Indonesia	4.2	6.2	6.5	6.3	5.8	5.2	4.7	4.7	4.7	5.0	4.9	5.2
Malaysia	-2.4	9.0	4.9	5.4	4.6	6.0	5.6	4.9	4.7	4.5	4.2	4.0
Singapore	-4.5	14.7	4.7	1.3	3.8	3.0	2.6	1.8	1.9	1.8	1.8	2.1
Thailand	3.3	7.9	0.0	6.7	2.8	1.6	3.3	2.2	2.9	2.8	3.2	3.5
Vietnam	5.4	6.4	6.2	5.2	5.4	5.9	6.1	6.5	6.8	7.0	5.5	3.5
Selected other Asian countries												
China	8.2	10.4	9.3	7.7	7.7	7.3	7.1	7.0	6.9	6.8	6.7	6.7
Hong Kong	-3.2	6.9	4.9	2.9	3.0	2.3	2.1	2.8	2.3	1.9	0.8	1.7
South Korea	-1.0	6.1	3.6	2.1	2.8	3.4	2.4	2.2	2.7	3.0	2.7	3.2
Taiwan	-3.6	11.1	4.2	1.2	2.2	3.5	3.4	0.5	-1.0	-0.5	-0.8	0.7
Selected industrial countries												
Euro-12	-3.8	1.6	1.6	-0.5	0.1	0.7	1.0	1.2	1.6	1.5	1.5	1.6
Japan	-5.4	4.1	-0.8	1.7	1.7	0.6	-0.9	0.7	1.0	0.5	0.2	0.8
United States	-2.5	2.7	1.8	2.1	1.8	2.4	2.7	2.3	2.2	1.8	2.1	1.2

Sources: International Monetary Fund, Economist and countries' statistics offices

Table 2: Inflation rate of selected trading partners, 2009–16
(percentage price increase over previous year—period averages)

	2009	2010	2011	2012	2013	2014	2015				2016	
							Q1	Q2	Q3	Q4	Q1	Q2
Selected ASEAN countries												
Cambodia		4.1	5.5	3.0	3.0	3.9	1.0	1.0	0.8	2.0	2.4	3.1
Indonesia	4.7	5.1	5.4	4.3	7.0	6.4	6.6	7.1	7.1	4.8	4.3	3.5
Malaysia	0.4	1.7	3.2	1.7	2.1	3.2	0.7	2.1	3.0	2.6	3.4	1.9
Singapore	0.5	2.9	5.2	4.6	2.3	1.0	-0.3	-0.4	-0.6	-0.7	-0.8	-0.9
Thailand	-0.9	3.1	3.8	3.0	2.2	1.9	-0.5	-1.1	-1.1	-0.9	-0.5	0.3
Vietnam	7.3	9.0	18.6	9.3	6.6	4.8	0.7	1.0	0.5	0.3	1.3	2.2
Selected other Asian countries												
China	-0.8	3.2	5.4	2.7	2.6	2.0	1.2	1.4	1.7	1.5	2.1	2.1
Hong Kong	-0.3	2.4	5.3	4.1	4.0	4.4	4.4	3.1	2.3	2.4	2.9	2.6
South Korea	2.8	3.0	4.4	2.1	1.1	1.3	0.6	0.5	0.6	1.1	0.2	0.9
Taiwan	-1.1	1.0	1.4	1.9	0.8	1.5	2.9	-0.7	0.0	0.3	1.7	1.3
Selected industrial countries												
Euro-12	0.4	1.6	2.7	2.5	1.4	0.4	-0.3	0.2	0.0	0.3	0.1	0.2
Japan	-1.3	-0.7	0.1	-0.03	0.4	2.8	2.3	0.5	0.2	0.7	0.2	-0.4
United States	-0.4	1.7	3.2	2.1	1.5	1.6	-0.4	0.0	0.1	0.4	1.1	0.7

Sources: International Monetary Fund, Economist and National Institute of Statistics

Table 3: Exchange rates against US dollar of selected trading partners, 2009–16 (period averages)

	2009	2010	2011	2012	2013	2014	2015				2016	
							Q1	Q2	Q3	Q4	Q1	Q2
Selected ASEAN countries												
Cambodia (riel)	4140.5	4187.1	4063.6	4037.8	4027.2	4037.6	4042.2	4056.7	4091.8	4050.9	4022.4	4056.3
Indonesia (rupiah)	10413.8	9089.9	8748.0	9363.0	10419.2	11850.2	12809.9	13125.2	13858.0	13786.3	13627.3	13324.1
Malaysia (ringgit)	3.5	3.2	3.1	3.1	3.1	3.3	3.6	3.7	4.1	4.3	4.2	4.0
Singapore (S$)	1.5	1.4	1.3	1.2	1.3	1.3	1.4	1.3	1.4	1.4	1.4	1.4
Thailand (baht)	34.3	31.7	30.5	31.1	30.7	32.5	32.6	33.2	35.2	35.8	35.6	35.3
Vietnam (dong)	17,725.2	19200.8	20574.3	20856.9	20990.3	21138.2	21372.9	21712.7	22164.6	22420.7	22929.4	22314.5
Selected other Asian countries												
China (yuan)	6.8	6.8	6.5	6.3	6.1	6.2	6.2	6.2	6.3	6.4	6.5	6.5
Hong Kong (HK$)	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8
South Korea (won)	1277.8	1156.3	1108.6	1126.6	1095.0	1053.6	1101.7	1097.4	1170.0	1158.3	1200.8	1163.4
Taiwan (NT$)	33.0	31.5	29.4	29.6	29.7	30.3	31.6	30.8	32.0	32.6	33.1	32.4
Selected industrial countries												
Euro-12 (euro)	0.7	0.8	0.7	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9
Japan (yen)	93.6	87.8	79.9	79.8	97.6	105.9	119.2	121.4	122.2	121.4	115.3	107.9

Sources: International Monetary Fund, Economist and National Bank of Cambodia

Table 4: Selected commodity prices on world market, 2009–16 (period averages)

	2009	2010	2011	2012	2013	2014	2015				2016	
							Q1	Q2	Q3	Q4	Q1	Q2
Maize (USNo.2)—US (USD/tonne)	167.3	185.9	291.7	298.4	259.4	192.9	174.2	168.4	169.5	167.1	160.0	171.1
Palm oil—north-west Europe (USD/tonne)	686.8	900.8	1125.4	999.3	856.9	821.4	627.9	664.0	514.6	518.0	586.9	647.8
Rubber SMR 5 USD/tonne)	1884.8	3405.7	4630.6	3200.7	2575.3	1755.6	1450.2	1525.9	1365.5	1229.1	1190.0	1408.1
Rice (Thai 100% B)—Bangkok (USD/tonne)	524.5	506.6	558.5	594.8	533.8	434.9	426.0	396.3	383.3	376.3	385.3	465.0
Soybeans (US No.1)—US (USD/tonne)	414.0	449.8	540.7	591.4	538.4	491.8	363.9	393.7	347.6	358.0	328.0	418.7
Crude oil—OPEC spot (USD/barrel)	60.5	76.8	106.2	109.5	105.9	96.2	50.9	60.5	48.2	38.0	31.2	44.7
Gasoline—US Gulf Coast (cents/litre)	42.9	53.3	71.9	74.6	71.2	65.6	40.1	49.0	42.2	32.9	27.9	37.5
Diesel (low sulphur No.2)—US Gulf Coast (cents/litre)	43.1	56.1	75.7	80.7	78.4	71.5	44.6	48.4	39.9	34.0	27.2	35.6

Sources: Food and Agriculture Organisation and US Energy Information Administration

Economy Watch—Domestic Performance

Main economic activities

In the second quarter of 2016, fixed asset investments approved were USD831.2 m, a decrease of 10.0 percent compared with a quarter earlier, but an increase of 226.4 percent compared with the second quarter of 2015. There was no agricultural investment. Garments investment approvals went up to USD239.9 m, 239.0 percent higher than in the previous quarter. Approvals for hotels and tourism decreased to USD19.8 m, 97.0 percent lower than the previous quarter.

In the second quarter, total international tourist arrivals contracted by 16.9 percent compared to the previous quarter, but increased by 12.3 percent on the same quarter last year. Arrivals by air declined by 24.4 percent, while arrivals by land and water dropped by 6.2 percent from the previous quarter.

In the second quarter of 2016, total exports dropped by 0.2 percent from the previous quarter, but increased by 9.2 percent from a year earlier. Garment exports decreased from USD1759.4 m in the previous quarter to USD1717.8 m. Exports to the US expanded by 4.1 percent from the previous quarter, but shrank by 10.9 percent compared to a year earlier. Exports to the EU dropped by 1.6 percent from the previous quarter to USD776.5 m, while exports to ASEAN countries rose to USD25.7 m, 0.4 percent higher than the preceding quarter. Agricultural exports contracted by 28.1 percent compared with the preceding quarter, rubber exports decreased by 12.8 percent, wood exports increased by 152.0 percent, and rice exports declined by 38.6 percent.

Imports in the second quarter declined by 14.2 percent from a quarter earlier, and decreased 18.4 percent from the previous year, to USD2383.4 m. Compared with the last quarter, imports of gasoline rose by 4.1 percent, imports of diesel increased by 19.5 percent, and imports of construction materials increased by 22.4 percent, whereas other imports decreased by 17.9 percent.

Public finance

Total government revenue in the second quarter increased 9.0 percent from a quarter earlier to KHR3849.4 bn, of which current revenue rose by 9.1 percent to KHR3836.0 bn. Tax revenue increased by 3.4 percent to KHR3367.8 bn, while non-tax revenue increased 80.6 percent to KHR468.3 bn. Total expenditure increased by 42.5 percent from a quarter earlier, to KHR3378.3 bn, due to an increase of 69.5 percent (KHR1062.5 bn) in capital expenditure and 32.8 percent (KHR2315.8bn) in current expenditure.

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Inflation and foreign exchange rates

The overall price index in the second quarter rose to 3.0 percent from 2.5 percent in the previous quarter. The prices of food and non-alcoholic beverages increased by 6.2 percent but that of transportation dropped 9.9 percent. The riel depreciated by 0.8 percent against the US dollar, 2.0 percent against the Thai baht, and 1.1 percent against the Vietnamese dong, compared to the previous quarter. The price of diesel fuel increased by 1.0 percent and gasoline increased by 0.2 percent from the previous quarter.

Poverty situation

Average real daily earnings of cyclo drivers, porters, waitresses, motorcycle taxi drivers and unskilled and skilled construction workers increased compared to August last year, while those of garment workers, small vegetable sellers, rice field workers and scavengers dropped.

In August, rice-field workers' earnings decreased to KHR7722 per day, 16.8 percent lower than in the same month last year. Sixty-five percent of those interviewed were the main income earners for their families. Their income increased compared to the previous quarter, 60.0 percent said. The majority stated that their income during August could support their families. Fifty percent were in debt, and the average monthly interest rate on their borrowing was around 2.23 percent.

Garment workers' daily wages decreased by 11.6 percent from a year earlier, to KHR 12,900. Sixty-eight percent of them were married. Their average level of education was sixth grade. On average they had worked in the factory for 4.6 years. Fifty-one percent of them gained skills from training in the factory, 24.2 percent training at home, while the other 24.2 percent had no skills. They worked on average 51 hours per week and saved up to 46.3 percent of their wages. Eighty-nine percent of them sent savings to their families, which could partially support them. About 66.0 percent of them did not want to change their jobs. Seventy-six percent were optimistic that their factory would continue operating.

In August, earnings of vegetable vendors dropped to KHR11,903 per day, 5.7 percent lower than in the same month last year. Vegetable vendors came from Battambang, Kompong Cham, Kompong Thom, Kampot, Kandal, Phnom Penh, Prey Veng, Svay Rieng and Takeo. Eighty-five percent of them had 0.4 to 1.5 hectares of agricultural land, while the rest did not own any. Ninety-five percent of the respondents were the main income earners in their families. Sixty-five percent indicated that their capital was not enough for their business.

Scavengers' earnings dropped by 13.5 percent from a year earlier to KHR9953/day due to an increase in the number of scavengers, a decrease in the source of rubbish and its price. Sixty-five of them were the family breadwinners. On average, scavengers needed to work around 10 hours per day. They spent 39.1 percent of their income, mainly on food (70.7 percent of their total spending) and rent (17.4 percent), and much less on health care and other expenses.

Daily earnings of unskilled construction workers expanded by 6.2 percent from a year earlier to KHR13,894, while the number of unskilled construction workers decreased and construction activities increased in August. Around 92.5 percent of these workers migrated alone to Phnom Penh or Siem Reap for work. They worked 8 hours per day on average. They spent mainly on food. Their income could partially support their families.

Compared to the same month last year, porters' earnings decreased by 4.7 percent to KHR14,094 per day. All the respondents migrated from provinces, and they shared lodgings with an average of five people. Their income was spent on food (82.3 percent), rent (12.4 percent), health care (0.8 percent) and other expenses (4.5 percent). Since they started as porters, their families were better off, 62.5 percent of respondents reported, while the others said that their families' livelihoods remained the same.

The daily earnings of waiters/waitresses increased by 3.6 percent compared to the same month last year, to KHR7895. All interviewees were provided accommodation. They had been working for about three years and worked on average 10.7 hours per day. They spent 22.9 percent of their income on food and sent 62.8 percent of their earnings to their families, which only partly supported them.

Economy Watch—Economic Indicators

Table 1: Private investment projects approved, 2009–2016

	2009	2010	2011	2012	2013	2014	2015				2016	
							Q1	Q2	Q3	Q4	Q1	Q2
	Fixed Assets (USD m)											
Agriculture	615.0	530.7	725.0	531.6	930.5	56.5	25.8	38.1	79.1	26.8	27.6	0.0
Industry	818.5	403.7	2860.1	829.3	3257.0	1002.5	342.8	130.9	130.6	410.4	252.4	597.0
. *Garments*	90.1	122.8	393.9	497.0	324.1	393.5	63.9	42.4	63.7	55.2	70.8	239.9
Services	4432.0	1337.3	3425.4	916.6	140.7	622.6	2504.6	85.6	69.7	74.5	643.6	234.1
. *Hotels and tourism*	3980.1	1105.1	2850.9	691.5	106.0	446.9	60.6	0.0	0.0	38.0	611.1	19.8
Total	5865.5	2271.7	7010.4	2278.0	4328.0	1583.9	2873.2	254.6	279.4	511.7	923.7	831.2
	Percentage change from previous quarter											
Total	-	-	-	-	-		1816.8	-91.1	9.7	83.1	80.5	-10.0
	Percentage change from previous year											
Total	-45.5	-61.3	209.0	-67.5	90.1	63.4	573.0	-33.2	-55.3	241.4	-67.9	226.4

Including expansion project approvals. Source: Cambodian Investment Board

Table 2: Value of construction project approvals in Phnom Penh, 2009–15

	2009	2010	2011	2012	2013	2014				2015		
						Q1	Q2	Q3	Q4	Q1	Q2	Q3
	USD m											
Villas, houses and flats	213.9	220.1	405.1	547.3	658.9	133.6	84.0	33.1	20.4	122.3	-	637.6
Other	187.8	217.8	199.9	463.6	859.6	190.0	141.7	105.6	11.7	49.8	-	252.6
Total	441.2	489.8	605.0	1010.9	1518.5	323.6	225.7	138.7	32.1	172.0	-	897.4
	Percentage change from previous quarter											
Total	-	-	-	-	-	34.3	-30.2	-38.5	-77.8	437.3	-	
	Percentage change from previous year											
Total	-60.5	11.0	23.5	67.1	28.1	8.0	-9.2	-64.2	-86.7	-46.8	-	

Source: Department of Cadastre and Geography of Phnom Penh municipality

Table 3: Foreign visitor arrivals, 2009–2016

							2015				2016	
	2009	2010	2011	2012	2013	2014	Q1	Q2	Q3	Q4	Q1	Q2
	Thousands											
By air	1111.7	1304.3	1480.4	1722.1	2017.7	2273.5	725.1	497.4	563.8	681.3	785.0	593.5
By land or water	999.7	1094.6	1401.4	1862.2	2192.5	2229.3	647.6	496.7	481.1	747.0	557.4	522,7
Total	2111.5	2398.9	2881.8	3584.3	4210.2	4502.8	1372.6	994.2	1044.9	1428.4	1342.5	1116.2
	Percentage change from previous quarter											
Total	-	-	-	-	-		5.4	-27.6	5.1	36.7	-0.6	-16.9
	Percentage change from previous year											
Total	-0.5	13.6	20.1	24.4	17.5	7.0	8.3	6.5	4.6	9.6	-2.4	12.3

Source: Ministry of Tourism

Table 4: Exports and imports, 2009–2016* (USD million)

	2009	2010	2011	2012	2013	2014	2015				2016	
							Q1	Q2	Q3	Q4	Q1	Q2
Total exports	2901.6	3630.2	4929.5	6106.4	6982.4	8106.0	2170.1	2182.0	2595.0	2309.3	2388.3	2383.4
Of which: Garments	2565.3	3223.4	4259.6	5015.4	5386.1	5960.5	1548.8	1601.7	1995.3	1681.2	1759.4	1717.84
. to US	1512.6	1853.9	2055.3	2143.3	2075.2	1963.6	491.1	494.3	585.3	438.8	423.1	440.36
. to EU	644.7	809.5	1322.2	1716.9	1969.6	2403.7	617.3	685.9	844.1	756.6	789.6	776.56
. to ASEAN	6.9	9.9	17.6	39.4	60.2	83.3	24.8	24.6	26.4	27.5	25.6	25.7
. to Japan	44.6	86.5	147.0	188.6	278.7	383.1	121.4	93.6	170.8	138.4	176.0	122.53
. to rest of the world	356.5	463.6	717.5	927.2	1002.9	1126.8	294.2	303.4	368.8	319.9	345.2	352.69
Agriculture	73.1	164.9	362.1	376.7	554.5	624.4	150.3	127.3	111.4	159.7	137.5	98.9
. Rubber	51.6	89.1	197.6	176.6	175.2	153.9	41.7	40.9	42.1	40.7	30.7	26.76
. Wood	3.5	34.1	48.8	36.8	73.6	132.0	13.9	9.8	7.3	15.3	4.9	12.4
. Fish	4.0	2.8	3.1	2.0	1.2	0.8	0.2	0.2	0.1	0.1	0.2	0.11
. Rice	10.9	34.7	106.6	146.4	262.3	248.5	89.5	72.4	54.7	98.8	91.4	56.1
. Other agriculture	3.0	4.1	6.0	14.9	42.4	89.1	5.2	4.0	7.2	4.9	10.3	3.56
Others	263.2	242.0	307.9	714.4	1088.2	1520.1	471.0	452.9	488.0	468.4	491.3	566.58
Total imports	4332.0	5190.6	6375.9	8593.3	8639.4	10,295.4	2717.3	2920.3	2907.9	2949.1	2784.7	2383.4
Of which: Gasoline	91.1	108.6	294.4	308.0	306.4	334.7	34.5	92.2	96.5	65.1	95.4	1717.84
Diesel	180.7	203.8	447.0	559.5	569.1	602.3	45.1	152.7	139.6	150.0	163.1	440.36
Construction materials	49.7	57.6	48.1	66.1	80.8	117.6	12.4	42.0	45.9	42.1	50.8	776.56
Other	4010.0	4820.6	5586.4	7659.1	7682.6	9240.7	835.2	2633.0	2626.0	2691.9	2475.0	25.7
Trade balance	-1429.9	-1560.5	-1446.4	-1341.6	-1610.9	-2184.3	-547.2	-738.3	-312.9	-639.7	-396.4	122.53
	Percentage change from previous quarter											
Total garment exports	-	-	-	-	-	-	3.8	3.4	24.6	-15.7	4.7	-2.4
Total exports	-	-	-	-	-	-	1.5	0.5	18.9	-11.0	3.4	-0.2
Total imports	-	-	-	-	-	-	-3.2	7.5	-0.4	1.4	-5.6	120.8
	Percentage change from previous year											
Total garment exports	-14.1	25.7	32.1	17.7	7.4	10.7	5.8	16.1	22.8	12.6	13.6	7.2
Total exports	-6.3	25.1	35.8	23.9	14.3	16.1	9.8	17.3	21.7	8.1	10.1	9.2
Total imports	1.4	19.8	22.8	16.8	15.4	19.7	21.4	19.2	4.0	5.0	2.5	110.1

* Import data include tax-exempt imports.

Sources: Department of Trade Preference Systems, MOC and Customs and Excise Department, MEF website

Table 5: National budget operations on cash basis, 2009–16 (KHR billion)

	2009	2010	2011	2012	2013	2014	2015				2016	
							Q1	Q2	Q3	Q4	Q1	Q2
Total revenue	5989.0	5989.0	6251.4	7691.9	8255.2	10,543.4	2647.8	3301.6	3063.8	2867.3	3533.1	3849.4
Current revenue	5859.1	5859.1	6179.3	7443.8	8233.2	10,359.4	2638.0	3274.5	3028.7	2818.2	3514.6	3836.0
Tax revenue	4693.0	4693.0	5277.5	6334.8	7198.1	8995.2	2430.6	3006.1	2656.2	2409.7	3255.5	3367.8
Domestic tax	3533.6	3533.6	4071.6	5002.8	5728.1	7226.5	2012.6	2481.6	2153.9	1943.6	2715.4	2854.2
Taxes on international trade	1159.4	1159.4	1205.9	1331.7	1470.0	1822.7	418.0	524.5	502.3	466.1	540.1	513.6
Non-tax revenue	1166.1	1166.1	901.8	1118.2	1035.2	1310.3	207.4	268.5	372.5	408.5	259.1	468.3
Property income	291.1	291.1	63.8	143.0	84.0	88.5	3.0	16.7	35.9	21.7	8.2	26.2
Sale of goods and services	460.1	460.1	588.7	667.4	750.3	871.2	189.6	219.2	304.6	333.9	198.3	315.4
Other non-tax revenue	408.9	408.9	249.3	298.8	200.8	350.5	14.8	32.6	31.8	53.0	52.7	126.7
Capital revenue	129.9	129.9	72.1	247.9	73.4	184.0	9.8	27.1	35.0	49.1	18.3	13.4
Total expenditure	8784.7	8784.6	9032.4	9660.9	12,535.7	13,306.5	2093.3	1964.8	3337.5	5121.3	2367.9	3378.3
Capital expenditure	2853.2	2853.2	3546.9	3628.3	5567.5	5590.7	654.4	584.7	649.9	2083.4	624.5	1062.5
Current expenditure	4773.1	4773.1	5341.2	6188.4	6968.3	7715.8	1438.9	1380.1	2687.7	3038.0	1743.4	2315.8
Wages	2048.8	2048.8	2170.6	2486.6	2997.3	3755.5	945.3	959.1	1281.2	1086.3	1133.1	1419.7
Subsidies and social assistance	1099.4	1099.4	1518.8	1586.8	1563.0	1627.0	194.3	207.1	544.0	797.1	259.1	439.7
Other current expenditure	1624.8	1624.8	1651.8	2115.1	2408.0	2333.4	299.3	213.9	862.4	1154.6	351.2	456.4
Overall balance	-2795.7	-2795.7	-1271.4	-1969.0	-4280.6	-2763.1	554.5	1336.8	-273.8	-2254.0	1164.9	471.2
Foreign financing	1845.2	1845.2	-2781.0	2457.8	4326.2	3972.1	368.9	330.1	297.6	1414.8	270.0	747.0
Domestic financing	938.6	938.6	2379.2	-332.9	824.4	-1428.7	-2464.8	-793.3	-259.1	-109.4	-1471.3	-475.7

Source: MEF website

Table 6: Consumer price index, exchange rates and gold prices (period averages), 2009–16

	2009	2010	2011	2012	2013	2014	2015				2016	
							Q1	Q2	Q3	Q4	Q1	Q2
	Consumer price index (percentage change from previous year)											
Phnom Penh - All Items	5.8	4.1	5.4	2.3	3.0	3.9	1.0	1.0	0.8	2.0	2.5	3.0
- Food & non-alcoholic beverages	9.9	4.4	6.5	2.5	3.9	4.9	4.2	3.9	3.3	4.7	4.7	6.2
- Transportation	5.8	7.0	6.9	3.3	-0.6	-1.0	-10.9	-7.9	-9.1	-8.9	-6.5	-9.9
	Exchange rates, gold and oil prices (Phnom Penh market rates)											
Riels per US dollar	4062.7	4187.1	4063.6	4039.2	4036.2	4060.4	4042.2	4056.7	4091.8	4050.9	4022.4	4056.3
Riels per Thai baht	122.8	133.1	133.2	130.0	124.9	119.4	124.4	122.6	116.8	113.6	113.4	115.7
Riels per 100 Vietnamese dong	25.0	21.7	19.7	19.4	19.1	18.7	19.0	18.8	18.6	18.2	18.1	18.3
Gold (US dollars per chi)	83.2	147.5	184.5	200.9	175.9	152.3	150.9	144.4	136.0	130.9	151.2	151.2
Diesel (riels/litre)	3262.3	3859.3	4761.2	4941.2	4852.1	4934.1	3823.4	4032.0	3840.2	3389.4	2903.8	2932.8
Gasoline (riels/litre)	4005.0	4368.1	5044.5	5312.7	5083.3	5155.7	3986.2	4189.0	4048.9	3582.5	3310.6	3318.2

Sources: NIS, NBC and CDRI

Table 7: Monetary survey, 2009–16 (end of period)

	2009	2010	2011	2012	2013	2014	2015				2016	
							Q1	Q2	Q3	Q4	Q1	Q2
	Billion riels											
Net foreign assets	14655.0	16697.9	17893.9	18154.5	21260.1	26699.7	26823.0	27975.3	26359.2	26665.5	29247.8	30138.5
Net domestic assets	1573.0	2778.9	5760.8	10437.4	11508.3	15859.8	16863.2	18178.3	20600.9	22157.6	21643.0	24399.1
Net claims on government	-2252.0	-2126.6	-2123.1	-2486.4	-2794.9	-4359.1	-5064.0	-5666.1	-5933.1	-6428.8	-7621.2	-7977.4
Credit to private sector	10532.0	13331.2	17552.8	23536.6	27608.8	36244.6	37759.4	40995.0	43807.1	46071.0	47627.0	52528.6
Total liquidity	16228.0	19476.8	23654.7	28591.9	32768.4	42559.5	43685.2	46153.7	46960.1	48823.1	50890.9	54537.6
Money	3120.0	3220.9	3956.2	4045.7	4878.2	6308.4	6628.0	6293.1	6287.5	6741.4	6717.8	6872.0
Quasi-money							37058.2	39860.6	40672.6	42081.7	44173.1	47665.6
	Percentage change from previous year											
Total liquidity	36.9	20.0	17.8	20.9	14.6	29.9	24.2	20.6	15.2	14.7	16.5	18.2
Money	30.1	3.2	16.9	2.3	20.6	29.3	23.3	20.3	12.6	6.9	1.4	9.2
Quasi-money	38.6	24.0	17.9	44.6	13.6	30.0	24.4	20.7	15.6	16.1	19.2	19.6

Source: National Bank of Cambodia

Table 8: Real average daily earnings of vulnerable workers (base November 2000)

	Daily earnings (riels)									Percentage change from previous year		
	2012	2013	2014	2015**			2016			2016		
				Feb	May	Aug	Feb	May	Aug	Feb	May	Aug
Cyclo drivers	10303	10438	10774	12408	11677	11096	11880	11898	11302	4.3	1.9	1.9
Porters	12143	13247	13580	16094	14782	13461	14888	11774	14094	-7.5	-0.1	4.7
Small vegetable sellers	10771	11366	14751	14379	17020	12623	20337	18979	11903	41.4	11.5	-5.7
Scavengers	8680	9819	9173	10181	13272	11509	11159	8737	9953	9.6	-34.2	-13.5
Waitresses*	6111	6697	7789	8111	8188	7618	7860	8187	7895	-3.1	-0.01	3.6
Rice-field workers	6151	6599	7514	7955	7552	9281	8484	7916	7722	6.6	4.8	-16.8
Garment workers	8932	10161	11178	14644	14803	14590	14937	13828	12900	6.1	-3.0	-11.6
Motorcycle taxi drivers	12930	13450	13386	13939	13761	13283	15526	15425	13653	11.4	12.1	2.8
Unskilled construction workers	11078	13184	13336	15981	14474	13087	16164	20227	13894	1.1	39.7	6.2
Skilled construction workers	13743	15442	17420	16336	18656	17779	18853	21150	19184	15.4	13.4	7.9

* Waitresses' earnings do not include meals and accommodation provided by shop owners. Surveys on the revenue of waitresses, rice-field workers, garment workers, motorcycle taxi drivers and construction workers began in February 2000. Source: CDRI

**November 2015 data are not available.

Continued from page 28 **CDRI UPDATE**

2 September: CDRI and the Institute of Technology of Cambodia (ITC) co-hosted a forum on "Climate Change Education" for the government of Canada. The guest speaker was the Honourable Stéphane Dion, Minister of Foreign Affairs, and distinguished government officials and HE Dr Sok Siphana, Chairman of CDRI Board of Directors, gave welcoming remarks; the event was attended by 300 high school and university students. The forum was an opportunity for CDRI to launch the Development Diplomacy Circle, a new platform for policymakers, think tanks and international partners to exchange ideas and solutions to regional and international development issues.

REASEARCH

Agriculture

The team is implementing six projects. Having received approval, the final report for the study on the *Impact of Education Public Spending on Human Capital, Poverty and Inequality: A CGE Approach for Cambodia,* supported by Partnership for Economic Policy (PEP), is being revised for publication as a working paper on the PEP website. Report writing for the project *Impact of Rice Export Promotion Policy and Food Security* has been delayed because all team members are fully engaged in fieldwork projects. The final draft report for *Irrigated Agriculture in Cambodia,* a study backed by the Australian National University (ANU), was submitted to ANU and is now awaiting comments.

The first round of a follow-up telephone survey for *Testing Innovative Models of Extension in Cambodia's PADEE Program,* funded by the International Food Policy Research Institute (IFPRI), was implemented and the cleaned data submitted to IFPRI. Work has started on *Rice Policy Analysis,* a study funded under the Lower Mekong Public Policy Initiative (LMPPI). Key informant interviews in Vietnam and Phnom Penh have been completed and the subcontractors will submit their draft reports in due course. Also completed was the two-month fieldwork for the *HARVEST Final Impact Evaluation*, funded by the United States Agency for International Development (USAID); data entry is underway.

Economics

The study on *Mapping Sending Channels and the Management of Remittances in Cambodia* was successfully completed. Also nearing completion are two other projects. The first is *Revisiting the Unfinished Agenda: Determinants of Credit Access and Its Impact on Farm Production and Use of Fertiliser in Rural Cambodia.* For the second project*, Interrelations between Partner Countries' Public Policies, Migration and Development: Case Studies and Policy Recommendations,* the team is due to attend an international dissemination workshop in Paris on 13-14 October.

Work has begun on *Enhancing China-Mekong Research and Policy Dialogue*, a new two-year study funded by China's Ministry of Foreign Affairs under the Lancang-Mekong River Dialogue and Cooperation framework. The team is preparing for the Kick-Off Workshop scheduled for November 2016.

This quarter also marks the start of the Unit's new five-year research program funded under the resource partnership between CDRI and the Swedish International Development Cooperation Agency (Sida). Running from July 2016 to June 2021, the program focuses on *Enhancing Industrial Development for Youth Employment, SME and Economic Growth in Cambodia*. Research consists of three components: integrating and upgrading Cambodia's participation in global value chains; promoting small and medium enterprise in the broad framework of industrial development; and developing human capital for industrialisation.

Education

In July the team pre-tested the research tools for the project *STEM Studies for Labour Market*, funded by Australia's Department for Foreign Affairs (DFAT), with students from four high schools in Pursat province. The results were used to fine tune questionnaires and methods before survey rollout. Also completed was a tracer study report for *Evaluation of the Impact of Master Program Graduates from the School of Public Health of the National Institute of Public Health (NIPH) on Cambodia's Public Health System*, a research

partnership of CDRI and NIPH. The preliminary findings of a pilot study on *Perceptions of Sexual Harassment in Cambodian Higher Education Institutions* were presented at a conference in Sweden in August.

At a retreat in Kampot, Development Research Forum (DRF) partners identified "Science, Technology and Innovation for Sustainable Development in Cambodia" as the theme for DRF Symposium 2016. A research seminar on the "Quality Assurance of Higher Education in the Asia Pacific: Experiences from Australia and Cambodia" featured a presentation by Professor Richard James, Pro Vice-Chancellor (Academic) and Director, Melbourne Centre for the Study of Higher Education. Panellists included representatives from the Accreditation Committee of Cambodia and the Ministry of Education's Department of Higher Education.

An article titled "Student Engagement in STEM Education: Global Trends and Implications for Cambodia" was prepared and published in this issue of the *Cambodia Development Review*, and a second on "Teaching and Learning Modes in Higher Education in Cambodia: A Case of Chemistry Students' Perspectives in RUPP" is being readied for publication in a later issue.

Environment

The draft report for *Gender in Environmental Impact Assessment in Cambodia,* a project funded by USAID under the Mekong Partnership for the Environment, is being revised to include feedback from two validation workshops held in Stung Treng and Phnom Penh. The study reviews the environmental impact assessment (EIA) procedure for the Kamchay and Lower Sesan 2 hydropower dams in Kampot and Stung Treng provinces, respectively, and the factors that hampered or facilitated women's participation in those EIA processes.

The unit is getting ready to co-host with the Stockholm Environmental Institute a workshop on "Arsenic Uptake in Rice in Cambodia", scheduled for late November 2016. In the meantime, a working paper *Common Pool Resources and Climate Change Adaptation* is being prepared for release in December.

Governance

Work has started on new exciting long-term research program funded by Sida titled *Ponlork: The Emergence of a New Era for Cambodia, New Generation, Subnational Governance and Political Pluralism.* Research will examine new contemporary dynamics, namely the emergence of a new generation, the further reform of subnational institutions, and the impact of these on concepts of citizenship, political engagement and political pluralism. The team is now designing a detailed concept note on the theme "New Generation: Youth Participation in Development and Politics".

CDRI Update

Major Events

3 July: A meeting was convened with Ms Kristina Kühnel, head of Development Cooperation at the Swedish Embassy in Phnom Penh, to discuss progress made under CDRI-Sida research program 2011-16 and salient features of the new program 2016-21.

13 July: Networking with policymakers and Korean partners at the "IT Management and National Development" seminar, organised by the National Science and Technology Council, was a good opportunity to learn about practical solutions to the challenges of building, science, technology and innovation capacity in Cambodia. The information gathered can be usefully integrated with CDRI's research on STEM education.

18-19 July: The executive director gave a lecture at the first capacity-building workshop "Global Citizenship Education Curriculum Development and Integration in Cambodia", organised by the Ministry of Education, Youth and Sport (MOEYS). CDRI was invited to cooperate with the Asia Pacific Center of Education for International Understanding and MOEYS (under the auspices of UNESCO).

27 July: The executive director and head of Economics participated in the workshop "Transport and Logistics in Cambodia" organised by the Ministry of Economy and Finance. The executive director was invited to serve on the Logistics Advisory Committee of the Ministry of Public Works and Transport.

3-4 August: The executive director attended the workshop "Identifying the Next $100 Million Idea for Social Impact" organised by the Rockefeller Foundation, Emerging Markets Consulting and Bridgespan Group at Himawari hotel. It was an excellent opportunity to meet representatives from some 40 philanthropic organisations and development partners and exchange ideas on the complementary role of think tanks in addressing society's challenges.

11-12 August: The "Lower Mekong Policy Forum on Environment, Agriculture and Livelihoods" was jointly organised by CDRI, the Lower Mekong Policy Initiative (LMPPI) and the Sustainable Mekong Research Network (SUMERNET) in Siem Reap. During this regional forum, CDRI was recognised as an essential regional and national research partner for addressing environmental challenges in the Lower Mekong Basin.

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